RECENT ADVANCES IN THE LAW OF UNFAIR COMPETITION

by

ELMER LEGRAND GOLDSMITH

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TABLE OF CONTENTS

"The law of 'Unfair Competition' is a popular branch of the law. It has a direct bearing on the lives of most of us, and is of general interest for that reason. It deals fundamentally and specifically with one of the most important phases of everyday life, -- the struggle for a living. It is largely free from legal red tape and technicality. It consists of one simple rule, -- 'Complete Honestly'. This rule is not a statute, the creation of a Congress or a Legislature. It is a statement of the public sentiment of the day. The law of unfair competition might well be called the Book of Rules of the business game. It is still in its infancy. Its possibilities of growth and effectiveness are almost unlimited. It started by regulating one unfair practice, viz: substitution. Today its principles are being applied to most commercial practices that are unfair, or, as the French Law terms it, disloyal." Nims' Second Edition Unfair Competition. Today the law of unfair competition "promises great things for the future of our business lives". Nims, (supra).

The general scope of this paper is the recent advances in the law of unfair competition. Several centuries ago the market of every crafstman and merchant was localized or extremely limited and there was little or no attempt by one competitor to take advantage of another. With the extension of the market boundaries and intensification and specialization in industrial lines, situations arose wherein one competitor endeavored to derive profit from another's gain. The original forms of such endeavors were malicious prosecution. A later form of unfair competition is now called "passing off" in the English Law, "concurrence de loyale" in the French Law, and "substitution" in the American Jurisprudence. Since the malicious forms of unfair competition have been and are now well defined, this paper will be concerned only with the extensions of the "passing off" or "substitution" and the monopolistic forms of unfair competition which have come into being with the growth of trade and commerce from a local to a national and international market, due to the further intensification and specialization of industry in the past century.

The law of unfair competition originated in the trade-mark law. From time immeorial, trade-marks, symbols or characters, etc. have been used to indicate the maker's or merchant's identity. Reference is made thereto in many of the writings of antiquity, as for example the Bible.

Historical records show that in 2700 B. C. the Chinese placed marks upon pottery. In 1590, occurred the first reported trade-mark case in the English law and "was an action upon the case * * * * by a clothier, that, whereas he had gained great reputation for his making of the cloth, by reason whereof he had great utterance, to his great benefit and profit; and that he used to set his mark to his cloth; and another perceiving it, used the same mark to his ill-made cloth on purpose to deceive him; and it was resolved that the action did well lie." Southern v. How, 2 Poph. 144. This case was an action for damages only and not for equitable relief. In the second reported case in 1742 Lord Hardwicke refused an injunction, stating that "every particular trader has some particular mark or stamp; but I do not know any instance of granting an injunction here, to restrain one trader from using the same mark with another; and I think it would be of mischievous consequence to do it." Blanchard v. Hill, 2 Atk. 484.

In 1803 in the newspaper case of Hogg v. Kirby, 8 Ves. Jr. 215, Lord Eldon used the term "fair competition" but stated, "A court of equity in these cases is not content with an action for damages . . . and, therefore, the remedy here . . . is . . . by an injunction and account". This is the first instance in the English Law where an injunction was granted in a case of unfair competition.

In 1810 Lord Eldon decided another early trade-mark case. Cruttwell v. Lye, 17 Ves. 335. In 1842 in a suit for infringement of a mark upon iron by a somewhat similar mark, an injunction was granted. Crawshay v. Thompson, 4 Man. & Gr. 357. These cases establish the historical background of trade-mark infringement in England which has been followed in the United States. In 1743 Lord Mansfield held that where both plaintiff and defendant used the name of the original inventor upon the same product, no action would lie, Singleton v. Bolton, 3 Dougl. 293, thus this early distinguishing the fraudulent use of a name or mark from a fair use thereof.

The tendency of the American and British Courts has been to confine within narrow and technical limits all trade-mark actions. Upon the other hand, the tendency of the courts has been to extend the limits of the law of unfair competition. In Blofield v. Payne, 4 B. & Ad. 410, the plaintiff recovered damages because of the defendant's use of a pecular package similar to complainant's. In Perry v. Truefitt, 6 Beav. 66, the "passing off" by means of names, marks, letters or other indicia was prevented. A year later in Croft v. Day, 7 Beav. 84, the use of "Day" by the defendant was restricted by the requirement that the same be distinguished from the trade-name "Day" owned by the assignee Croft. An earlier case, Knott v. Morgan, 2 Keene 213, granted relief to the complainant by prohibiting the defendant from operating what we would now call a bus line, where the defendant simulated the conveyances and the uniforms of the drivers. With this historical setting of trade-mark law and the law of unfair trade as developed in England, we pass to the historical setting in the United States.

Probably the earliest unfair competition case in America was Snowden v. Noah, 1 Hopk. 348, wherein Chancellor Sanford decided that it was unfair competition for one newspaper to use the title of another. In 1837 another case related to a patent medicine. Tomson v. Winchester, 19 Pick. 214. In 1840 Chancellor Wallworth decided a newspaper case in which an injunction issued. Bell v. Locke, 8 Paige 75. Still another early case in which an American Court granted an injunction was the Taylor's Persian Thread Case decided by Judge Story in 1844. Taylor v. Carpenter, 3 Story, 458. Perhaps the earliest case (1877) relating to unfair methods of competition decided by the Supreme Court of the United States was that of McLean v. Fleming, 96 U.S. 245.

It will be noted that prior to 1875 there were but few trade-mark cases decided and reported, and it may be parenthetically stated that prior to 1875 there was but little industrial development as we now understand these phases of our life. In the last quarter of the nineteenth century, however, there were over two thousand decisions in

England and the United States formulating the law of unfair competition. It is the purpose of the immediately succeeding portions of this paper to indicate rather briefly the general rules relating to unfair competition as enunciated in these cases. Thereafter will be discussed the several phases of this branch of the law which have been modified in the twentieth century by the later decisions as well as by the statutory enactments and the decisions interpreting the latter.

All of the various forms of unfair competition are forms of fraud except that competition which is monopolistic in character and declared unfair by statute, or wherein the element of fraud is presumed and need not be proved. A trade-mark is of a dual nature. One purpose is to guarantee to the public that the goods are those of the known manufacturer and, therefore, of a known quality. The other purpose is to guarantee to the manufacturer the enjoyment of his "good-will" or the reputation, which the excellence of his product has developed. It is a fundamental rule that the right to use a trade-mark is acquired by first or prior use. Another general rule is that the first appropriator has the right to extend the use of the mark upon the same goods into other territories, and to include other goods of a nature allied to the original business. Collins Co. v. Oliver Ames & Sons, 18 Fed. 561. This rule now has been qualified by holding that innocent adverse use in the extended territory or business may prevent an exclusive right to the trade-mark therein. Hanover Star Milling Co. v. Metcalf, 240 U. S. 403. Citizens' Wholesale Supply Co. v. Golden Rule, 180 N. W. 95. Another rule in relation to trade-marks and trade-names is that the owner has a property right therein. This right is limited, for it cannot be alienated except by the transfer of the business, or "good-will" as a "going concern" with the sale or transfer of the trade-mark. This is an element which enters largely into consideration when a referee in bankruptcy sells the assets of the bankrupt. A contract for the establishment of a business and extension of the trade-mark to the same will be upheld, Coca Cola Bottling Co. v. Coca Cola Col, 11 T.M. 134, and a contract to refrain from the use of a particular mark is valid and will be enforced. Smith v. Yost, 10 T.M. 33.

"A trade-mark may consist of a name, symbol, letter, form or device, if adopted and used by a manufacturer or merchant in order to designate the goods he manufactures or sells, to distinguish the same from those manufactured or sold by another, to the end that the goods may be known in the market as his or of a certain character when he is not known, and to enable him to secure such profits as a result from his reputation for skill, industry and fidelity. Mr. Justice Clifford in McLean v. Fleming, supra. Amoskeag Mfg. Co. v. Trainer, 101 U.S. 51.

The technical trade-mark must not only be exclusive, distinctive, and identifying, but must be used in lawful commerce and be affixed, applied to, or associated with a subject of lawful commerce. Thus, the titles of books are not a proper trade-mark, while titles of plays and periodicals may be trade-marks. This right may be defeated if the words become Publici Juris as "photoplay". Photoplay Publishing Co. v. LaVerne Pub. Co., 10 T.M. 102. Photoplay Publishing Co. v. Eastlake et al, 261 F. 428.

A trade-mark which is not fanciful or arbitrary, in that at the time of its adoption it was the name of an article or class of goods, nevertheless, when applied to a new kind of goods generally is valid. Celluloid Mfg. Co. v. Cellonite Mfg. Co., 32 Fed. 94. In England a contrary rule applies and if the use becomes so widespread that the mark loses its primary or sole distinction as to ownership but indicates the product per se, the mark is held to have acquired a "secondary meaning" and to be dedicated to the public. Linoleum Co. v. Nairn, 7 ch. Div. 834. A modification in the United States of the "celluloid" rule in the direction of the British rule has been made within the past year in the case, Bayer Co. v. United Drug Co., 272 F. 505, in which it was held that the purchasing public knew acetyl salicylic acid only under the trade-name of "Aspirin" and, therefore, "Aspirin" had acquired a "secondary meaning". After the patent upon the product had expired, it was found that the only way competitors could sell the acid to the ultimate consumer was to mark the same with the name "Aspirin", and this the court permitted them to do.

Another rule is that if a trade-mark or name is descriptive of some quality, characteristic, purpose or effect, the same cannot be a perfect trade-mark, but words which are used in a metaphorical sense or which psychologically produce the desired idea, may be a perfect trade-mark. For example, "waterproof" would be descriptive, but "wetproof" which suggests the same thing would be a perfect trade-mark. Conversely, a deceptive mark is not a good technical trade-mark, but where a mark of this character was in common use for thirty-four years, it was held to be a technical trade-mark. Lambert Pharmacal Co. v. Bolton Chemical Corp., 219 F. 325.

Similarly, a geographical name is not a perfect trademark but if through long usage, such name has acquired a "secondary meaning" it will be held a perfect trade-mark. When a name does not indicate geographical origin as the "New York Store" in Indianapolis, the trade-name will be protected. Where a geographical name for a long period has referred exclusively to a product made at that place and not to the place itself, it is a perfect trade-mark, and though the manufacturer of the original product removes to another locality he is entitled to retain the use of the name. Manitou Springs Mineral Water Co. v. Schueler, 239 F. 593. He may even prevent a subsequent maker from using the same name in the original place upon the same product, unless he clearly differentiates the product so that the public can distinguish it from the original article.

A style of package, mode of packing, or putting up goods cannot be a perfect trade-mark unless the same has never before been employed by merchants or manufactuers generally. Similarly, the form of an article cannot be a perfect trade-mark.

Words or phrases from a dead language may be perfect trade-marks but words from a foreign language are subject to the same rules of law as English words. Numerals or letters may be perfect trade-marks except when descriptive of the quality or class of goods. Thus, "711" and "111" are both perfect trade-marks.

In general, the defenses to a suit for the infringement of a trade-mark are genuineness of the article, want of title, abandonment, imperfect mark, a deceptive mark, no infringement, no competition between goods, no lawful commerce, estoppel to assert right to exclusive use by laches, contract, or operation of law, and "unclean hands" by any false representation in the sale of goods.

The foregoing in general are the fundamental rules of trade-mark law. There are a vast number of marks, etc. which are neither perfect nor technical, for the reasons stated. It is the "good-will" of a business which is the essence and not the mark itself. Chief Justice Fuller quoting Judge Story said, "Good-will is the advantage or benefit which is acquired by an establishment beyond the mere capital, stock, funds, or property employed therein, in consequences of the general public patronage and encouragement which it receives from constant or habitual customers, on account of its local position or common celebrity, or reputation for skill or affluence, or punctuality, or from other accidental circumstances or necessities, or even from ancient partialities in prejudices." Metropolitan Bank Co. v. St. Louis Dispatch Co., 149 U.S. 436.

Under this general class of imperfect trade-marks, we find trade-names which includes names of individuals and places. It is a general rule that a perfect trade-mark cannot be acquired in a surname, because others of the same name are entitled to use their names. Courts within the past twenty years have held that a person must not use his name so as to mislead the public, but must distinguish from the first user. Cases of this character are "Baker's Chocolate", "Roger's Silverware", "Williams' Soap", and "Howard", "Steinway", "Knabe", and "Chickering" pianos. Walter Baker & Co. v. Baker, 87 Fed. 209; Wm. A. Rogers v. H. V. Rogers, 237 Fed. 887; Williams Soap Co. v. J. B. Williams Soap Co., 193 Fed. 384; Baldwin Co. v. R. S. Howard Co., 238 F. 154; Stix, Baier & Fuller Dry Goods Co.

v. American Piano Co., 211 F. 271; Chickering v. Chickering & Sons, 215 Fed. 490 respectively.

An interesting question is: If a coined word is used as a trade-mark and later it is discovered that a person possesses the same word as a surname, would such person be entitled to use his name on the same product? It is believed that the courts would make the person clearly distinguish his lack of connection with the first appropriator.

The courts look with disfavor upon the purchase of a small business with a desirable surname attached and with equal or more disfavor upon a later corporation that simulates the name of the earlier and well-known corporation, for the choice of a corporate name is a deliberate act. Chas. S. Higgins Co. v. Higgins Soap Co., 144 N. Y. 462. This doctrine has been extended to include non-competing lines, for the effect it would have upon the securities of the two companies, and to also include corporations which are not engaged in commerce. Willys-Overland Co. v. Akron-Overland Tire Co., 273 Fed. 674. It is no defense that the Secretary of State approved and selected name in filing articles of incorporation. General Film Co. of Mo. v. General Film Co. of Mo., 237 F. R. 64. Int. Com. Y.W.C.A. v. Y.W.C.A. of Chicago, 62 N.E. 557. There is one exception to the rule; in the case of artists and professional men a name and "good-will" cannot be transferred with the business. Because of the personal element, such a transfer is against public policy as amounting to a misrepresentation.

The branch of non-technical or imperfect trade-marks has been extended far beyond the original limits of technical trade-marks. This extension is generally called unfair competition and has been evolving contemporaneously with these branches of the law. It was not until 1888 that the Supreme Court of the United States distinctly recognized the doctrine of unfair competition, by stating, "Undoubtedly an unfair and fraudulent competition against the business of the plaintiff -- conduct with the intent, on the part of the defendant, to avail itself of the reputation of the plaintiff to "palm off" its goods as plaintiff's, -- would in a proper case, constitute ground for relief." Lawrence Mfg. Co. v. Tennessee Mfg. Co., 138 U.S. 537.

The courts originally extended protection to the mark or visible medium of "good-will", later to the proprietory name, and still later to all agencies, whether tangible or intangible, contributing to the "good-will", succinctly defined as the habit of people in purchasing an article or patronizing the business. In England "passing off", in the United States "substitution" or "palming off" and in France "concurrence de loyale" are the general terms applied to that competition wherein one competitor attempts to secure an advantage by a copy or close simulation of another's goods or place of business. The fundamental test of "unfair competition" is not whether the public is likely to be deceived as to the origin of the goods, but whether the defendant, in effect, is, by his conduct "passing off" his goods or business as complainant's. Borden's Ice Cream Co. v. Borden's Condensed Milk Co., 201 Fed. 510.

In the absence of an infringement of a technical trade-mark, copyright, patent or print and label registration, a suit upon the ground of unfair competition is determined not by the rule that the public actually was deceived, but whether it would be deceived, but whether it would be deceived and actual or threatened damage to the complainant did or would result. When giving relief to each complainant, the court is confronted with the extension or creation of a monopoly and the restriction of competition. Thus, the court has held that Hubbell, in the arbitrarily selected size and shape of the parts of his devices, did not acquire the sole right to the exclusion of other manufacturers who openly adopted such size and shape for the purposes of standardizing and making the parts interchangeable with those of each other and of the complainant. Harvey Hubbell v. General Electric Co., 262 F. 155. To all that has been previously said with reference to non-technical marks and trade-names which are generally lawful to use, there is this exception. Although each and every element may be old in the trade, nevertheless, if the later comer so chooses each and every old element that his general ensemble is likely to deceive the average or general public, he is not entitled to use these elements. Thus a court "may not enjoin the performance of an act which is lawful, but it may forbid the defendants from doing a series of acts which are calculated to produce an illegal and wrongful end". Dr. A. Posner v. Posner et al, 10 T.M. 118. It is immaterial whether the immediate purchaser from a manufacturer or dealer is or is not deceived, where the ultimate purchaser is likely to be. Southern White Lead Co. v. Cary, 25 Fed. 125. It is a general rule that the later producer must distinguish his product from that of the earlier user and he should get as far away from the original as he can instead of as close as he can. Equity does not concern itself with the means whereby unlawful competition is performed, for if the result is fraudulent and the public are induced to believe that what is offered by one is that of another, such means although independently lawful, will be enjoined. Bates Mfg. Co. v. Bates Numbering Machine Co., 172 Fed. 895. It is another rule that manufacturers are not permitted to so mark, package, or label their goods that unscrupulous dealers by but a slight change may destroy the differentiation and thereby "pass off" the articles as those of the originator. Penn. Rubber Co. v. Dreadnought Tire & Rubber Co., 225 Fed. 138. Also Geo. C. Fox Co. v. Best Baking Co., 95 N.E. 747. As to what would deceive the 'average person', the courts have invariably held that that which would deceive a cautious and discriminating purchaser is not the criterion by which the alleged unfair competition is to be judged, but those unfair acts which would mislead the ordinary or usual buyer.

Interesting recent cases relating to geographical trade-names distinguish the general rules heretofore given as follows: A dealer of flour in Chicago obtained inferior flour from Milwaukee and labeled it "Best Minnesota Patent, Minneapolis, Minn." The public was deceived and purchased the flour to the detriment of the Minneapolis Millers. One Minnesota miller was held to have the right to prevent such use although Minnesota and Minneapolis are geographical terms and can be used by all Minnesota and Minneapolis millers. Pillsbury-Washburn Flour Mills Co. Ltd., v. Eagle, 86 F. 608. A manufacturer of baseballs who had a contract to make the same for the American League, could not restrain a rival manufacturer who secured a similar contract, from using the same words "Official American League" for the period of last mentioned contract. A. J. Leach & Co. v. Simmons Hardware Co., 138 S.W. 503.

Another problem is: Suppose a soap manufactuer with the trademark "Spotless Town" establishes a town of that name. Subsequently a citizen thereof manufactuers soap and marks it "Spotless Town Soap: Spotless Town Soap Mfg. Co. What relief if any could the founder of the town secure against the second soap concern.

The general rule with relation to descriptive phrases and trade-names has been modified in the following cases: The words "Junket Tablets" were used to designate a preparation of rennet, and the objectionable words "Junket Capsules" marked a similar preparation in capsules. It was held that the use of the latter words was objectionable, but the phrase "Auker's Capsules for Making Junket" was not. Hansen v. Siegel-Cooper Co., et al, 106 F. 691. Upon the expiration of a patent for making brushes, the bristles of which were set in rubber, the complainant adopted the name "Rubberset" and the defendant made similar brushes under the name "Set in Rubber-Devoe". Both marks were placed on the ferrule of the brushes and it was held that the defendant could place the words "Set in Rubber" on the handle with the word "Devoe" on the ferrule, but could not position both words on the ferrule. Rubber & Celluloid Harness Trimming Co. v. F. W. Devoe, et al., 233 F. 150. In another case the complainant manufactured hooks and eyes under a patent and sold them under the trade-name "Hump" until they became known as "Hump Hooks and Eyes". They also manufactured hairpins but did not use the mark thereon. The defendant used the word "Hump" in its corporate name and upon its hairpins and such mark was descriptive. Such use was not held unfair competition, since the public had never associated the word "Hump" with the hairpins of the "Hump Hook and Eye" manufacturer. DeLong Hook & Eye Co., v. Hump Hairpin Mfg. Co., 130 N.E. 765.

The rule relating to personal trade-names is modified in the following: A sequel to the original W. Baker & Co. v. Baker (supra) Case was that the defendant W. H. Baker & Co. of Winchester, Va. was required to differentiate his product from the original Baker product, and he did so by using the statement "W. H. Baker is distinct from the old chocolate manufacturer of Walter Baker & Co." Subsequently, Wm. H. Baker of Syracuse, New York, used the same phrase but changed the "W" to "Wm." thereby inferring that he was the defendant in the original suit. He was enjoined in his use of the phrase and was required to differentiate from both Baker products. Baker v. Baker, 115 F. 297. Another case was where the complainant was bequeathed an undertaking business by his brother, and later removed the establishment. The widow established a competing business in the same building under her own name and published the following: "No interruption to business during improvements", when in fact there were no improvements, and "We have no branches". Such use of the phrases coupled with the personal name was held unfair competition and prohibited. W. R. Speare Co. v. Speare et al, 265 F. 876.

Another interesting case relating to personal names is Pain v. Pain et al, 4 T.M.R. 144, wherein it was held that since the plaintiff was not in business at the time he brought the suit and had not been for three years previously, he was not suffering any damages, and the preliminary injunction which ordinarily would issue since the defendant was a corporation, would be denied. Again where "Royal" was arbitrarily adopted as a trade-name for baking powder, the defendant, whose surname was Royal, was enjoined from using the words "Maxim Baking Powder" under which his surname was printed in letters of the same type. Royal Baking Powder Co. v. Royal, 122 F. 337. A somewhat similar case was where the trade-mark "Welcome" was applied to soap. The defendant, whose name was Welcome A. Smith, printed labels with the word "Welcome" in larger letters above the words A. Smith, and the word "Welcome" appeared alone on the label at one end of the package. The defendant was enjoined from using his name in such a manner as to infer that the soap was "Welcome Soap" made by A. Smith. Lever Bros. Ltd. et al, v. Smith, 112 F. 998.

Merchandise for sale is usually inclosed in containers or cartons, with identifying labels. In the absence of the label registration, in order to sustain an allegation of unfair competition, the similarities must exceed the differences, when considered as a whole, so that the ordinary purchaser usually will be misled by the preponderance of similarities. Schlitz Brewing Co. v. Houston et al, 263 O. G. 332. The labels, therefore, do not have to be identical, for in Notaseme Hosiery Co. v. Straus et al, 209 F. 495, "Notaseme" and "Irontex" were held to be similar and unfair competition.

A rectangular light blue paper label 4.6" x 2.5" with a trade designation printed in dark blue in the upper half was infringed by a similar label 4.7" x 2.6" with dark blue printing on light blue paper, notwithstanding that different trade devices were used, for it was shown that the defendant changed its distinctively dissimilar and original label to the infringing one. Lalance v. Grojean Mfg. Co. v. National Enameling & Stamping Co., 109 F. 317. Where the defendant's labels were used on similar goods and were engraved by the same company and apparently were copied from the complainant's labels, such use was unfair competition. Notaseme Hosiery Co. v. Straus, (supra).

It is not to be inferred from the foregoing that mere imitation of color or other indicia upon a label constitutes unfair competition, for the contrary has been held in the following: Color - Pacific Coast Condensed Milk Co. v. Frye & Co., 147 Pac. 865; Arrangement and color - E. Regensburg & Sons v. Juan F. Portuondo Cigar Mfg. Co., 142 F. 160. The courts will enjoin the sale of any counterfeit labels upon the ground that they are intended to be used and when used must be deceptive, even though the labels are not actually used in commerce or placed on any goods. Carson v. Ury et al, 39 F. 777.

Unfair competition relating to the dress of goods is subject to the previous rules concerning labels. It is not to be inferred that the similarities hereinbefore mentioned must necessarily be that of sight, for one of the truest tests of similarity is that of sound, and words which are idem sonans are infringements. It has been held that a chocolate candy made in the form of a bar with peaks and humps on it and the word "Peaks", with the letters K and S connected, printed upon tinfoil wrappers, was infringed by a similarly wrapped competing candy with the word "Alps" and the letters A and S connected. Mason Au & Magenheimer Confectionery Mfg. Co. v. Chumas; Same v. Alps Candies et al, 275 F. 357.

The use of the same colors, labels, containing vessels or cartons does not constitute unfair competition when such feature or features are in common use in the trade and especially when they serve a purpose of utility, convenience or attraction. Viavi Co. v. Vimedia Co. et al, 245 F. 289. The fact that the first manufacturer has changed his dress does not give the competitor the right to adopt or simulate the abandoned dress. De Long Hook & Eye Co. v. Francis Hook & Eye & Fastener Co., 159 F. 292. But if a trademark is abandoned another can use it later. This is of importance in a receiver's sale when the question is: Was the business sold as a "going concern". Where the complainant, who was the junior manufacturer and made superior tooth brushes, sold under the name "Keep Clean" and the defendant, notwithstanding the fact that he had applied the name "Sta-Kleen" prior to complainant's manufacture, was held guilty of unfair competition because the word "Sta-Kleen" was printed in the same red letters and the package dressed in the same character. Florence Mfg. Co. v. J. C. Dowd & Co., 178 F. 73.

In another case the defendant put upon the market a cheaper grade of tobacco in plugs of the same size and shape and with tags thereon of the same size, shape, style and color. The only difference was the word "Traveler" upon defendant's tag and "Schnapps" upon plaintiff's tag, which difference could not be distinguished at a distance. The evidence showed that the simulation was intended to and did in fact deceive customers who intended to buy complainant's product. The defendant was enjoined from the use of a label or tag of this kind in spite of the fact that complainant had no exclusive right to the use of a tag upon a plug of tobacco. R. J. Reynolds Tobacco Co. v. Allen Bros. Tobacco Co., 151 F. 819.

An interesting case is that of Swift & Co. v. Brenner et al, 125 F. 826. Soap was put up in single packages by complainant and the top thereof marked "Old Mill Soap", with a picture of an old mill, underneath it "Made by Swift & Co. Chicago", and on each side "Old Mill Soap Made by Swift & Co. Chicago." Defendant packaged soap in single cakes with the picture of an old mill on the top and the words "Old Stone Mill Soap" beneath which were the words "Made by Crown Mfg. Co." and on each side "Old Stone Mill Soap Made by Crown Mfg. Co." The situation of the letters and the type were similar in each case so that the packages presented a similar appearance and this was held unfair competition. It will be noted that in order to protect rights in the use of a particular dress of an article sold, the complainant need not have an exclusive right in any one element of the dress or packing of the article, size, shape, coloring, lettering, wording or symbol so long as the ensemble has come to be a public guaranty of origin and quality. Howard Dustless Duster v. Carleton, 219 F. 913.

Advertising may be performed by letters, circulars, periodicals or signs. Mere extravagance in advertising is not a fraud upon the public which will deprive the complainant of relief in a suit for unfair competition. Edward & John Burke v. Bishop, 175 F. 167. A demand for goods created by advertising belongs to the advertiser, who will be protected from a competitor seeking to take advantage of such advertisements. Chas. H. Elliott Co. v. Skillkrafters, Inc., 114 At. 488. The same pictorial views may be used in advertising where the products are substantially identical, and in a recent case it was held not unfair competition for a jobber to photograph and incorporate in his catalogue certain pages of complainant's catalogue, when the goods described were identical, both parties being jobbers of the same articles made by the same manufacturer. In this case there was no deceit or attempt to "palm off" the goods of one for the other, and furthermore the catalogues were easily distinguishable. Benj. T. Crump Co., Inc. v. J. L. Lindsay, Inc., 107 S.E. 679.

The general rules governing infringement of trade-marks, trade-names, dress of goods and labels apply with equal force to that broad class of unfair competition -- simulation. The remaining forms of simulation may be divided as follows: Color may not be appropriated as a valid trade-mark unless it has acquired a "secondary meaning". Diamond Match Co. v. Saginaw Match Co., 142 F. 727. Thus the manufacturer of a two color match was held to have acquired no inherent right to two colors. When the complainant had built up a valuable trade by dying dust cloths black to make them distinctive in appearance, it would be protected where such color identified the origin of the cloth. Howard Dustless Duster Co. v. Carleton, (supra). Another case occurred where the defendant not only colored its syrup, barrels and kegs to correspond with complainant's but circularized the trade calling attention to the cheapness of defendant's products and advising that consumers could not tell it from complainant's. Coca

Cola Co. v. Gay-Ola Co., 200 F. 720. A slight modification of this "passing off" occurred when a soda fountain operator diluted complainant's syrup by adding other ingredients before selling it. The substitution was enjoined. Coca Cola Co. v. Brown & Allen, 274 F. 481.

Another interesting phase of simulation is that of form. George G. Fox Co. v. Best Baking Co., 95 N.E. 747. It was held that defendant's manufacture and sale of bread of the same size, shape, color and general appearance, accompanied by a readily detachable distinguishing paper band was unfair competition. Upon the ground that the form and color had acquired a "secondary meaning" similar to that in the aforesaid case, the Shredded Wheat Biscuit Company was held to have an exclusive property right in its biscuit. Shredded Wheat Co. v. Humphrey Cornell Co., 250 F. 960. An exceptionally singular case was where the defendants put out an envelope similar to that used by the telegraph company, the intention being to attract the receiver's attention. Upon opening the envelope and seeing that it was merely an advertisement, the momentary deception created was immediately dispelled, and such practice was held to be a mimicry and not unfair competition. Portal Tel. Co. v. Loermon Knight, 188 F. 696.

An interesting class of cases was first decided in Weinstock & Co. v. Marks, 109 Cal. 529, wherein it was held unfair competition for the defendant to construct a similar building, dress his windows to correspond with those of the adjacent merchant and fail to place signs upon his windows or building to distinguish his place of business. A later case is that of the United Cigar Stores Co. of America v. United Confectioners, 113 At. 226. The complainant was a national organization whose store windows were provided with a shield with the initials U.S.C. Co. and the store front was painted red. The defendant had an L shaped store, the corner of which was occupied by complainant. Later, the defendant continued the red paint to include its store fronts, and likewise used a shield with the initials U.S.C. Co. The judge, after personal inspection of the fronts, issued a preliminary injunction compelling the defendant to distinguish the store fronts so that the public would not be deceived. Also see J. S. Baum Mer. Co. v. Levin, 174 S. W. 442 (1914).

Another series of interesting cases relate to conveyances. It will be remembered that in the case Knott v. Morgan, (supra) an injunction issued restraining the defendant from simulating complainant's conveyances. Another early case related to the simulation of milk wagons. Nokes v. Mueller, 72 Ill. App. 431, and in 1884 there was another interesting cab case. N. Y. Cab Co. v. Mooney, 15 Abbots New Cases, 152. These earlier cases have laid the foundation for the general rule that even though color cannot constitute a valid-trade-mark, nevertheless, when such color has acquired a "secondary meaning" such as in Yellow Cabs, Blue Cabs, Black and White Cabs and Checkered Cabs, such color will be protected. Yellow Taxi Cab Co. v. City Taxi Cab Co., 2 T.M. Rep. 519; Yellow Cab Co. v. Walter J. Gibbons, 8 T.M. Rep. 248; Taxi & Yellow Taxi Operating Co. v. Martin, et al., 108 At. 763; Yellow Cab Co., Inc., v. Becker, 10 T.M. Rep. 187.

Where an article is not patented, anyone may make it, but a qualification is that the second manufacturer must distinguish his product. The imitation of goods in all of its minor details will constitute unfair competition, although there are cases which hold otherwise. The imitation of functional features, however, is not unfair competition.

One may not make a product and instruct retailers to substitute it for complainant's. Thus, in Barnes et al. v. Pierce, 164 F. 213, the manufacturer of an antiseptic called "Argyrol" enjoined the jobber who listed "Argyrol" but supplies customers with a cheaper substitute. An unbelievable extension of the doctrine of substitution is found in the case of Eli Lily & Co. v. Wm. R. Warner & Co., 275 F. 752. It was shown that the defendant manufacturer experimented with all kinds of chocolates and cocoa to obtain a chocolate having the particular color and taste to disguise a quinine preparation identically like complainant's. Defendant's salesmen explained and demonstrated to retail druggists that defendant's cheaper product could be substituted for complainant's without the purchaser being aware of the substitution or in any way harmed. The court said that although the Warner Co. as well as all other manufacturing chemists, was entitled to manufacture a compound of quinine and chocolate and compete with the Lily Company, and, furthermore, could call the same a chocolate quinine compound, nevertheless, in view of defendant's conduct, the Warner Company was enjoined from using chocolate in any way, shape or form for disguising a quinine preparation, which heretofore they had a legal right to do.

One division of the law of substitution relates to fluids, which in turn may be divided into beverage and non-beverage. Prior to prohibition, intoxicating liquors, particularly whisky, were a prolific source of litigation. Typical of this litigation is that of Hostetters' Bitters. The Federal Court in California in 1901 held that it was not unfair competition for the defendant's agent to suggest to retailers that the defendant's product be sold from the complainant's bottles. Hostetter Co. v. Martinoni, 110 F. 524; Hostetter Co. v. Brunn, 107 F. 707; Hostetter Co. v. Sommers et al, 84 F. 333. In 1905 upon substantially the same evidence, the New York Federal Court held that such acts constituted unfair competition. Hostetter & Co. v. Gallagher Stores, 142 F. 208. The New Hampshire

Federal Court extended this doctrine in the following case: The complainant furnished glasses with its trade-mark blown therein for use in an advertising campaign to sell their beverage. Defendant received some of these glasses and subsequently sold a competing beverage therefrom, which selling was enjoined. Moxie Co. v. Bagoian, 197 F. 680.

An example of a trade-mark fluid is acetylene gas. The nationally known Prest-O-Lite Company has been uniformly successful in preventing its several competitors from refilling its containers. The defendants accepted empty containers from the customer and in return furnished him with a Prest-O-Lite container filled with the substituted fluid. Prest-O-Lite Company v. Auto Acetylene Light Co., 191 F. 90; Prest-O-Lite Co. v. Heiden et al, 219 F. 845; Prest-O-Lite Co. v. Davis et al, 215 F. 349; Prest-O-Lite Co. v. H. W. Bogen, Inc., 209 F. 915; Auto Acetylene Light Co. v. Prest-O-Lite Co., 264 F. 810; Prest-O-Lite Co. v. Bournonville, 260 F. 440; Prest-O-Lite Company v. Acetylene Welding Co., 259 F. 940.

It is not to be inferred from all that has preceded, that literary and artistic productions, titles, and authors' names are not subjected to unfair competition. The difficulty in the latter class, is that the author or creator's name is a personal name or a nom de plume, subject to all the rules heretofore given with reference to trade-names. Likewise titles, which by their very nature must be descriptive of the subject matter, are subject to all the rules governing descriptive trade-names and trade-marks. There may be a property right in the production per se. In the case, Bureau of National Literature v. Sells et al., 211 F. 379, the re-sale and "palming off" of second-hand books of complainant's was held unfair competition. But where no "palming off" occurred such a re-sale was not held unfair competition. Ginn & Co. v. Apollo Pub. Co., 215 F. 772. The courts are divided upon the question of whether the name of a play will be protected when the offending title is similar. When such title has attained a "secondary meaning" the use of a similar title will be enjoined, but otherwise the similar titles are held to be non-conflicting, and where a plurality of plays have the same book title and are each based upon the book, such use is not unfair competition. Glaser v. St. Elmo, 175 F. 276.

It has been held that there is no unlawful competition between a moving picture character and a similar literary one. It would seem, however, that this doctrine is rather severe but owing to the novelty of the cinema, the law is not applied with equal force and effect as in other branches of trade. The reasonable ground apparently should be that where an author has created a character, which character, as Sherlock Holmes or Nick Carter, has acquired a "secondary meaning", the author's reputation should be protected for it may be seriously injured by the "passing off" of spurious and inferior characters by others in the judicially determined non-competing fields. Where the copyright had expired, the creator of a character or characters who first named them, enjoined his former employer from publishing similar cartoons drawn by another cartoonist. This relief rested upon the property right acquired by the creator, which might be injured if the public became tired to the characters because of the poor imitations. Fisher v. Star Co., 132 N.E. 133, 139.

Photographic skill likewise will be protected. The reproduction and sale of an original photograph with the name of the original photographer thereon constituted unfair competition. White Studio, Inc. v. Alexander W. Dreyfoos et al., 116 N.E. 796. The foregoing has been extended to cover the defendant's copying the size, shape, color and language of the plaintiff's subscription contract and heading the photograph for advertising purposes in simulation of complainant's. Elliot Service Co. v. Dispatch Photo News Service Co., Inc., 189 N.Y. Sup. 459. A unique newspaper title case occurred in Powell v. Valentine, 10 T.M. Rep. 277. In each instance two newspapers combined and continued to serve all their subscribers under one of the original names, but the other paper retained an office and a bank account. The defendant's use of the other original name, although accompanied by the statement that he was not a successor of the earlier paper, nevertheless, was enjoined.

The courts definitely decided that the gathering and distributing of news is a legitimate business and that there is a property right therein. National Tel. News Co. v. Western Union Tel. Co., 119 F. 294. Illinois Commission Co. et al v. Cleveland Tel. Co. et al, 119 F. 301. This doctrine was sutained and extended by the Supreme Court. It held that although there was no damage to the public or deception, nevertheless, complainant had a property right in the news he had gathered which would be protected. The defendant took the bulletins issued or newspapers published by complainant and re-wrote them. In many instances, due to the difference in time between the different localities in the United States and the fact that news from foreign countries was collected in New York, the defendant was able to supply its subscribers with the re-written news long before complainant's customers received their news. International News Service v. The Associated Press, 9 T. M. Rep. 15.

Another phase of unfair competition relates to patents and patented articles. Infringement of the patent monppoly, however, forms no part of this paper. One instance of acts relating to patents was where the defendant threatened suit to several customers of complainant, but refused to bring a test suit to decide the question of infringement. This refusal coupled with a continuation of the notices of threatened suits to complainant's customers, constituted unfair competition. Racine Paper Goods Co. v. Dittgen, 171 F. 631. Electric Renovator Mfg. Co. v. Vacuum Cleaner Co., 189 F. 754. Atlas Underwear Co. v. Cooper Underwear Co., 210 F. 347. In 1918 it was held that one who has the right to use a word as a designation of his goods under a somewhat similar statutory monopoly (a registered trade-mark) and in good faith warned dealers of his supposed right was not guilty of unfair competition. McIlhenny Co. v. Gaidry, 253 F. 613. Where the plaintiff denied infringement and numerous suits had been brought against his customers by the defendant who refused to sue the plaintiff directly, such suits would ordinarily constitute unfair competition, but since the plaintiff in a prior suit had had the opportunity but failed to intervene, the continuation of such notices of infringement and threats to sue, did not constitute unfair competition.

Alleged unfair competition may ensue upon the expiration of a patent upon a product. Where the defendant to properly identify the previously patented construction utilizies the names known to the trade, such utilization is not unfair competition, for the name is used in its "secondary" sense but the defendant must distinguish the origin. An extension of the "secondary meaning" acquired during the life of a patent is illustrated by the Shredded

Wheat Biscuit Case. Although the patents upon the shape of the articles and machine had expired, it was held that the shape had acquired a "secondary meaning" which would be protected. Shredded Wheat Company v. Humphrey Cornell Company, (supra).

Another phase of "passing off" is the withdrawal of partners from a firm, officers from a corporation and employees from prior employment and the establishment of a competing business. In such cases the rules relative to trade-names are particularly applicable. Reference to the former connection may be made but must not be used improperly to "pass off" the new business as the old. A former employee, in the absence of knowledge acquired in a fiduciary relation, may approach complainant's customers. American Specialty Co. v. Collis Co., 235 Fed. 929. In the case of Hurtzig v. Schierenbeck, 5 T. M. R. 417, it was held that a former employee may lawfully solicit trade from customers if the list thereof was obtained from a trade journal.

Another branch of the same law derived from the foregoining is that relating to trade-secrets, which are of similar forms. The chief of these is the use of a list of complainant's customers for solicitation. Chas. H. Elliott Co. v. Skillkrafters, (supra). It is also the duty of former employees not to divulge trade secrets acquired in a fiduciary relationship. Morrison v. Woodbury, 10 T.M.

Rep. 130. A third phase of trade-secrets which is unfair is the use of an unlawfully obtained list of a rival's customers. Witkop & Holmes Co. v. Great A. & P. Tea Co., 124 N.Y. Supp. 956. Where the defendant acquired the trade-secret while under contract to manufacture and sell complainant's product and subsequently breached the contract, and put out a competing article under the old label representing it as made by complainant, such use of the trade-secret was enjoined. Feasel v. Noxall Polish Mfg. Co., 268 F. 887. From the foregoing, however, it is not to be inferred that knowledge fairly acquired by the competitors or employees during previous employment cannot be used, for in each instance the same has been held lawful. Eli Lily & Co. v. Wm. R. Warner, (Supra), S. W. Scott & Co. v. Scott, 174 N.Y. Supp. 583, respectively.

Interference with a competitor's business is a phase of unfair competition. In addition to the various forms of libel, slander, malicious and civil prosecution and "passing off" a competitor may unfairly interfere with complainant's contracts. These may be between employer and employee, customers and complainant and jobbers and manufacturers who supply complainant with material. But, where the defendant offered employees of a competitor higher wages, better conditions, and increased opportunities of advancement and the employees were not under a contract for any definite period of employment. Eastman

Kodak Co. v. Warren, 9 T. M. Rep. 446. Even where originally the defendants were employees and took with them a number of other employees, such taking was held lawful. Lapointe Mach. Tool Co. v. J. N. Lapointe Co., 99 Atl. 348.

Two rather unique cases relating to territorial jurisdiction are, A. Bourjois & Co., Inc. v. Katzel, 275 F. 539, and Morris et al. v. Altstedter, 156 N.Y. Supp. 1103. In the former, a domestic purchaser of a foreign product in a foreign market, imported and sold the same in its original package. The complainant, having acquired the good-will and territorial rights in the United States from the foreign manufacturer, imported the bulk product and packaged it in the United States, applying thereto the foreign trade-mark. It was held that the only remedy of the complainant was to recover from the foreign manufacturer for the breach of the contract. In the second case, the defendant and complainant both resided in the United States. After differing about the price of an article, the defendant made and sold in Canada photographic reproductions of complainant's goods. The profit, however, was received by the defendant in the United States, wherefore it was held that the United States could enjoin such competition. Morris et al. v. Altstedter, (supra).

The foregoing concludes that portion of the paper devoted to common law doctrines of unfair competition, which have been developed by the courts without the aid of or interference by the legislative branch of the government.

This paper, as stated, does not include a discussion of the libel, slander and malicious prosecution phases of the law of unfair competition, which properly may be included under the preceding division of this paper.

The succeeding portions of this paper will consider briefly the statutory provisions relating to unfair competition, in contra-distinction to the Common Law, but do not include a discussion of patent and copyright law. The statutory provisions may be divided into two groups; the first, those relating to the Federal and State laws providing for the registration of trade-marks and labels; and the second, those relating to unfair methods of competition in general.

By 1870, the court decisions had so definitely established the doctrine that a property right existed in a trade-mark, that Congress passed the first trade-mark act on July 8, which on August 14, 1876 was followed by the criminal provisions. These statutes, however, were held unconstitutional because they related to intra-state trade as well as interstate trade. Congress, however, was not discouraged by the unconstitutionality of the first act and on March 3, 1881 passed the first valid Federal Trade-mark Law which was followed by others amending and enlarging it. These laws are all declaratory of the Common Law and provide for the registration of perfect or technical trade-marks. The enactment of March 3, 1921, however, provides for the registration of non-technical marks to permit American manufacturers to register their marks in foreign countries having reciprocal relations with the United States. This later act, however, provides for registration and confers no rights whatsoever upon the registrant. The provisions of the other or general trade-mark acts provide that registration of the trade-mark shall be <u>prima facie</u> evidence of appropriation, use and ownership of the mark and the exclusive right to use the same within the boundaries of the United States. Since this law is merely declaratory of the Common Law, an erroneous grant of registration may be cancelled upon proof that the mark was used and never abandoned by another, prior to its adoption and use by the registrant. The only advantage that registration in the United States Patent Office confers upon the owner of the mark, is that, in an unfair competition suit for infringement of the registered trade-mark, fraud, even by an innocent user, is presumed in the use of the alleged infringing mark and thus no positive showing of fraudulent intent or actual deception upon the public is necessary.

Another statutory section of the unfair competition laws, which is an extension of the trade-mark law is the Federal provisions for the registration of prints and labels. The first print and label act was that of January

18, 1874, and the present provisions are those of March 4, 1909. In general the same rules relating to trade-marks apply to prints and labels.

The Federal government, however, has not been the only one to take cognizance of the property rights in trade-marks and labels, for the several States have provided for the registration of trade-marks, in some instances of prints and labels, and in other instances of containers. The Federal government does not provide for the registration of containers of distinctive design but, if patentable, grants design patents.

As stated, the statutory provisions relating to trade-marks, prints and labels in general are declaratory of the Common Law. An interesting question, however, recently arose in the case of Theodore Rectanus & Co. v. United Drug Co., 248 U.S. 90. The facts in this case were that Theodore Rectanus, a Louisville, Kentucky druggist in 1883 used the trade-mark "Rex" for a stomach medicine, and products bearing that trade-mark in that locality were known as his. The United Drug Company takes title to the trade-mark "Rex" from a Mrs. Regis of Massachusetts who in 1877 appropriated the mark and continuously used it upon the same medicine. In 1893 she registered this trade-mark in Massachusetts and in 1900 in the United States Patent Office. The Federal statutes provide for the registration of a trade-mark to the first appropriator and user, granting him exclusive use throughout Federal territory. The District Court held that in spite of the innocent and adverse use of the infringing mark for over twenty years, the mark belonged to the United Drug Company, although during these years its business had never extended into the territory covered by Rectanus, and an injunction against further use would lie. The Circuit Court of Appeals reversed the District Court holding that the United Drug Company's long non-usage of the mark deprived them of its exclusive right in the Louisville territory, even though granted the same by statute. They based their decision upon the laches of the United Drug Company in not extending its business into all parts of the country, which was confirmed by the Supreme Court of the United States. We now have this doctrine in our statutory trade-mark law. Independent, innocent and non-contested use of a tradė-mark whether registered or unregistered by a later appropriator for a long period of time will establish property rights in him., which cannot be dispossessed by the early appropriator. This decision establishes territorial or vertical divisions in the use of a registered trade-mark.

Another phase of the general trade-mark law which has been modified in a striking manner is illustrated in the case of the Bayer Co. v. United Drug Co., (Supra). The Bayer Company had registered in the United States Patent Office the trade-mark "Aspirin" for a chemical drug technically known as acetyl salicylic acid. The various licensees under the patent continued to furnish pills to the retailing druggists from the powder product which they manufactured after the patent expired in 1917. Prior to its expiration, the public had been taught self-prescription and when purchasing acetyl salicylic acid always called for "Aspirin", since they knew it by no other name. The testimony showed that the retail druggists and jobbers knew the product under both names. Heretofore, upon the expiration of the patent, a product could be sold by anyone under the trade-name. In this case, the court in giving justice to both parties, held that following the lines of the Theo. Rectanus v. United Drug Co., (supra), there could be a horizontal division of customers or trade as well as a vertical or territorial one, and, granted an injunction against the use of "Aspirin" upon acetyl salicylic acid, with the exception that the United Drug Company could package pills in lots of one hundred or less and label them "Aspirin", but when shipping to the retailing and jobbing druggists the package container must be labeled with the technical name.

A further phase of the statutory law which has been modified is illustrated in the case of the Aluminum Cooking Utsensil Company v. Sargory Bros., 276 Fed. 447. The patent office arbitrarily has divided merchandise, etc. into different classes and sub-classes and will allow independent registration of the same marks. The Aluminum Company registered "Wear-Ever" for cooking utensils. Sargory Bros. registered the same trade-mark for boilers. The court in enjoining the latter from using this trade-mark on tin wash boilers, said, "They are also using a trade-mark which cannot legally exist for use on articles so closely related as the defendant's wash boilers are to plaintiff's line of goods". Another recent case was that of Aunt Jemima Mills Company v. Rigney & Company, 247 F. 407, wherein the plaintiff registered the words "Aunt Jemima" accompanied by the picture of a laughing negress, for pancake flour. The defendant subsequently registered the same mark for maple syrup. The court said that syrup and flour are both foods, and if the use of the mark were permitted, the plaintiff's reputation would be in defendant's hands.

In the latter part of the last century, while the courts were formulating the common law rules, the conscience of the body politic quickened and in July 1890 in response thereto Congress passed the Sherman Act (See Appendix A for pertinent sections relating to unfair competition and monopolies) under which various administrative commissions were established and certain methods of competition declared unlawful. "It was believed that wide-spread and growing concentration in industry and commerce restrained trade and that monopolies were acquiring increasing control of business." Federal Trade Commission v. Gratz, 40 Sup. Ct. Rep. 572. The Sherman Act, as well as other enactments by the several States, some as early as 1889, "was designed to arrest this movement and to secure disintegration of existing combinations. However, the conviction became general in America that the legislation of the past had been largely ineffective and the Clayton Act, 1914, (See Appendix A) was framed largely with the view of making more effective the remedies given by the Sherman Law, and in the hope thereby of remedying conditions in business which a great majority of American people regarded as manacing general welfare, and which for more than a generation they had vainly attempted to remedy by the ordinary processes of law." Federal Trade Com. v. Gratz, (Supra). At the same time, the administrative machinery was revised and the Federal Trade Commission created. (See Appendix A). These three laws were directed generally towards the monopolistic tendencies and practices of the trade rather than the fraudulent activities, although the scope of the statutes is not so limited as will be noted later. The chief monopolistic tendencies are known as "full-line forcing", "exclusive dealing with requirements", and "control of re-sale prices". In "full-line forcing" contracts the general rule is that they will be held invalid as in restraint of trade. An exception is contracts relating to patented articles, but even this exception has fallen into disfavor.

A far-reaching decision was rendered early in April 1922 by the Supreme Court of the United States in the United Shoe Machinery Case, 42 U.S. 336. The Federal Trade Commission was sustained in its requirement that the company remove from its lease-hold contracts, those paragraphs which required the lesses to use only the lessor's products and machines and not those of a competitor, but if a competitor's machines were used, the lessee was subject to pay an exorbitant rental. The leased machines were protected by patents, but other machines were unprotected, the patents having expired. Since the lease-hold contracts relate to valid and existing patent rights, the Supreme Court appears to nullify the provisions of the Constitution of the United States, which guarantees inventors an absolute monopoly for a limited time.

In the branch of the law relating to the "control of resale prices" the general rule is that a dealer or manufacturer may refuse to trade with customers for any reason whatsoever but cannot agree so to do with others. Western Sugar Refining Co. v. Federal Trade Com., 275 F. 725. In the case, United States v. Colgate Co., 250 U.S. 300, a tacit understanding was held lawful between the manufacturer and his immediate customers since the manufacturer merely suggested the resale price and subsequently refused to sell to violators of the suggestion. The Supreme Court said, "He may withhold his goods from those who will not sell them at the prices which he fixes for their resale. He may not go beyond the exercise of this right by contract or combination, expressed or implied, which hinders or obstructs the natural flow of commerce in the channels of interstate trade". These two decisions but slightly distinguish and depart from the general rule. Contracts generally are unlawful where the combination or agreement is not to resell to specified retailers or jobbers who do not maintain the resale price. Miles Medical Company v. Park & Sons, 220 U.S. 373; Federal Trade Commission v. Beech-nut Packing Company, 42 Sup. Ct. Rep. 150; United States v. Schrader & Sons, Inc., 252 U.S. 85.

Contracts containing the feature of "exclusive dealings with requirements" are invalid. In certain business, where the contract would not be a fraud upon the public, the rule has been modified since a breach thereof would be fraud. When active competition exists, a contract, which requires the dealer to confine his purchases to the oil company which furnished him for a nominal rental tanks and pumps with the company's trade-mark thereon, is valid. Standard Oil Company v. United States, Texas v. United States, both 273 Fed. 478. These decisions are based upon the ground that supplying the public with oil of a different brand from a pump marked with the name of another brand would be deceptive.

Another example of the scope of the Trade Commission's authority is sustained by the courts in prohibiting an unincorporated association not engaged in "doing business" and a similar association in a somewhat similar field from co-operating and combining to coerce the jobbers in both fields. These were doing a wholesale and retail trade and the associations attempted to restrict business to either field by refusing to recognize or sell to them. National Harness Mfgrs. Assn. v. Federal Trade Commission, 268 F. 705. Another illustration of the extended power of the commission to prohibit or correct an unfair method of trading is the case, Federal Trade Commission v. Albany Chemical Company, 11 T.M. Rep. 76. The court sustained the commission's order compelling the Albany Chemical Company to return and surrender to the several States all state trademark registrations secured upon the trade-name "Aspirin", holding that since the federal trade-mark registration had been cancelled and the name had acquired a "secondary meaning", so far as the ultimate purchaser was concerned, the trade-mark belonged to the trade in general.

Another example of the power of the Commission to extend its jurisdiction to practices heretofore recognized as morally but not legally wrong, is found in the case of T. C. Hurst & Son v. Federal Trade Commission, 268 F. 874. It was decided that the giving of a gratuity to a salesman of another firm to 'push the sales' of the seller's goods without the knowledge or consent of the salesman's employer is unfair and the court held that the Federal Trade Commission has the power to order the grantee to desist from such practice.

Fraudulent marking is covered by statutes relating to foods and drugs and patented articles (Sec. 4901). The court under the Clayton Act have extended these restricted classes as follows.

In April 25, 1922 the Supreme Court handed down an epoch-making decision in the case of the Winstead Hosiery Company v. Federal Trade Commission. (Case reported, not issued). After due investigation, the Commission ordered the hosiery company to cease marking underwear products in a manner but slightly descriptive of the goods, which might mislead the public. In almost every instance, such markings would not mislead the jobbers or retailers, since such designations were in general use throughout the underwear trade. This case appears to be an extension of the principles of the truthful marking of merchandise such as we have known in the case of marking adulterated and artificially colored foods under the Food and Drug Act. The Supreme Court held that the use of the designation "All Wool" and "Merino Wool" to be misleading where the fabric was not wholly wool or Merino wool. The court said that the company in marking goods must indicate the percentages of each material in the several fabrics. With the Supreme

Court sustaining the Commission in this case, may we not expect this doctrine to be extended to each and every class of the retail trade? In the furniture trade is it too much to ask that the designation "American Oak" be truthfully labeled as oak, grained and stained pine, and mahogany stained pine, poplar or birch where the wood is actually poplar, pine or birch and that "solid" actually mean solid throughout and not a solid base of common wood veneered with a finer wood? Is it beyond our imagination to expect all cotton, woolen and flax goods to be properly labeled with the percentages of each and the processes of manufacture? When will the cheaper grades of heavy silk be labeled as silks "weighted" with lead or tin salts? Today manufacturers of the better grades of fiber silk would lose nothing by calling fiber silk as such, since when properly manufactured and used, it is far superior to natural silk. In the fur trade, why should a dyed muskrat skin mask itself under the name "Hudson Seal", when probably the living animal never was nearer Hudson Bay than Alabama or Georgia, and probably the skin never saw the Hudson River until it reached New York to be dyed and made up into a garment. The foregoing doctrine could be indefinitely extended beyond the enumerated examples, but we pass on in the belief that this epochal decision promises relief from false and suggestive trade-names which generally are not one whit misleading to the jobbers and retailers but are misleading and deceiving to the public and are unfair to the manufacturer of higher grade merchandise.

This paper, with the exceptions noted, has considered the various branches of unfair competition. The term 'unfair competition' has been used in a general and restricted sense. In the latter, reference is had to trade-mark law and its extensions. In the former, unfair competition embraces unfair methods. Although heretofore distinctions have been made between these two branches of the law, nevertheless, the decisions within the past two years indicate that they are generally approaching each other. Whereas the term methods of unfair competition formerly was restricted to monopolistic practices except within the past few years as we have seen, it now must be extended to cover fradulent practices which are limited to those upon the public. It is interesting to observe that the first cases of trade-mark infringement were decided upon the theory that it was fraud upon the public to permit one man to use the mark of another. Subsequently the courts based their decisions, not only upon the ground that a property right existed both in the trade-mark and the good-will of the business, which would be protected. The methods of unfair competition branch of the law, therefore, is following in the path of the trade-mark branch of the law of unfair competition.

It has been well said by Lord Macnaughton, Reddaway v.

Banham L.R.199, p. 221, "Fraud is infinite in variety; sometimes it is audacious and unblushing; sometimes it pays a short of homage to virtue, and then it is modest and retiring; it would be honesty itself if it could only afford it. But fraud is fraud all the same; and it is the fraud, not the manner of it which calls for the interposition of the Courts."

"Competition is not an unmixed good. It is a battle for something that only one can get; one competitor must necessarily lose." Federal Trade Com. v. Gratz, (Supra.). It is a basic principle of the law that a court cannot grant relief for loss sustained through competition where such competition has been lawful or does not offend the sensibility of the court. The faith and hope of the honest American business man for fairness and honesty in competition lies in the courts.

"The courts have been ever ready to extend the doctrine and possibility of a cleaner and greater business practice as the occasion has required and the gradual but progressive, judicial developement of the doctrine of unfair competition in trade has shed luster on that branch of our jurisprudence, an embodiement, to a marked degree, of the principles of high business morality, involving the nicest discrimination between those things which may and those things which may not be done in the course of honorable rivalry in business." Denison Mfg. Co. v. Thomas Mfg. Co., 94 Fed. 651.

In conclusion it is observed that the developement by the courts of the law of trade-marks and unfair competition has been entirely independent of statute law and in the branch of unfair methods of competition the courts have extended the definition of "unfair" from monopolistic to fraudulent and deceptive practices. Fair competition and honesty in business is the heritage of posterity bequeathed by the judiciary, who have never hestitated to extend the law to the ethical ideal and compel dishonest competitors to conform thereto.

TABLE OF CASES

Byron v. Johnson	(1816)	2 Mer.	29
C			
Carson v. Ury et al,	(1889)	39 F.	777
Celluloid Mfg.Co.v.Cellonite Co.	(1887)	32 F.	94
Chickering v. Chickering & Sons	(1914)	215 F.	490
Citizens W.Sup.Co.v.Golden Rule	(1920)	180 N.W.	95
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Crawshay v. Thompson	(1842)	4 Man&Gr	357
Croft v. Day	(1843)	7 Beav.	84
Crump, Benj.v.J.L.Lindsay,Inc.	(1921)	107 S.E.	679
Cruttwell v. Lye	(1810)	17 Ves.	335
D			
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Dennison Mfg.Co.v.Thomas Mfg.Co.	(1899)	94 F.	651
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E			
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Swift & Co. v. Brenner	(1903)	125 F.	826

T

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U

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V

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W

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Y

THE PATENT MONOPOLY

WHAT IS IT?

Elmer L. Goldsmith
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THE PATENT MONOPOLY - WHAT IS IT?

The Patent Law of this country, contrary to the general understanding, is founded in custom and is not wholly statutory. Early example of patents were in the monopolies granted to the guilds of the Middle Ages. Representative of these were monopolies held by the Hanseatic League and the Hansards in England, which dates from 1261 (Henry III). The foreign trade of England was a monopoly at the time of Edward VI in 1561.

Monopolies were the prerogative of the sovereignty, to-wit, the Government, and usually were granted to favorites of the then reigning monarch. These monopolies became so oppressive with respect to the necessities of life that in 1623 in England there was passed the Statute of Monopolies. This Statute prohibited the granting of any monopolies and abolished all prior monopolies except those for inventions, etc., invented <u>or introduced</u> into England. This is the present British Law.

The respective colonies in this country granted patents. The earliest patent in this country was granted by Massachusetts in 1641 to Samuel Winslow for a process of manufacturing salt. In 1656 it also granted a patent to John Winthrop. Massachusetts, Connecticut and Pennsylvania were the colonies granting the most patents.

There was no provision in the Articles of Confederation (1776 to 1789) for the granting of patents, so that during this entire period this was the prerogative of the states or colonies, and many citizens obtained patents on the same invention in the different states. For example, James Rumsey in 1785 obtained patents for a new type of boat from Maryland, Virginia, Pennsylvania and New York.

When the States adopted the Constitution they gave up their right to grant patents, and this right was reserved to the Federal Government, see Article 1, Section 8. The first United States patent was dated July 31, 1790 and granted to Samuel Hopkins the exclusive right to use a new process of making pot and pearl ashes. This patent was signed by George Washington, President, and Thomas Jefferson, Secretary of State, and Edmund Randolph, Attorney General. All early patents were signed by the President and bore the great seal of the United States.

All early patents were granted without what is now known as the investigation. The terms of such patents were fourteen years.

In 1832 Congress passed an act requiring the <u>use</u> of a patent in this country within one year of the date of its grant. In 1836, however, the present basic patent statute was passed, and this requirement for working or actual use was repealed. The examination system was then set up and it has continued ever since. Patents were not numbered prior to 1836. Since 1836 they have been numbered and the numbering is now close to 2,500,000.

By way of comparison it might be stated that France, Belgium, Italy and Spain grant patents upon application and without examination. Germany, Austria, Norway, Sweden and Australia upon application grant patents only after examination. Prior to 1875 Great Britain upon application granted patents without examination but thereafter examination has been the rule. The United States has the best examination system, which, however is not infallible. Germany, prior to the present war had the next best examination system.

Since a patent is a statutory monopoly the territory in which the monopoly is effective, of necessity, is restricted to the territorial boundaries of the Government granting the patent. Thus United States patents cover all of the United States and such territories as are under the Government of the United States including, by special act of Congress, the Virgin Islands. The United States patent laws did not cover the Phillipine Islands prior to it's independence. United States patents do, however, cover the territory of Hawaii.

In the United States, in addition to patent monopolies, there are other statutory monopolies, such as, copyright and trade mark registrations. Copyrights are granted for a term of 28 years and are renewable upon application by the artist or author, or his heirs, for an additional 28 years and cover a variety of artistic creations. This renewal feature permitted the heirs of the authors of "On Wisconsin" to regain control of this song. One specific form of copyright covers what are known as prints or labels used in commerce. All others related to artistic creations, such as books, statistical data, architectural plans, songs, music, work of art, etc.

Trade mark registrations are granted for a term of 20 years and may be renewed for a like term. Such trade marks only relate to interstate commerce, foreign commerce or commerce with the Indian tribes. Each state, or territory also has the right to grant trade mark registrations covering sales in that state or territory and the specific conditions vary in each state.

There are a few isolated instances where one has the option of applying for a trade mark registration or for a design patent. These, however, are extremely few. At one time, some 25 years ago,the several tire companies endeavored to protect their tire tread designs by registering them as trade marks for the maximum design patent only could be for 14 years whereas the trade mark registration runs for 20 years and was renewable at the end of each 20-year period. By this subterfuge the tire manufacturers endeavored to get a monopoly of unlimited term upon their individual tread designs.

This situation, however, was quickly remedied for such tire tread registrations that had been granted were cancelled and since then all applications for tire tread trademark registrations are refused.

The term of a United States patent, other than for designs, is 17 years.

Patents cannot be renewed or extended except by an Act of Congress. This act or these acts can be specific or general. The only known specific extensions have related to design patents covering the insignia of patriotic organizations, such as the emblem of the D.A.R., Daughters of 1812, American Legion (twice extended), etc., in other words, items of non-commercial character.

Statutes of general extension have been proposed with respect to this war. Following World War I, upon proper petition and showing, any patent owner who was in the service of the United States Armed Forces and who was not, during that period, deriving remuneration from his patent, could have the life thereof extended beyond the normal expiration date and for a term equivalent to three times his period of active service in such armed forces.

A United States patent may be of one of several kinds. It may be for an ornamental design and may be granted for a term of $3\frac{1}{2}$, 7 or 14 years, at the inventor's election. Upon expiration of that patent anyone is legally entitled to make, use and sell such an ornamental design. The subject matter is usually ornamentation or outline, or both. The requisites necessary to the grant of such a patent are design novelty, and the creation must involve invention. It is entirely possible to obtain design and so-called mechanical patents upon the same structure, the former being directed to ornamentation only and the latter to the mechanical structure only.

It is to be noted that there is a twilight zone wherein the author or artist has his choice of applying for a copyright registration on a work of art or for a design patent. In view of the lesser actual cost of the copyright and the longer terms, the choice, if an election be possible always should be resolved in favor of the copyright protection.

The statutory fee for a Federal trade mark is now \$25.00, for a label or print copyright is now \$6.00, for other copyrights \$4.00, for copyright renewal \$2.00, for a 3½ year design patent \$10.00, for a 7 year design patent \$15.00, for a 14 year design patent \$30.00, while for all other patents the filing fee is \$30.00 and the final fee is \$30.00 subject to an additional fee for filing or issuance of \$1.00 per claim for each claim over twenty,respectively,in the application and the patent.

On May 23, 1930 the Plant Patent Act became effective. Such patents cover the fruit, foliage, flower, stem, roots and other parts of the plant. Tuber propogated plants, however, are excluded. It is essential that the plant invention or discovery be assexually reproduced. If it cannot or has not been so reproduced no patent thereon can be obtained. One need not be an inventor in the accepted sense of that term to obtain a plant patent. If is sufficient, as was the case in North Carolina, to discover a new variety of a plant, etc., and assexually reproduce it for the discoverer to obtain a patent thereon. Primarily this Plant Patent Act was passed to protect the work of Luther Burbank and others in the plant field of inventions against unauthorized reproduction and sale of plant inventions.

The well known pink or salmon colored grapefruit is protected by plant patent No. 53 to Albert E. Heninger of McAllen, Texas.

The main class of patents are the so-called mechanical patents. There is comprehended within this terminology patents for a machine, which is defined as a combination of two or more parts or elements having conjoint action, a composition of matter, an article of manufacture, and the process, method or art of doing or making things, and improvements thereon.

The requirements for patentability are, that the subject matter to be patented must be new, it must be useful, and it must involve invention. In other words, it must be above the skill of the average worker or artisan in the particular field to which the subject matter is addressed.

There is no definition of what invention is. There are a lot of definitions that hold that certain things do not constitute invention. In other words, invention is defined negatively.

Obviously the law does not protect or favor illegality or immorality. Therefore, if the subject matter is wholly illegal or wholly immoral no patent can be obtained on that subject matter. However, if the subject matter is capable of a legal or a moral use as well as an illegal or an immoral use, the patent will be granted upon the subject matter, it being presumed that the grant is for that use which is legal and moral. The patent will not be sustained to suppress an illegal use.

As a test of what is new, prior to 1941 one could file an application and obtain a mechanical patent on anything coming within the prescribed rules provided the invention had not been publicly used or sold or had not been a matter of public knowledge by way of publication, or otherwise, for more than two years prior to the date of filing of the application. Since 1941 the period has been reduced to one year. Design patents have a comparable period. Prior invention and/or use abroad in and of itself will not defeat a later American inventor from receiving a valid patent.

With respect to what is comprehended within the term invention, one recent decision has held that the requisite is a flash of genius. This decision has been vigorously criticized since it would seem to exclude protection to those inventors who have labored long and laborously through a cut and try effort to produce a perfect result. Most of Edison's inventions would have to be excluded upon this basis if that decision were to prevail.

Another Court, following this so-called "flash of genius" decision, has recently gone so far that it held that it would not appear that a large research organization could create an invention because of the skill of those employed and the fact that there was a deliberate intent to create the desired results. This ignores the fundamental concept in an invention that the flash of genius is evidenced not so much in the use of the instrumentalities but in the conception of the perfected result or objective and then the reduction to practice of that objective by any and all as well as the best means available.

These two Court decisions are obviously trends toward circumscribing the patent monopoly, and are examples of the many judicial attacks presently made upon the patent system.

For a better understanding of what a patent, in effect, really is, it is to be noted that prior to the grant of the patent there are no rights whatsoever conveyed or vested so that the notice you frequently find, "patent applied for" or "patent pending", has no legal significance. In fact, many times it serves as a notice to unscrupulous competitors to rush in and capture the cream of the market before the patent issues for until a patent issues there can be no infringement.

Patents are considered as personal property and are subject to substantially all the rules relating thereto. They cannot, however, be taken over on an execution upon a common law judgment but they can be taken over in an equity proceeding such as bankruptcy.

I might here point out that two states have so-called "trick" statutes relating to the sale of patent rights or any licensing or leasing thereunder. These do not relate to the sale of an application for letters patent or the licensing or leasing or granting under an application for letters patent. These two states are Indiana and Kansas. The statutes are very similar and the Kansas statute has been held constitutional by the Supreme Court.

As long as one is on the buying end or acquiring end of a deal involving patents or patent rights, such as licensing, leasing or granting, the provisions of these statutes may be ignored. If the seller or licensor does not know about it and the buyer or licensee later wants to take advantage of the failure of the sellor or licensor to comply with the statute, the buyer or licensee can invalidate or void the deal and recover all monies and other considerations paid. The grantor or the one licensing or selling under a patent in Indiana or Kansas, accordingly had better comply with the statute if the contractural relationship is to hold up later in court. Such compliance requires certain note indorsements if notes be given, and the filing of the original Letters Patent or a certified copy thereof together with an affidavit relative to title.

A patent should be considered a contract between the people of the United States and the inventor, and in this manner: the offer is made to extend to the inventor the right to exclude all others for a limited term, that is, 17 years in the case of mechanical patents, from the manufacture, use and sale of the invention as defined by the patent provided that the patent is directed to subject matter which is novel, useful and involves invention.

The people accordingly have lost nothing by such grant because the inventor has the common law right to keep secret his invention. The tendency of the Courts and the Justice Department today is to ignore this fundamental fact and to treat the patent as something taken away from the public which, of course, is not the fact.

Since the examining system is subject to the frailties of human nature and since all possible knowledge may not be available to the examining corps, it may have made a mistake in judgment. Therefore, it is possible to have patents declared invalid because the Court feels that no invention is involved but only mere mechanical skill, or that the patent should not have been granted because what the patent covers was known to others long prior to the patented invention by the inventor to whom the patent was granted. Thus the contract consideration fails and the contract fails, that is the patent is held invalid.

Accordingly it is seen why the Federal District Courts can and do frequently declare patents invalid or hold the patents valid but not infringed. In this instance, the monopoly cannot be construed to be of such scope to include within its definition,measured by the claim or claims,the defendant's product, composition, machine or process and at the same time be valid. If the defendant can prove any one of the 26 defenses available against a patent it will be appreciated that there is no consideration for the contract and therefore the contract falls and the patent will be declared invalid and of no force and effect or the defendant has a personal defense against the patent owner which prevents enforcement of the patent against the defendant.

What is the patent monopoly? The majority of people believe that what is shown in the drawing or what is recited in the description is the definition of the monopoly, but that is not so. What is recited by the claims constitutes the metes and bounds, measurement, or definition of the invention to which the monopolistic protection is extended. That is why the claim or claims of a patent are the most important part of the patent. Obviously the shorter, briefer and more to the point that a claim is recited or set out, the broader will be the protection for example "A one piece bifocal lens". - Corner Reissue patent.

There are two things that should be borne in mind about this monopoly. In the first place the patent grant states that the patent is granted to the inventor for the subject matter defined in the claims and he has the exclusive right to make, use and vend the invention therein defined for a period of 17 years from the date of the issuance of the patent. He has no such thing or right. He has only the right, during this limited life of seventeen years, to exclude others from using the invention defined by his claims. This will be obvious if it be assumed that in the stage of a development there should appear sequentially four or five patents, each one a little narrower than the predecessor. Now how can the fourth or latest patentee practice his invention without infringing the patents of the first three inventors, and so on back to the first inventor if all patents are alive and valid?

Thus this so-called positive language grant must be construed negatively to give each of the patentees the positive right of exclusion only, not the affirmative right to make and use the invention defined by the claims in question because so to do might invade someone else's prior and still existing monopoly.

Another common mistake is that anyone can take a patented invention and make one or more of the same for his own use. As a practical matter obviously due to difficulties of ascertaining who the infringer is or that there is an actual infringement, such an individual infringer is seldom, if ever, disturbed by the patentee. But such an individual infringer has absolutely no defense against infringement unless that defense is such a positive one as would be available to him even if he were actually engaged in the manufacturing and selling of that which is charged with infringement.

The patent monopoly can be divided by the patent owner if he so desires. He can sell a part of it or not. If he sells an undivided interest, then the purchaser or purchasers become tenants in common and each has the right to do with his share what he sees fit without being responsible to the other co-owner or co-owners.

The patent owner may divide the rights geographically and such a division or territorial transfer technically is known as a grant. For example, he may reserve to himself all of the territory on one side of the Mississippi and grant all of the territory on the other side to a purchaser or grantee.

The patent owner can divide his monopoly and give each of several exclusive licensees an exclusive license directed to a different industry. For example, a machine can be made that is capable of working on metal sheets, plastic sheets and paper board sheets, the latter for example being corrugated board or solid fibre board or a chip or felted board. The patentee could grant one manufacturer in the metal industry the exclusive right to use that machine. Then he could grant in the paper board industry another manufacturer the exclusive right to that machine for use thereon, or he can subdivide that further, if he so desires, giving to the corrugated board manufacturer the exclusive right for corrugated board only and so on for other types of paper boards.

The patentee can divide his monopoly horizontally, as it were. For example, let us assume that the first vacuum cleaner patent was of basic character. One manufacturer could take all the rights for the portable household type vacuum cleaner. Another manufacturer could take all the rights for a portable non-household cleaner, such as you see on the city streets every spring and summer and early fall, and which is used for cleaning out furnaces. The third horizontal division could be for such vacuum systems as are built into a building, such as is included in the Fletcher Trust Building, where all the piping is rigid with the building, the main suction fan, etc., is in the basement, and the several pipes on the different floors terminate in outlet closures which can be opened and to which may be detachably secured a suction hose and pick-up head. This is what is generally known as horizontal division of the patent rights because each of the licensees would have an exclusive right for all of the United States and the territories but the limits would be in the use of equipment.

I have previously hinted at an unusual situation that is not well understood. In the absense of contract limitations an assignment of an undivided interest, even to a millionth part, confers on the assignee acquiring that millionth part substantially all the rights that the other title owners have, and such owner of such a fractional interest can grant licenses, leases, etc. without the consent of the other co-owners. Division of title thus defeats exclusiveness.

It might be well to consider what recovery may be had for violation of the patent right, or otherwise expressed, infringement, of a patent. If the infringement is proved to wilfull and deliberate the patent owner can recover treble damages. This, however, is an unusual situation. Normally if there is infringement, the patentee only recovers damages and/or profits (now 1948 general damages and possible attorney's fees).

He also can obtain an injunction against the infringer prohibiting continuation of the infringement if the suit is brought in chancery or equity. If it is brought in law the injunction cannot be obtained but only a money recovery can be had. An injunction may even bar the infringor after the patent has expired.

In the absence of exceptional circumstances an injunction pending the litigation, known as a preliminary injunction, usually is not granted to the patent owner unless and until the patent previously has been litigated and held valid by that court granting the preliminary injunction or by some other competent court.

Since the monopoly only dates from the date of issuance of the patent normal recovery for patent infringement only dates back to the date of issuance of the patent, and recovery cannot be had for such infringement as has occurred prior to the date of issuance of the patent. There is an exception to this general rule: For example, where there has been a deliberate and wilfull violation of the confidence with respect to the patent owner during the period he was trying to get his patent. In such instance the court has granted damages for violation of that confidence equal to what would be a reasonable royalty and the Court makes the defendant account to the patent owner for the infringement of the patent after it issues and grants an injunction preventing further infringement. The first decision of this kind revolutionized the patent policies of many companies relative to independent inventor disclosures.

A statutory exception to recovering all damages and/or proceeds is that the patent owner can only recover for the last past six years of infringement. In other words, he cannot wait and let a defendant infringe for 15 years, for example, then bring suit and recover for the full 15 years. He can bring such suit, of course, but his actual recovery will be limited only to the 10th to the 15th years. This is in effect a statute of limitation.

You frequently hear of a so-called reissue patent. I want to emphasize that it is supposed to be a corrected original patent and, accordingly, by statute and judicial decision the term of that reissue patent is such that it expires on the date that the original patent would have expired. A reissue patent cancels the original patent.

It is not uncommon to have a reissue of a reissue, and the third patent, to-wit, the second reissue, also expires on the date of expiration of the original patent. Every reissue supersedes the original patent and it is the claims of that reissue patent which remain in full force and effect as distinguished from the claims of the original patent or of a prior reissue patent.

Formerly if an application for reissue was filed within two years of the date of issue of the original patent (and now within one year), it was and is possible to obtain in that reissue patent claims broader than the original patent claims, providing the inventions covered by both were the same. In the event the reissue patent seeks to dominate another invention not covered by the original patent, to that extent the reissue patent claims will be held invalid.

It is also possible to reissue a patent at any time during the term of the original patent even, for example, in the last year of its life, providing the claims are commensurate with or are of less scope than the claims of the original patent.

Disclaimers in effect narrow the patent and must be filed within a reasonable period, or no recovery can be had for infringement of that patent.

You have probably heard the term "intervening rights". Briefly this means that if an original patent issues with claims of limited scope and a manufacturer notes the limited character thereof and produces an article or machine that does not infringe the claims of the original patent but does in fact infringe certain of the claims of a later reissue patent, then under some circumstances this specific manufacturer can proceed with his manufacture despite the reissue patent. This right is based on equitable estoppel.

The qualifications with respect thereto are as follows: Some of the circuits hold that such a manufacturer can not acquire intervening rights if the reissue patent application was filed within the two (now one) year term, following issuance of the original patent, holding that that manufacturer was charged with the knowledge that the patentee could lawfully file a broadening reissue. Other circuits, however, hold that this limitation is not to be so strictly construed, and now the file jacket of the original patent in the Patent Office carries a notation that an application for reissue has been filed by the original patentee.

One District Court in Connecticut has also held that if anyone individual or manufacturer has acquired intervening rights the benefit thereof enures of the entire public and therefore the reissue patent owner, under those circumstances cannot recover or stop infringement with respect to a product or products manufactured in accordance with the intervenor's product. The defense of intervening rights is personal in most circuits. This Connecticut case has never been followed, was not appealed, and, as implied before, is not good law.

Since 90 to 95% of the present Federal Judiciary have been appointed since 1933 this particular decision may subsequently be seized upon and enlarged and engrafted onto the doctrine of intervening rights in reissue patent cases to limit a legitimate monopoly.

Another equitable estoppel is the defense known as a shopright. A shopright is a non-exclusive free license which has vested by operation of law based upon facts and circumstances occurring where an inventor-employee solicits or permits the employer to utilize the employee's invention, such utilization requiring some time or money to be expended by the employer.

A kindred license wherein the employer-employee relationship does not exist may also vest under comparable circumstances between an inventor and another.

The invention may directly relate to the employer's business or only indirectly relate thereto, oreven be entirely remote therefrom.

Usually the employee is in a capacity other than that of a designing engineer. When such non-engineering situation arises the employee is the sole owner of the invention and can do with it what he wills regardless of the employer subject, however, to the employer's shopright under that invention.

When, however, the employee is hired for special development, or designing, etc., is a regular part of his duties, the employee's invention belongs to the employer. In view thereof most corporate employers now require the employee to sign a contract for new employment or continued employment reciting employer ownership of employee inventions in so far as same relate directly or indirectly to the employer's business. Such contract must be reasonable for if not they cannot be enforced because they would be against public policy. By way of example, elements of unreasonableness may involve time and/or a particular industry.

There is one more item in connection with patent monopolies that should be considered. That is this: One who owns a patent cannot use that patent in an illegal manner. This is termed misuse. If such misuse is proved, then the court will not intervene and give any remedy or recovery or relief to the patent owner, because if the suit is founded in equity the patent owner comes into court with unclean hands. Furthermore, there may be a statutory misuse. That is covered in one of the sections of the Clayton Act, which states briefly that one cannot legally use patents to suppress free competition or to compete unfairly. A few examples of the former misuse of patents are the Morton Salt case, the Lecithin case, the Barber Asphalt case and the Carbice Ice case. These all come under the doctrine of the matter of unclean hands.

The Hartford Empire et al vs. U. S., a recent case that was litigated over a period of some 5 or 10 years, was one that finally held that there was suppression of free competition and that the patents were illegally pooled for that purpose. It also held that a monopoly was illegally created as a result of such pooling. The Hartford Empire Company was required, as one of the items of redress imposed by the Court, to grant a free license under a certain group of patents to each of the glass plants that had used the Hartford Empire glass feeder and was using it under a lease and also was required, if the royalties theretofore paid by that licensee exceeded the cost of the equipment, to give such licensee a bill of sale to that licensee. Other restitutions and remedies were also invoked in that decree.

A western Court made this significant statement some eight years or so ago, that each of two patent owners' with commercial establishments could legally cross-license under their respective patent the other manufacturer but when they, in their cross-license agreement went beyond that and put additional limitations into that agreement, which in effect created a monopoly which was not present or possible under either of the patents individually, the court held that the license agreement was invalid and both parties were equally guilty and could not recover for infringement against third parties and that these defendants could do as they pleased thereafter.

There have been cases of where patents have been misused by way of licenses to impose, in the granting of any other licenses, a requirement that the later licensee agree not to sell the licensed product to any jobber or distributor who sold below a certain named price. This is usually termed domination of the resale price. It has been held fundamentally that any price limitation can only carry up to and including the first sale price and not beyond that. The agreement which includes a resale price provision accordingly is illegal and as long as such an agreement is in force the respective party or parties cannot recover for infringement by others who may not even be a purchaser from one of the licensees.

However, if the parties so licensing enter into new agreements and eliminate the resale price restriction, it has been held that they have purged themselves of the wrong and they can thereafter recover for any subsequent infringement of the patents by others not purchasing from any one of the licensees.

In conclusion I would like to point out that during the past ten years there have been various and many attempts by ~~the so-called~~ those currently in power in the Government to either emasculate or abolish the patent system. It is conceded by all those who are conversant with patents that there are many matters in the present patent system that require correction. The proponents of the patent system point out that you don't kill the patient when he has a sore thumb or sore toe. You either treat the thumb or toe itself, and if you cannot effect a cure you amputate that part only. Certainly you do not kill the patient.

From historical, sociological and psychological bases, without question, the American standard of living must be conceded to be predicated upon this patent system, despite all its weaknesses, inherent errors, etc., and it is a peculiar thing that the standards of living in the respective countries in the world are almost in the same ratio as the number of patents granted by the Governments thereof.

(1949 Addition)

The outstanding case regarding the misuse of patents and the equitable relief granted is the United States versus Hartford Empire et al previously referred to. While this and other recent cases would infer that the Department of Justice and the Courts are against patents because they inherently are monopolistic in character, forgetting the contractural phases of the patent grant, there is a ray of hope that the pendulum has swung to the greatest extent on the attack side. This ray of hope is evidenced by the following acknowledgements by certain Judges:

In Borg-Warner Corp vs Goodwin 80 U.S.P.Q. 32 at 36 (1949) Justice Jackson stated "the only patent that is valid is one which this Court "(United States Supreme Court)" has not been able to get its hands on". This was followed a week or two later wherein in Graver Tank and Mfg. Co. Inc. vs Linde Air Products Co. 80 U.S.P.Q. 451 certain claims of a patent were held valid and infringed by the same Court.

Judge Frank recognized the present tendency when in Picard vs United Aircraft Corporation 128 Fed (2) 632 at 643 (1942) he stated "we should not throw out the baby with the bath water".

Certain Citations

"Flash of Genius" Cuno Eng. Co. vs Automatic Devices Corp. 314 U.S. 84 (1941).

"Research Department" Potts vs Coe 140 Fed (2) 470 at 473 App D. C. (1944).

"Captive Inventors" Picard vs United Aircraft 128 F (2) 632 at 643 C.C.A. Md Cir (1942).

Intervening Rights (Conn) Schenk vs United Aircraft Corp. 51 U.S.P.Q. 519.

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Supreme Court of the United States

SPECIAL EQUIPMENT COMPANY v. COE, Com'r. Pats.

No. 469 Decided Mar. 26, 1945

PATENTS

1. Defenses

Evidence

Statement in plaintiff's brief in R. S. 4915 suit that subcombination claims are sought purely to prevent appropriation of machine by obvious expedient of eliminating specific element is not of a purpose either to suppress use of patented invention or to use it or patent to exploit or enlarge patent monopoly of complete machine; statement expresses only purpose to prevent appropriation of complete machine by appropriation of part of it embodied in subcombination for which patent is asked; there is nothing to suggest any purpose or reason for purpose to enlarge monopoly of subcombination or complete machine by tying together their uses; control of part could not be used as means of enlarging already acquired control of whole.

2. Title—Licenses—In general

Cited Supreme Court cases hold that patentee may not enlarge monopoly of patent by licensing invention on terms which tie to its use the use of material or devices which licensed invention does not embrace, whether they are patented or unpatented, licensing instant subcombination, which is less useful than whole, would not be practical means of enlarging use of whole.

3. Infringement—Combinations—In general

Patentability—Aggregation or combination—In general

Revised Statutes 4915 suits—In general

Failure to acquire control of whole combination is legitimate reason for wishing to acquire and retain control of part, if it involves patentable invention; it is legitimate to use patent on subcombination as means of preventing appropriation by others of patentees more important complete invention which he is using, where there is absent any purpose to enlarge monopoly of either invention; patent on combination embodied in complete machine, without allowance of subcombination claims, would not prevent free use of subcombination; hence denial of patent on subcombination would deprive inventor of benefit of exclusive right to use subcombination in ways specified by patent laws; it would leave public free to use and appropriate a part, however important, of inventor's complete machine, even though patented; if, as Supreme Court must assume in ex parte R. S. 4915 suit, plaintiff has two inventions, both useful and one of which includes other in its entirety, it is evident that value of former would be greatly impaired if subcombination invention could be freely used by others; such appropriation of full combination could be achieved only by appropriation of unpatented subcombination which is by hypothesis also useful invention entitled to claim benefit and protection of patent laws.

4. Patentability—Aggregation or combination—In general

Pleading and practice in Patent Office

Revised Statutes 4915 suits—In general

Statutes permit, and it is settled practice of Patent Office, many times sustained by Supreme Court, to allow claims to combination and also subcombinations; without more, use of subcombination patent to prevent appropriation of complete machine does not so infringe patent laws and is not so contrary to principles governing award of equitable relief as to permit Supreme Court in ex parte R. S. 4915 suit to refuse judgment, which statute authorizes, directing that patent issue.

5. Nature of patent rights

Patent grant is not of right to patentee to use invention, for that he already possesses; it is grant of right to exclude others from using it; as R. S. 4884 provides, grant is of "exclusive right to make, use, and vend" invention, and this includes exclusive right to license others to make, use, and vend it; by terms of statute grant is nothing more than means of preventing others, except under license from patentee, from appropriating his invention; it by no means follows that such grant is inconsistent or inappropriate exercise of constitutional authority of Congress; in choice of means of promoting useful arts by patent grants, Congress could have provided that grant should be conditioned on use of patented invention, as it provided by repealed Act of 1832 authorizing issue of patents to aliens conditioned on use of invention; but Congress was aware that unpatented invention could be suppressed and public thus deprived of all knowledge or benefit of it; it could have concluded that useful arts would be best promoted by compliance with conditions of statutes which it did enact, which require that patents be granted only for limited term on application fully disclosing invention and manner of making and using it; it thus gave inventor limited opportunity to gather material rewards for invention and secured to public benefits of full knowledge of invention and right to use it on expiration of patent.

6. Defenses

Title—In general

Supreme Court has consistently held that patentee's failure to make use of patented invention does not affect patent's validity; no question of nonuse was involved in Ethyl v. United States, 309 U. S. 436, 44 USPQ 614, and it lends no support to contention that patentee may not rightly use patent as protection against misappropriation of his invention, even though it is not used; it held only that patent monopoly afforded no defense for violations of Sherman Act which patentee had effected by using patent to enlarge patent monopoly beyond grant and as means of increasing use of independent patented invention; Congress has frequently been asked to change policy of statutes as interpreted by Supreme Court by imposing forfeiture or providing for compulsory licensing if patent is not used within specified time, but has not done so.

7. Certiorari and certificate to Supreme Court

Since record in ex parte R. S. 4915 suit establishes no intention by plaintiff not to use invention, and no proposed use of it disclosed or suggested by record affords basis for withholding grant of patent, judgment of appellate court below refusing patent on that ground is reversed and cause is remanded to it for proceedings in conformity with Supreme Court's opinion to enable it to consider and decide issues raised by pleadings.

Particular patents—Fruit Treating

Ewald, Fruit Treating Apparatus, R. S. 4915 suit not dismissed.

On writ of certiorari to Court of Appeals for District of Columbia, 62 USPQ 12.

Action under R. S. 4915 by Special Equipment Company (assignee of Mark Ewald, application, Serial No. 636447, filed Oct. 26, 1939; Patent Office Division 25) against Conway P. Coe, Commissioner of Patents. On writ of certiorari to review judgment dismissing complaint. Reversed; Mr. Justice Douglas, dissenting with opinion in which Mr. Justice Black and Mr. Justice Murphy concur; Mr. Justice Rutledge, dissenting with opinion.

CLARENCE J. LOFTUS and CURTIS F. PRANGLEY, both of Chicago, Ill. (BALLARD MOORE and JAMES M. GRAVES, both of Washington, D. C., on the brief) for petitioner.

FRANCIS M. SHEA (CHARLES FAHY, DAVID L. KREEGER, ROBERT L. STERN, and ABRAHAM J. HARRIS on the brief) all of Washington, D. C., for respondent.

Mr. Chief Justice STONE delivered the opinion of the Court.

This is a suit in equity, brought in the District Court for the District of Columbia, under R. S. § 4915, to compel respondent, the Commissioner of Patents, to issue a patent upon an application for a subcombination of the elements of a machine for which the inventor had previously filed a patent application. The district court gave judgment for respondent. The Court of Appeals for the District affirmed, 144 F.2d 497 [62 USPQ 12], and we granted certiorari, 323 U. S. —. The question is whether the Court of Appeals correctly rested its decision upon the ground that petitioner did not intend to make or use the patented invention and that the purpose of seeking the patent was to exploit and protect the machine, or which the subcombination the combination invention embodied in the complete machine, of which the subcombination is a part.

Ewald, the plaintiff in the district court in whose stead petitioner, his assignee, was later substituted as a party, made application for a patent on a "fruit-treating apparatus" embracing the combination embodied in his complete machine. Certain claims of his application were allowed October 27, 1938, but a patent has not yet issued. The following year he made a renewed application for the subcombination, with which the present suit is concerned. The specifications of the original application disclosed mechanisms for automotically performing the successive operations of bobbing (cutting off the stems), splitting, paring, and coring pears, in preparation for canning or other processing.

The original application specified and claimed an apparatus consisting of two spaced, horizontally mounted turrets or turn tables, combined with means for continuously, but intermittently, rotating both in the same direction. Fixed upon, and rotable with the table of the first turret, are a plurality of pear receiving and clamping means, spaced upon the upper surface of the turn table, adapted to receive and clamp either a pre-split or a whole pear. At the first intermittent stop a swinging knife shears off (bobs) the stem of the fruit, which extends beyond the clamps. At the next intermittent stop, overhead traveling jaws or clamps grasp the fruit concurrently with its release from the first clamp and carry the fruit longitudinally to a point over the second turn table.

As the pear is thus carried from the first turret to a position over the second, it is split by a fixed vertically positioned knife straddled by the overhead traveling clamps. As the clamps force the pear against and past the knife, it cleaves the pear into substantially equal half sections. The pear sections are then automatically, successively deposited in spaced cups fixed on the second revolving turn table. At the next stop of that turn table the pear section resting in its cup is peeled by an automatically operated paring knife. At the next successive stop the core is removed from the pear section by an automatically operated coring device. After completing the coring, the mechanism automatically separates the pear section from the core and the peeling and discharges them and the pear section into appropriate receptacles.

In the operation of the machine whole or split pears may be fed by hand to the holding and clamping devices on the first turret where the pears are bobbed. The whole pear is then split as it is carred by the overhanging jaws from the first turret to the second. The peeling and coring of both pre-split and whole pears are then carried through by the operation of the second turret.

The patent application for the complete machine discloses a highly ingenious device, which is said to have achieved a great advance in the art by increasing the speed and skill with which pears are prepared for canning, and to result in a great saving of manpower. The renewed application for the subcombination specifies and claims the apparatus which we have described but without the splitting knife. In the operation of the device thus claimed the pears are pre-split by hand. The split sections are placed face to face in the receiving and clamping means upon the first turn table, after which the operation, except the splitting by the splitting knife, proceeds in exactly the same way and accomplishes the same result as when the splitting knife is present.

Additional claims, which are those sued on, covering all the elements of the combination except the splitting knife, were duly presented to the Patent Office. There they were rejected as incomplete, broader than the invention disclosed by the petitioner in his application, and misleading, and as covering constructions not contemplated by petitioner's application. Respondent Commissioner, alleging no prior art against the allowance of the claims, set up these objections in his answer in the district court as the sole grounds of defense to the suit. The district court sustained the Commissioner on the grounds assigned by him for rejection of the claims, and for the further reason that the subcombination claims did not "combine to produce any useful result."

The Court of Appeals, after observing the operation of petitioner's subcombination without the cutting knife, as shown by moving pictures, concluded that the device was far more useful in its operation than the old method of preparing fruit by hand, and, without deciding the point, added that it was plausible to say "that two distinct inventions are disclosed in the application" [62 USPQ at 14].

Without further examination of the issues raised by the pleadings it affirmed the judgment of the district court upon the new and independent ground that a patent on the subcombination should not be granted because of the "the dangers of approving a principle which permits a patent monopoly to be extended by granting claims on distinct inventions, which the applicant has no intention of exploiting as distinct inventions" [62 USPQ at 15]. It said: "The record shows that it [the subcombination patent] is to be used to exploit and protect the patent monopoly of another related invention, to-wit: the complete machine. There is no intention to make or license to others to make the partial machine because, although it is possible to use it without the cutting knife, it is not designed for such independent use" [62 USPQ at 14]. It thought that the grant of a patent which the patentee has no intention of exploiting as a distinct invention "for the purpose of blocking the development of machines which might be constructed by others," is inconsistent with the constitutional requirement that the patent grant must "promote the Progress of Science and Useful Arts."

We are pointed to no factual basis in the record for the assertion that petitioner contemplates either the misuse or non-use of the combination patent other than that suggested in the court's opinion that the complete machine does the work better than the subcombination, without the knife, can do it and that there would be no reason to manufacture the partial machine when the complete machine was available. A separate opinion in which all the judges concurred also states that petitioner "admitted, both on argument and in his brief in the present case, that its purpose in filing the disputed claims was to 'protect' the main invention and that it had no intention of manufacturing the subcombination machine." The reference, as agreed by counsel on argument before us, is to a statement in petitioner's brief in the court

[1] below that: "The claims in issue are sought purely to prevent appropriation of the . . . machine by the abvious expedient of eliminating the splitting mechanism." It will be observed that this statement of petitioner is not of a purpose either to suppress the use of the patented invention or to use it or the patent to exploit or enlarge the patent monopoly of the complete machine.

[2] The court below found support for its conclusion in our decisions holding that a patentee may not enlarge the monopoly of his patent by licensing his invention on terms or conditions which tie to its use the use of material or devices which the licensed invention does not embrace, whether they are patented, Ethyl Gasoline Corp. v. United States, 309 U. S. 436, 459 [44 USPQ 614, 621-622]; Standard Sanitary Mfg. Co. v. United States, 226 U. S. 20, or unpatented. Motion Picture Patents Co. v Universal Film Mfg. Co., 243 U. S. 502; United States Shoe Machinery Co. v. United States, 258 U. S. 451; Carbice Corporation v. American Patents Corp., 283 U. S. 27 [8 USPQ 211]; Leitch Manufacturing Co. v. Barber Co., 302 U. S. 458 [36 USPQ 35].

It is clear that no such case is presented here. We find nothing in the statement quoted from petitioner's brief in the court below or in the record to indicate that petiioner proposes to make any such use of the patent which it now seeks, either by the method of licensing it or otherwise. The statement expresses only a purpose to prevent appropriation of the complete machine by the appropriation of a part of it embodied in the subcombination for which the patent is asked. There is nothing to suggest any purpose or reason for a purpose to enlarge the monopoly either of the subcombination or of the complete machine by tying together their uses. Control of a part could not be used as a means of enlarging an already acquired control of the whole. And obviously licensing the subcombination, which is less useful than the whole, would not, in any circumstances disclosed by the record, be a practical means of enlarging the use of the

[3] whole. Failure to acquire control of the whole would be a legitimate reason for wishing to acquire and retain control of a part, if it involves a patentable invention. And we think it plainly is legitimate to use a patent on the subcombination as a means of preventing appropriation by others of petitioner's more important complete invention which he is using, where there is absent, as there is here, any purpose to enlarge the monopoly of either invention.

A patent on the combination embodied in the complete machine, without the allowance of the subcombination claims, would not, as the court below thought, prevent the free use of the subcombination. The Corn-Planter Patent, 23 Wall. 181, 224; Schumacher v. Cornell, 96 U. S. 549, 554; Rowell v. Lindsay, 113 U. S. 97, 101; Mercoid Corp. v. Mid-Continent Co., 320 U. S. 661, 668 [60 USPQ 21, 25]. Hence denial of a patent on the subcombination would deprive the inventor of the benefit of the exclusive right to use the subcombination in the ways specified by the patent laws. It would also leave the public free to use, and thus to appropriate a part, however important, of the inventor's complete machine, even though patented.

If, as we must assume, petitioner has two inventions, both of which are useful and one of which includes the other in its entirety, it is evident that the value of the former would be greatly impaired if the subcombination invention could be freely used by others. See Deering v. Winona Harvester Works, 155 U. S. 286, 302. But such appropriation or impairment of the value of the full combination could be achieved only by appropriation of the unpatented subcombination which is by hypothesis also a useful invention, entitled to claim the benefit and protection of the patent laws.

[**4**] The statutes permit, and it is the settled practice of the Patent Office, many times sustained by this Court, to allow claims to a combination and also its subcombinations. Railroad Co. v. Dubois, 12 Wall. 47, 60; Deering v. Winona Harvester Works, supra; Leeds & Catlin v. Victor Talking Mach. Co., 213 U. S. 301, 318; Altoona Theatres v. Tri-Ergon Corp., 294 U. S. 477, 487 [24 USPQ 308, 313]; Mercoid Corp. v. Mid-Continent Co., supra, 667 [60 USPQ at 25]. The question then is whether without more, the use of the subcombination patent to prevent appropriation of the complete machine so infringes any provisions or principles of the patent laws, or is so contrary to principles governing the award of equitable relief as to permit the court to refuse the judgment, which the statute authorizes, directing that the patent issue.

In answering it the court below assumed that such purpose to protect the whole invention was to be achieved by complete suppression of the use of the subcombination invention and that the suppression for the protection of the complete machine would invalidate the patent because it would be contrary to the constitutional purpose and to the spirit if not the letter of the patent laws. We think both assumpations are unwarranted. Section 4886 of the Revised Statutes authorizes "any person who has invented . . . any new and useful . . . machine" to "obtain a patent".

[**5**] The patent grant is not of a right to the patentee to use the invention, for that he already possesses. It is a grant of the right to exclude others from using it. As the statute, R. S. § 4884 provides, the grant is of the "exclusive right to make, use and vend" the invention, and this includes the exclusive right to license others to make, use and vend it. By the very terms of the statute the grant is nothing more than a means of preventing others, except under license from the patentee, from appropriating his invention.

It by no means follows that such a grant is an inconsistent or inapproriate exercise of the constitutional authority of Congress "to promote the Progress of Science and useful Arts" by securing to inventors "the exclusive Right to their . . . Discoveries". Congress, in the choice of means of promoting the useful arts by patent grants, could have provided that the grant should be conditioned upon the use of the patented invention, as in fact it did provide by the Act of 1832 (4 Stat. 577) authorizing the issue of patents to aliens conditioned upon the use of the invention, which provision was later repeal (5 Stat. 117, 125). But Congress was aware that an unpatented invention could be suppressed and the public thus deprived of all knowledge or benefit of it. It could have concluded that the useful arts would be best promoted by compliance with the conditions of the statutes which it did enact, which require that patents be granted only for a limited term upon an application fully disclosing the invention and the manner of making and using it. It thus gave to the inventor limited opportunity to gather material rewards for his invention and secured to the public the benefits of full knowledge of the invention and the right to use it upon the expiration of the patent.

[**6**] This Court has consistently held that failure of the patentee to make use of a patented invention does not affect the validity of the patent. Continental Paper Bag Co. v. Eastern Paper Bag Co., 210 U. S. 405; Crown Co. v. Nye Tool Works, 261 U. S. 24, 34; Woodbridge v. United States, 263 U. S. 50, 55; Fox Film Corp. v. Doyal, 286 U. S. 123, 127, [13 USPQ 243, 244]; Hartford-Empire Co. v. United States, 323 U. S. 386, 433 [64 USPQ 18]. No question of non-use was involved in Ethyl Gasoline Corporation v. United States, supra, 459 [44 USPQ at 621], on which the court below relied, and its lends no support to the contention that a patentee may

not rightly use his patent as a protection against misappropriation of his invention, even though it is not used. There it was held only that the monopoly of a patent afforded no defense for violations of the Sherman Act which the patentee had effected by using his patent to enlarge the patent monopoly beyond the grant and as a means of increasing the use of an independent patented invention.

Congress has frequently been asked to change the policy of the statutes as interpreted by this Court by imposing a forfeiture [1] or providing for compulsory licensing [2] if the patent is not used within a specified time, but has not done so.

We have no occasion to consider here whether a better rule governing the grant of patents could be devised than that prescribed by Congress, as this Court has interpreted it; or whether the courts on equitable principles should decline to enjoin patent infringements or decline to compel the issue of a patent if and when it appears that the patentee or inventor intends to make no use of the invention. The record neither calls upon nor permits us to decide any of these questions, for it fails to establish that petitioner has any such intention. Petitioner's intended use of the patent to prevent others from appropriating it and by that means from appropriating an essential part of his complete machine is in no way inconsistent with petitioner's making other permissible uses of the subcombination patent. In fact, he does use the subcombination as a part of his completed machine and proposes to continue to use it. Execution of his declared purpose to prevent appropriation of either of his inventions, whether used separately or together, would not prevent his licensing others to make, use and vend the subcombination, on terms which would adequately protect the value of the monopoly of both his inventions to which he is entitled by the patent laws. And we cannot say that others, who could not secure a license to use the complete machine, would not find it profitable to secure, or that petitioner would not find it profitable to grant, licenses to use the subcombination which the court below has found to be a useful device which has advanced the art.

[7] The record establishes no intention by petitioner not to use his invention, and no proposed use of it disclosed or suggested by the record affords any basis for withholding the grant of the patent. The judgment below must therefore be reversed, and the cause remanded to the Court of Appeals for further proceedings in conformity to this opinion to enable it to consider and decide the issues raised by the pleadings. See Bates v. United States, 323 U. S. 15, 17 and cases cited.

Reversed.

Mr. Justice DOUGLAS, with whom Mr. Justice BLACK and Mr. Justice MURPHY concur, dissenting.

The right of suppression of a patent came into the law over a century after the first patent act was passed. In 1886 Judge Blodgett had ruled that a patentee "is bound either to use the patent himself or allow others to use it on reasonable or equitable terms." Hoe v. Knap, 27 F. 204, 212. In 1896 that rule was repudiated by the Circuit Court of Appeals for the Sixth Circuit in Heaton-Peninsular Button-Fastener Co. v. Eureka Specialty Co., 77 F. 288, 295, where the court stated that a patentee's "title is exclusive, and so clearly within the constitutional provisions in respect of private property that he is neither bound to use his discovery himself, nor permit others to use it." That theory was adopted by this Court in Continental Paper Bag Co. v. Eastern Paper Bag Co., 210 U. S. 405, decided in 1908. That was an infringement suit. One defense was that the patentee had suppressed the patent. The Court held, Mr. Justice Harlan dissenting, that suppression of the patent was no defense; that the patentee's "right can only retain its attribute of exclusiveness by a prevention of its violation." Id., p. 430.

I think it is time to be rid of that rule. It is inconsistent with the Constitution and the patent legislation which Congress has enacted.

Article I, Section 8 of the Constitution grants Congress the power "to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." Of the various enumerated powers it is the only one which states the purpose of the authority granted Congress. "The Congress is given no general power to issue letters patent or to reward inventors as it will. An experience with grants of monopoly in England was fresh in the minds of the Fathers; the lesson had been underlined in recent differences with the Crown." Hamilton, Patents and Free Enterprise (1941), p. 152, Temporary National Economic Committee, Monograph 31, 76th Cong., 3d Sess. The purpose "to promote

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1 See Hartford-Empire Co. v. United States, supra, 433, n. 26.

2 See Hartford-Empire Co. v. United States, supra, n. 27.

the progress of science and useful arts" accordingly provides the standards for the exercise of the power and sets the limits beyond which it may not go. That purpose also provides the guide for the interpretation of patent laws enacted pursuant to that power.

It is a mistake therefore to conceive of a patent as but another form of private property. The patent is a privilege "conditioned by a public purpose." Mercoid Corp. v. Mid-Continent Co., 320 U. S. 661, 666 [60 USPQ 21, 24]. The public purpose is "to promote the progress of science and useful arts." The exclusive right of the inventor is but the means to that end. That was early recognized by this Court. See Pennock v. Dialogue, 2 Pet. 1, 19; Kendall v. Winsor, 21 How. 322, 327-328; Seymour v. Osborne, 11 Wall. 516, 533-534. But the Paper Bag case marked a radical departure from that theory. It treated the "exclusive" right of the inventor as something akin to an "absolute" right. It subordinated the public purpose of the grant to the self-interest of the patentee.

The result is that suppression of patents has become commonplace. Patents are multiplied to protect an economic barony or empire, not to put new discoveries to use for the common good.[1] "It is common practice to make an invention and to secure a patent to block off a competitor's progress. By studying his ware and developing an improvement upon it, a concern may 'fence in' its rival; by a series of such moves, it may pin the trade enemy within a technology which rapidly becomes obsolete. As often as not such maneuvers retard, rather than promote, the progress of the useful arts. Invariably their effect is to enlarge and to prolong personal privilege within the public domain." Hamilton, op. cit., supra, p. 161. One patent is used merely to protect another. The use of a new patent is suppressed so as to preclude experimentation which might result in further invention by competitors.[2] A whole technology is blocked off. The result is a clog to our economic machine and a barrier to an economy of abundance.

It difficult to see how that use of patents can be reconciled with the purpose of the Constitution "to promote the progress of science and the useful arts." Can the suppression of patents which arrests the progress of technology be said to promote that progress? It is likewise difficult to see how suppression of patents can be reconciled with the provision of the statute which authorizes a grant of the "exclusive right to make, use, and vend the invention or discovery." Rev. Stat. § 4884, 35 U. S. C. § 40. How may the words "to make, use, and vend" be read to mean "not to make, not to use, and not to vend"? Take the case of an invention or discovery which unlocks the doors of science and reveals the secrets of a dread disease. Is it possible that a patentee could be permitted to suppress that invention for seventeen years (the term of the letters patent) and withhold from humanity the benefits of the cure? But there is no difference in principle between that case and any case where a patent is suppressed because of some immediate advantage to the patentee.

I think it is time to return to the earlier, and I think the true, philosophy of the patent system. We should not pass on to Congress the duty to remove the private perquisites which we have engrafted on the patent laws. This Court was responsible for their creation. This Court should take the responsibility for their removal. I would adopt the view of Hoe v. Knap, supra. In a case like the present (Butterworth v. Hoe, 112 U. S. 50, 61), as in infringement suits (Morton Salt Co. v. Suppiger Co., 314 U. S. 488, 492-494 [52 USPQ 30, 32-33]) the Court sits as a court of equity. It should withhold its aid from a patentee who has employed or plans to employ the patent not to exploit the invention but to suppress it in order to protect another patent or otherwise.[3] Cf. Ethyl Gasoline Corp. v. United States, 309 U. S. 436, 459 [44 USPQ 614, 621-622]. If that purpose were clear, a patent should not issue in the first instance. If it has been issued and not cancelled and the patent has been suppressed, anyone

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[1] For illustrations see Investigation of Concentration of Economic Power, Hearings, Temporary National Economic Committee, Pt. 2 (1939), pp. 345, 776; Hamilton, op. cit., supra, pp. 46-47, 59.

[2] The vice is the same as the practice, consistently condemned by this Court, of writing into the claims broad general specifications. As stated by Mr. Justice Bradley in Carlton v. Bokee, 17 Wall. 463, 471-472, "We think it proper to reiterate our disapprobation of these ingenious attempts to expand a simple invention of a distinct device into an all-embracing claim, calculated by its wide generalizations and ambiguous language to discourage further invention in the same department of industry. * * *"

[3] These situations are to be distinguished from the case of the inventor who though he has an expectation of exploiting the patent has not yet arranged the necessary financing, or, for other reasons, has not yet been able to go into production.

should be permitted to use it at least on payment of reasonable royalties. In that way the constitutional objective will be more nearly realized—the product of the inventive genius of the human mind will be put to work in the economy.

Mr. Justice RUTLEDGE, dissenting.

I would affirm the judgment. But I do not reach the interesting and important questions debated by the Court's opinion and my dissenting brethren. They are of such a character that, in my opinion, they should not be determined in the absence of a record presenting facts and issues making this necessary. In this case the facts do not so clearly present the issues of "fencing" and "blocking" that decision upon them is required or appropriate.

Those issues were not raised or considered until the case reached the Court of Appeals. Evidence concerning intent to suppress was not received in the District Court and petitioner is entitled to its day in court upon that question, unless it has conceded it. The record, as this Court's opinion indicates, is not clear that the concession has been made with the effect of admitting that petitioner had no intention to exploit the patent. If, as the trial court found, the machine without the splitting knife would not "produce any useful result," this fact together with the assertion of the claims relating to the full combination, or with it and the concessions apparently made in the Court of Appeals, might be sufficient to sustain that court's conclusion that the only purpose of the alleged invention was to "fence" or "block." But the Court of Appeals expressly rejected the trial court's finding in this respect and a showing of motion pictures here, such as took place in the Court of Appeals, appeared to demonstrate conclusively that the machine not only works without the cutting knife, but produces a highly useful result if the pears are split before being placed in the machine for bobbing, peeling and coring. Whatever foundation might have been found, therefore, to support the conclusion of intent to fence or block, in the machine's lack of capacity to produce any useful result, disappears from the case.

The record, however, discloses another ground which was considered in the Patent Office and the District Court, wholly sufficient to dispose of the case and requiring affirmance of the judgment. This was that the claims in issue are too broad to cover the invention. No one of the claims specifies or indicates that the pears must be pre-split in order for the invention to be used or to produce a useful result. With commendable candor, counsel conceded this in the argument here, and indeed the claims on their face require the concession. Patents are not to be granted upon claims which do not accurately describe the invention and all of its essential features. These claims are stated in language broad enough to include whole pears. Admittedly the machine will not work, without the knife, as to them. In my judgment therefore the claims are too broad. The Patent Office and the District Court so found. The question is open and was presented in the Court of Appeals and here. Accordingly I would affirm the judgment.

Tabulation of Articles by Elmer L. Goldsmith Published in the Journal of the Patent Office Society, a publication which goes to most patent lawyers and the scientific and legal employee's in the U. S. Patent Office (1918 to 1948).

Vol 8,	page 341	"Rule 75" relative to ex parte priority proof of prior invention.
Vol 15	page 142	"Substitute for the oath
15	658	"Public Search Room"
17	241	"Comment on Classifying the Official Gazette"
18	366	"Infringement prior to issuance of Patent"
21	967	"Aggregation rejections"
24	582	"Anti-monopoly-anti-trust laws"
* 27	429	"Re: Special Equipment Co v Coe"
28	904	"Re: Unnecessary Claims"

*Only extra copy attached with Supreme Court's decision and dissenting opinion. My entire library, volumes 1 to 29 was donated to the Indiana University Law Library in 1948.

Elmer L. Goldsmith (1949)

JOURNAL
of the
PATENT OFFICE SOCIETY

JUNE
1945

VOLUME XXVII NUMBER 6

Situations Wanted

INDUSTRIAL CHEMIST AND CONSULTANT, B. S., M. S., Ph. D., LL.B., twenty years' experience in research, consulting and patent problems. Former major, Chemical Warfare Service, Technical Division, now available. Box No. 1, June JOURNAL.

REGISTERED PATENT ATTORNEY with nineteen years' domestic experience in U. S. and foreign patents including chemical and metallurgical fields desires part-time connection or overflow work preferably New York area. Box No. 2, June JOURNAL.

PATENT ATTORNEY, 32, member N. Y. and D. C. bars, over 10 years' private practice and corporation experience, including substantial litigation, interference and inter partes trade-mark practice. Chemical training. Desires position preferably with small active firm with highly varied practice. Will consider corporation position having comparable responsibilities and adequate future prospects. Box No. 3, June JOURNAL.

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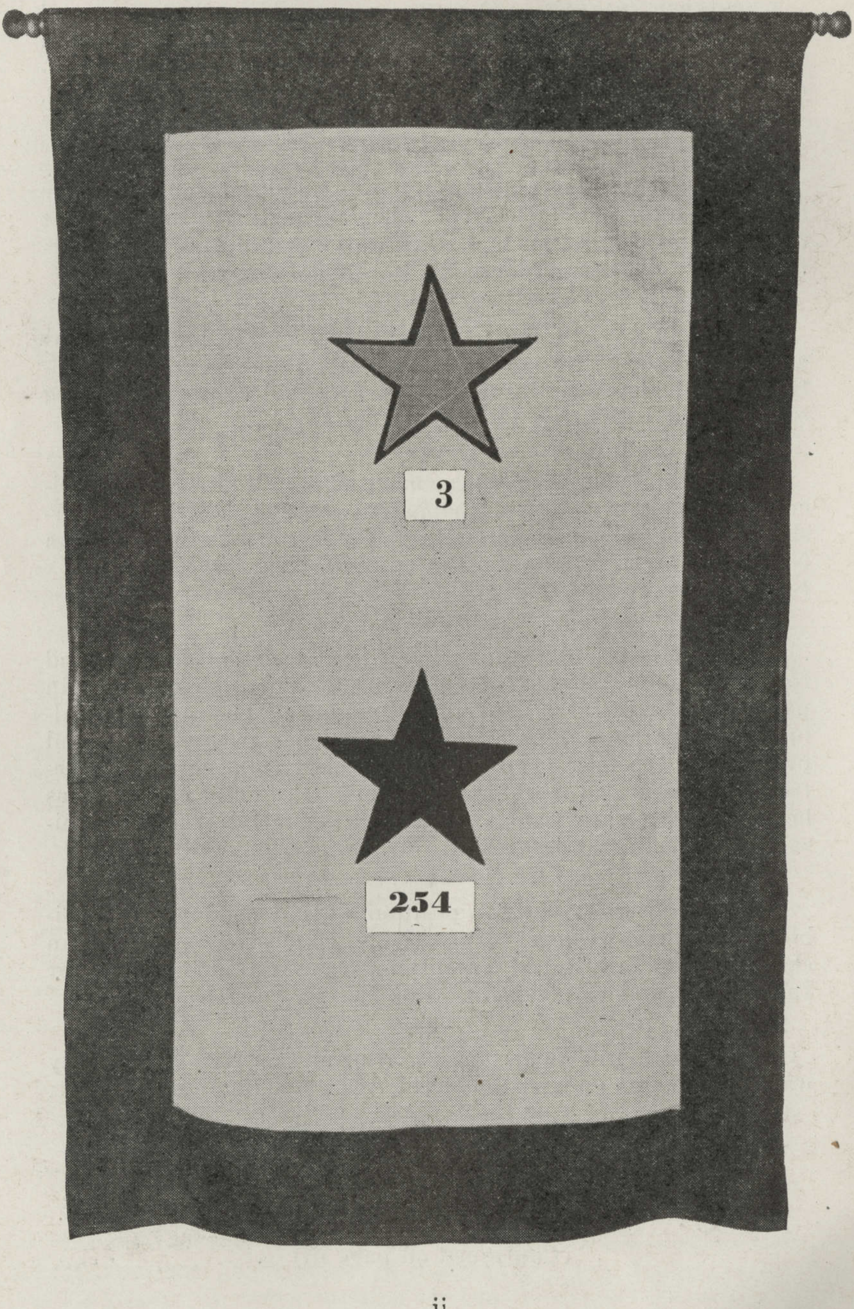
(Continued on page iii)


3
254

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A medium of expression and exchange of thought for advancing and improving the patent system; a forum for the presentation and discussion of legal and technical subjects relating to the useful arts; a means for disseminating a wider knowledge of the workings and advantages of the patent system; a periodical for bringing about a more uniform practice of patent law and through which all interested in developing the patent system may work to a common end.

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Publication of signed articles in this JOURNAL is not to be understood as an adoption by the Patent Office Society of the views expressed therein. The editors are glad to have pertinent articles submitted.

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Contents

Commissioner Coe Resigns

Conway P. Coe, whose tender of resignation as Commissioner of Patents has been accepted by President Truman, leaves the Patent Office June 15, 1945, after almost twelve years of service, to resume the practice of patent law.

In a tender of resignation dated March 2, 1945, addressed to President Roosevelt, Mr. Coe said:

> "My service as Commissioner of Patents and as a member of several federal agencies has entailed many and serious personal sacrifices. Before the outbreak of the current war, I was prompted to resume the practice of my chosen profession, but when the emergency arose I decided, that, in the public interest, I should remain at my post. Now, however, I feel that I can properly consider the personal obligations that confront me, and I accordingly request, with all deference to you, that you accept this tender of resignation from the Office of Commissioner of Patents."

A similar tender of resignation was addressed to President Truman following the death of President Roosevelt. In accepting the resignation of the Commissioner, President Truman said:

> "I have given it careful consideration and have come to the conclusion that I must regretfully accept, effective June 15, 1945, your decision to return to private practice.
>
> "I have been aware of the high level of your work as Commissioner of Patents over the past twelve years and of your contributions to the work of the National Defence Research Council, the National Inventor's Council and the National Patent Planning Commission.
>
> "I know that you have continued in that office at the repeated request of President Roosevelt. I am sure that he was deeply appreciative of your willingness to continue in the discharge of your exacting duties, and of the very high degree of application, specialized knowledge and devotion which you have given to them.
>
> "I take this opportunity to express to you my own appreciation of your past services and I shall feel free to call upon you for special assistance in connection with the important pending questions affecting the patent laws."

Mr. Coe, a native of Maryland, who was appointed Commissioner June 26, 1933, at the age of 35, was one of the youngest men ever to have served in that capacity.

In an informal ceremony on June 15th, Mr. Coe was presented with a watch by the Patent Office Society and with the chair he had used as Commissioner, by Officials and employees of the Patent Office. Mr. Kalk represented the Society and Assistant Commissioner Henry, the Officials and employees. Mr. Coe, in responding, said:

> "After twelve years in the capacity of Commissioner of Patents, I am returning to my former professional duties. I shall often recall the congenial companionship and the loyal co-operation that I have experienced as Commissioner. I do not intend to say "goodbye" for I am happy to foresee that I shall continue to have the benefit of your friendship and association.
>
> "You may be sure that I appreciate your part in the work of the Patent Office in what has been the most critical period of its long career. Your services and sacrifices have benefited our country in the era of peace and in the tragic time of war. Many of the staff of the Office have given their aid—and some their lives—to assure the victory of our Army and Navy. And all of you have shared in the contribution which the Office has made to the armament with which our nation has re-enforced the bravery of our fighters on land, at sea and in the sky. Your consciousness of that fact is, I am certain, both a reward and an inspiration for you all.
>
> "You are well aware that as participants in the functions of the Office you are promoting one of the most vital and effectual influences in our national economy, that is, our patent system. That fact will also, I am confident, be a stimulus and a recompense to you.
>
> "Once again I assure you of my grateful remembrance of our pleasant relationship, and of my earnest wish for its continuance in the years to come. And I repeat that my words of parting are not good-bye but au revoir."

In addition to his duties as Commissioner Mr. Coe was a member of the National Defence Research Council, the National Inventor's Council and Executive Secretary of the National Patent Planning Commission. He has been publicly commended by the House Appropriations Committee for his efficient administration of the Patent Office.

Invention, The Law and Society

By Emanuel R. Posnack *

It is not unusual for the general law practitioner, upon encountering a case involving a patent, to make a hurried detour, regarding it as forbidden territory reserved exclusively for the patent specialist. The inclination to avoid this "technical" terrain is quite understandable, but it is nevertheless regrettable, for it has deprived American business enterprise of the considered judgment and influence of the largest section of the nation's lawyers in a field of law that is at one and the same time a source of vital nourishment for the life-blood of industry, as well as of restrictive toxins that have had a poisoning effect.

The recent U. S. Supreme Court case of *Hartford-Empire Co. et al* v. *United States,* decided January 8, 1945, (65 Sup. Ct. Rep. 373, 64 *U. S. P. Q.* 18) involves patents, but it is of concern not alone to the patent specialist, but to the entire legal profession as well. The Court's opinion is not technical in the engineering sense, but rather concerns itself with the broader aspects of patent law, particularly in its relation to our anti-trust laws. A study of the case and its numerous citations leads into many fields that influence every phase of modern enterprise and every aspect of living. Its direct path leads into industrial empires, and reveals how State-created rights—legal monopolies—are employed to encroach upon public rights. Its by-ways lead into the field of invention generally, and that covers the countless materials, services, processes, machines and "things" that constitute the fabric of human society.

The *Hartford-Empire* opinion and related cases reveal that the vital field of patent law is in a state of confusion, that it is replete with judicial inconsistencies and conflicts of opinion, that it provides legal ground for discrimination, and that the law is inadequate to meet

*Patent Lawyer, New York City.

the current trend towards an economy of abundance. These present problems of law and legislation,—problems that are clearly within the province of the entire Bar.

Let us examine the *Hartford-Empire* opinion in the light of its bearing upon free competitive enterprise. The case involved a large number of corporate and individual defendants who were charged with violating the Sherman and Clayton Acts in that they "agreed, conspired, and combined to monopolize, and did monopolize and restrain interstate and foreign commerce by acquiring patents covering the manufacture of glass making machinery, and by excluding others from a fair opportunity freely to engage in commerce in such machinery and in the manufacture and distribution of glass products."

In a lengthy opinion by Mr. Justice Roberts, the court found suppression of invention and of competition, and while definitely frowning upon such practices, nevertheless in certain cases *sanctioned* them. The Court objected to what it called an "offensive and defensive alliance of patent owners with its concomitant stifling of initiative, invention, and competition." Yet in the same opinion the Court held that the owner of a patent cannot by judicial decree be prevented from setting a price for its use by others, electing to use it himself and to refuse to license it, or retaining it without either using it or licensing it. Referring to these rights the Court asserted:

> These are options patent owners have always enjoyed . . . A patent owner is not in the position of a quasi-trustee for the public or under any obligation to see that the public acquires the free right to use the invention. He has *no obligation either to use it or to grant its use to others.* If he discloses the invention in his application so that it will come into the public domain at the end of the 17-year period of exclusive right, he has fulfilled the *only obligation* imposed by the statute . . . Congress has repeatedly been asked, and has refused, to change the statutory policy by imposing a forfeiture or by a provision for a compulsory licensing if the patent is not used within a specified time.[1]

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[1] Italics in this article the author's.

It appears from the opinion that although *alliances* or *combinations* to suppress, "block off" and "fence in" competing inventions are prohibited, being in the nature of combinations in restraint of trade, an *individual* patent owner may engage in such restrictive practices, provided he does so on his own account. And in his relation with his licensees, he may *set prices* at which a patented product may be sold, he may *establish quotas* of production, he may *parcel out territories* where it may be sold, and he may *limit its uses.*

The Court pointed out that these rights of a patentee have a statutory basis, and cited the governing rule from *Chapman* v. *Wintroath,* 252 U. S. 126, as follows:

> A party seeking a right under the patent statutes may avail himself of all their provisions, and the courts may not deny him the benefit of a single one. These are questions not of natural but of purely statutory right . . . No court can disregard any statutory provisions in respect to these matters on the ground that in its judgment they are unwise or prejudicial to the interests of the public. United States v. American Bell Telephone Co., 167 U. S. 224, 247.

It is to be presumed that this right of a patent owner to employ restrictive practices is not intended to apply only to an individual patentee, but that the right may flow from the statute to any number of co-owners just as it does to a single patent owner. What is there then to prevent two or more industrial titans from acquiring joint ownership of a patent, and directly granting licenses on a restricted price and quota basis? Would not this expedient be a possible method of monopolizing a particular field to suppress competition,—a practice which the antitrust laws seek to prevent? Is not this a possible means of throttling production which runs counter to the goal of an economy of abundance that seems to be favored by practically every section of our politico-economic spectrum?

There is thus an obvious inconsistency between our present patent laws and the economic trend of the times. And there is a decided difference between the patent laws as they have been interpreted by the courts and the general policy with respect to competitive enterprise. Mr. Justice Rutledge, in his partially dissenting opinion in the *Hartford-Empire* case, refers to this special position of patent law as follows:

The case presents again the fundamental problem of accomodating the provisions of the patent law to those of the anti-trust statutes. Basically, these are *opposed* in policy, the one granting rights of monopoly, the other forbidding monopolistic activities. The patent legislation presents a *special case,* the anti-trust legislation the nation's *general* policy."

This special consideration given to a patentee stems from Article I, sec. 8 of the United States Constitution which states that:

The Congress shall have power . . . to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.

The specific statutory provisions are R. S. sec. 4886 (35 U. S. C. 31) which states:

Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, or who has invented or discovered and asexually reproduced any distinct and new variety of plant . . . may . . . obtain a patent therefor.

and R. S. sec. 4929 (35 U. S. C. 73) which states:

Any person who has invented any new, original, and ornamental design for an article of manufacture . . . may . . . obtain a patent therefor.

The justification for granting the special privilege of monopoly to the creators of intellectual property such as inventions has both an ethical and a practical basis. Inventions are contributions of something new to the world's common store—something that never before existed. Hence, unlike other forms of monopolies which tend to deprive the world of the full production of known things for which there has been an established demand, the monopoly in an invention deprives the world of nothing. By refusing to accept the bounty of the patented invention, which it may freely do, the world is no worse off than before. By accepting it, the world has acquired an addition to its store of wealth.

Inventions are a form of wealth quite unlike that which is to be found in the bowels of the earth, or which can be produced through the physical exertions of the human body. For both natural resources and human energy are necessarily limited in accordance with the dimensional limitations of the earth and the known limitations of human strength. But inventions, stemming from the boundless extent of the human mind, can flow on forever, without limit.

It is to activate this limitless source, the human mind, that attractive rewards are offered, including the extraordinary inducement of a limited monopoly. It is this inducement that stimulates creative effort to produce the mechanism of manufacture and commerce, and that provides the fuel to motivate this wealth-producing mechanism. It is the incentive of reward that has given rise to that stream of inventive thought which has so richly contributed in the fabrication of our man-made world.

The patent monopoly is intended for the benefit of the inventor himself, or of the assignee or licensee that is investing capital in the exploitation of the invention. And the instrumentality by which the monopoly is enforceable is mainly the writ of injunction against infringers, with the right to an accounting and monetary relief.

With the effective weapon of an injunction at his disposal, the patentee is potentially a powerful figure within his realm. The history of patent litigation in this country indicates that up to about thirty years ago he was practically king within his domain. And his domain had expanded so as to include not only the specific patented device, but also *unpatented parts* for use in the patented combination. Supplying an unpatented element necessary for the operation of a patented machine was regarded as constituting *contributary infringement. (Leeds & Catlin* v. *Victor Talking Machine Co.,* 213 U. S. 301, 325). Even *unpatented supplies* incident to the use of a patented invention were within the domain of the patent owner. (*Henry* v. *A. B. Dick Co.,* 224 U. S. 1).

Today the domain of the patentee has been narrowed considerably as a result of an anti-monopoly trend in judicial decisions—a trend which indicates that the public is regarded as a party in interest. *Henry* v. *Dick,* supra and analogous cases have been expressly overruled, and the old doctrine giving patentees a monopolistic control of unpatented machines, parts or supplies used with the patented product no longer prevails. (*Motion Picture Patents Co.* v. *Universal Film,* 243 U. S. 502; *Carbice Corp.* v. *American Patents Dev. Corp.,* 283 U. S. 27; *Mercoid Corp.* v. *Mid-Continent Investment Co.* et al. 321 U. S. 802, 60 *U. S. P. Q.* 21).

The present laws keep the patentee within the terms of his grant, and when he steps beyond, *he is denied the use of the injunctive weapon against an infringer.* In other words, if a patent owner should *misuse* his patent, he cannot maintain an action against an infringer as long as such misuse or its effect continues. And by misuse is meant unlawfully attempting to monopolize or even partially monopolize unpatented supplies, machines or consumable materials, suppressing competition by unlawfully restricting the resale price of a patented commodity, and expanding the patent monopoly by employing it to control other fields (*Leitch Mfg. Co.* v. *Barber Co.,* 302 U. S. 458; *Ethyl Gasoline Corp.* v. *United States,* 309 U. S. 436; *Morton Salt Co.* v. *G. S. Suppiger Co.,* 314 U. S. 488; *Mercoid Corp.* v. *Mid-Continent,* supra).

The trend is unmistakeably in favor of the public as against restrictive monopolistic practices as far as it is possible for the courts to go in the light of existing patent legislation. It has unquestionably become the intent of the courts to prevent the supercharging of patents and their employment as instrumentalities for giving illegal monopolies the appearance of possessing governmental sanction. But it is also apparent that with all the paring of patentees' rights, the courts have never exhibited an intent to destroy our patent system or impair the effectiveness of its role in our economic order of free enterprise. Yet for the courts to follow both the present trend of judicial interpretation and the letter of the law is to subject themselves to opposite forces. "Whether the one or the other is wise is not for us (the Court) to determine. But their accommodation is one we must make, within the limits allowed to the judicial function, when the issue is presented,"—quoting from Mr. Justice Rutledge's dissent in the Hartford-Empire case above referred to.

When such incompatability exists between the law and the times, the law must be changed. It is the duty of the Bar of the nation to take cognizance of this incompatability, and to lend the weight of its skilled hand in refashioning the law to make it conform to the times.

An analysis of the incompatability discloses, as was above shown, that whereas the trend is away from restrictive practices, a patentee may nevertheless impose restrictions as to *price, quantity, use* and *territory.* After the throttling effects of such restrictions by patent monopolists in the glass industry were first revealed, the Temporary National Economic Committee proposed to sweep away with a single stroke all rights to impose any such restrictions. But these proposals met with no success,—and fortunately so. There is no doubt but that quantity and price restrictions (including price-maintenance contracts of branded and trade-marked commodities) are inherently opposed to an economy of abundance and free competitive bidding. Such restrictive practices are generally designed to prevent overstocking and to maintain high prices, thereby inducing an economy of scarcity and tending to lower the general standard of living. The outlawing of restrictions as to price and quantity thus appears to be in the public interest.

But restrictions as to use and territory do not necessarily tend in the same direction. In fact, if a patentee were not permitted to grant licenses for specific uses and territories, he might find himself compelled to grant a license to a firm able or willing to exploit the invention to a limited extent only. The patent owner's hands being tied, he would be unable to arrange for a *further exploitation* of his invention as to other uses and other territory.

Doubtless the T. N. E. C. feared *suppression* of patented inventions by those who desired to prevent competition with existing obsolete devices and processes, and possibly also by those who were opposed to the introduction of labor-saving machinery. The fear was well grounded, but the proposed remedy would have proven detrimental to the patent system. The obvious remedy would be *compulsory licensing.* Under such a system, if a patent owner or licensee does not exploit the invention as to all its uses and in all possible territory, such unexploited uses and unexploited territory would be open, under the patent monopoly, to the highest bidder or to any interested party on an equitable basis.

Compulsory licensing is not a new idea. It is practiced in other countries, and a number of attempts have been made to legislate it into our patent laws, but without success. A similar attempt now would undoubtedly meet with opposition from the same pressure groups who stood in its way previously. But the times have changed; the trend is away from an economy of scarcity, and from the suppression of inventions. It is the duty of the Bar to bring this phase of patent law up to date.

It has been suggested that legislation be passed to void patents which have been misused or employed to violate anti-trust laws. Congress has consistently refused to adopt such legislation, and justly so. Voiding of a patent would mean its dedication to the public, and that might have some serious drawbacks. The uncertainty of success inherent in the exploitation of an untried invention requires the relatively clear field which the patent monopoly affords. The voiding of a patent would eliminate this advantage, and the lure to venture capital would be gone. Many a potentially successful invention would thus die of lack of capital. Furthermore, innocent parties in interest, such as a licensor not participating in the acts of exploitation of his patent, would be unjustly deprived of his property. These and other undesirable consequences make the voiding of patents a dangerous expedient, which need not be resorted to when there is adequate anti-trust and compulsory licensing legislation, and when the present laws against misuse of patents are properly and firmly applied.

The misuse of patents which we have thus far considered presents merely one side of the picture—that depicting the *supercharging* of patent rights which gives to the patent monopolist an undeserved strategic advantage in a field of competitive enterprise. The other side of the picture shows the *undermining* of patent rights which gives the patent owner an asset of questionable value,—and which often places both the inventor and the investor relying on the patent grant in a precarious position.

Indeed, due to the attitude of the courts, large numbers of patents have become functionally anemic. The patent pirate—the pilferer of patented designs and other inventions—openly thumbs his nose at the Patent Office, for he is reasonably sure that he has the backing of the federal judiciary. And it is inevitable that this should have come to pass in the light of the marked trend towards the adjudication of most litigated patents as *invalid.* The impression has been created that all patents are of doubtful value, and as a result infringement has been encouraged. And there is a serious danger that, as a consequence, there will be a lag in inventive effort and in the production of patented inventions.

The core of this situation is the *confusion which exists as to the very definition of invention.* In our country, the world's most prolific producer of inventions, the extent of this confusion is amazing. Where the Patent Office issues patents that are presumptively valid, the courts more frequently than not decide that they are invalid, and hence worthless. And there is similar disagreement among the more than one hundred federal district courts and appellate tribunals.

Today a patentee or an operator under a patent is penalized because he has seen fit to rely on the Patent Office as the national authority on patent matters. He invests his time, effort and capital in the development and exploitation of an invention because of a monopoly grant by the government,—only to have the courts take away the monopoly when the patent is put to the test.

Through the eyes of many a patentee the situation is as follows: The Government induces him to disclose his invention to the public, in return for which he is offered a limited monopoly. He accepts the offer. A few turns of the Government machinery, and the inventor has his monopoly. And the public is free to *inspect* his invention. A few more turns of the Government machinery, and the inventor has lost his monopoly. And the public is free to *use* his invention.

The patentee feels he has been cheated. He does not understand the Government's patent-issuing and patent-adjudicating machinery—for he is not a patent lawyer. He does know, however, that he was induced to part with something that belonged to him,—that it was the Government that did the inducing, that made the offer, and that deprived him of the promised reward after he had performed his part of the contract. That, to him, closely resembles a fraud.

When a patent gets into the courts, its validity is not a matter of mere academic concern to those interested. And when a manufacturer, justly or unjustly, wants to be freed from the restrictions of a competitor's patent, he generally spares no expense to prove its invalidity. His attorneys accordingly microscopically scrutinize domestic and foreign patents and publications in many fields, often going back to the dim past in their investigations, in search of fragments of ideas that bear some resemblance to the elements of the patent in suit. When the court is finally confronted with this mass of evidence of the "prior art" it generally comes to the conclusion that the "flash of genius" is lacking and that the alleged invention is after all no invention at all, and hence is not entitled to patent protection.

In practically every patent infringement suit, the defense of invalidity is interposed. And when the patent, because of such defense, is sifted through the maze of accumulated prior art, and subjected to an intense legal bombardment, and compelled to run the gauntlet of an array of often arbitrary or outdated doctrines, the patented invention emerges as an utterly vitiated concept or a "mere shade of a shadow of an idea."

Its contribution to productivity and employment, in the light of the particular industry's prior status, plays no part in the court's decision; and its commercial success is never considered when the court is convinced that invention is lacking, as it generally does by the test of the "flash of genius" formula pronounced in *Cuno Engineering Co.* v. *Automatic Devices* (314 U. S. 84).

Indeed, so far has this *subjective* doctrine been developed that it has resulted in different tests of invention for individuals and large organizations. Because "a patent application sought by a corporate research organization does not ordinarily represent the product of an individual's work but is the collective achievement of the organization" *(Potts* v. *Coe,* 567 O. G. 170, Jan. 18, 1944), invention is not to be presumed even if the alleged invention meets the *objective test* that it is useful, novel and not obvious to those skilled in the art. The reasoning appears to be that developments of individuals during the course of their corporate employment cannot be the result of the required flash of genius, and hence the subjective test applied to individuals cannot be applied to organizations.

This rule could readily lead to the strange conclusion that a given invention is patentable if developed by a single individual working alone, and not patentable if developed through the step-by-step method of modern research organizations. On its very face the rule seems discriminatory, and may well tend to discourage research and encourage suppression of invention by large organizations.

This contradictory situation illustrates the existing state of confusion as to the very meaning of invention. And it brings to the fore the question as to the need of a new philosophy in the evaluation of inventive thought and in the determination of a uniform test for a patentable invention. This is a problem that is not within the exclusive province of the patent lawyer, for it relates to the broad fields of modern technology and economics, and hence is equally as well the concern of the Bar at large.

Among the specific aspects of this problem the most important is the question of supplanting the subjective test by an adequate objective test where important determining factors are (1) *functional improvement* even if accomplished through a trivial mechanical change, (2) the *use* to which an invention can be put and (3) its contribution to *productivity* and *labor employment.* And among the general aspects of the problems is the frequently discussed suggestion to confine the trial of patent causes to *jurists having special patent and technological experience,* whereby they may be (1) capable of readily comprehending the technical subject matter involved, and (2) competent expertly to pass on the question of invention, whether by present standards, or by standards involving tests as to functional improvement, use, and effect on productivity and labor employment.

The public's interest in a fair and practical test of invention is not exclusively confined, however, to a position in favor of the patentee as when a meritorious invention is involved,—but also to a position against the patentee when the invention does not merit patent protection. In other words, when a patent has been erroneously issued, through an oversight or mistake in judgment of a patent office examiner, it is to the public's interest that it be relieved of the burden of supporting the invalid patent. The problem then is (1) how to rectify the error after it has been made and an intrinsically invalid patent issued, and (2) how to prevent or reduce the frequency of such errors.

At the present time it is entirely possible for a patent which is intrinsically invalid to be used by its owner as a threat to throttle competition. Unless someone is willing to go to the considerable expense generally necessary to test the patent's validity in court, the threat may hang over the heads of the patentee's competitors for the life of the patent. Because of the patentee's right to fix prices and restrict production, the public may be compelled to pay a heavy premium for the use of the alleged invention. Indeed, threatened competitors may find it more expedient to accept licenses under the patent than to fight it,—thereby participating in the restrictive practices permitted under the law, against the public's interest. *And there is nothing the government can do about it,* as long as the patentee and licensees operate within the legal bounds of the patent grant. For although a private party in interest may test the validity of a patent, either by way of defense or by instituting a suit for a declaratory judgment, this right is denied to the government.

Here again is a situation where the patent law is behind the times. While the courts are asserting, more emphatically than ever, that the public has a vital interest in patent grants, the government as the public's agent is powerless to protect this interest against intrinsically invalid patents. This poses the question of the desirability of giving the government (1) the right to *initiate* a law suit to test the validity of a patent, and (2) the right to *intervene* in patent litigation already pending, to assure an adequate defense and to prevent collusion between the litigants or a settlement against the public interest.

The other aspect of this problem, that of preventing or reducing the issuance of invalid patents, primarily involves the Patent Office search of the prior art, in the light of the prevailing test of invention. It is a matter of common knowledge among those with experience in patent litigation that validity searches conducted by private practitioners attacking a patent are very frequently more thorough and exhaustive than searches conducted by the patent examiner during the prosecution of the application. As a result, the court deciding the issue of validity often has before it more pertinent patents and publications than the Patent Office had when deciding on patentability. With a more complete view of the prior art than possessed by the Patent Office, the court may feel justified in declaring that the patent in suit should never have been granted, and in overruling the Patent Office by decreeing the patent to be invalid.

The obvious remedy appears to be for the Patent Office to conduct as exhaustive a search as is done by private parties seeking to void a patent. It may be argued that this would involve enlargement of the Patent Office personnel and would in general entail greater expense. But is it not logical to ask whether it would not be worthwhile to spend more in order to assure the issuance of valid patents upon which industry could rely, than to spend less and risk the continued issuance of patents destined to be rendered worthless, to the discredit of the entire patent system? If the presumption of validity which attaches to an issued patent is not to become a meaningless legal fiction, is it unreasonable to demand that the very foundation upon which the patent grant rests be made of firmer stuff?

The extent of the Patent Office search, and the test of invention in the light of which the search is conducted during the prosecution of a patent application, are basic matters in which the Bar at large should be interested. And if it is urgent that changes be made in view of present-day conditions, it would appear that the direct and positive method of legislation be resorted to, rather than the slower judicial and administrative processes.

Another shortcoming of our patent system which is detrimental to the public interest is the nature of the patent certificate. There is generally little or nothing on its face to indicate clearly in what precise respects the claimed invention is an improvement over previous developments. Instead of a *concession* of what is old or known, and then a *listing* of points or claims of the specific improvements, as is to some degree attempted in other countries, our form of patent certificate contains a description and one or more claims which need give no history whatsoever of the art. To ascertain the previous state of the art,—and often to determine the scope of the claims,—it is generally necessary even for the expert patent lawyer to obtain the file history of the case. Hence, although a copy of the patent is readily obtainable at a slight cost, the public is kept in the dark as to what is the real invention unless a further, and often costly, investigation is made.

Because of the special monopoly privilege accorded an inventor, it would appear to be entirely fair to impose upon him the requirement that he concede *on the face of the patent* the prior existence of that which the Patent Office's exhaustive search has shown to be old. And because of the monopoly burden which the public has agreed to bear, it is entitled to know not only the specific points of novelty over the conceded prior art, but also the *list of prior art patents* revealed during the course of the application's prosecution. With such knowledge before it, and with the realization that the expert patent issuing and patent adjudicating tribunals are harmoniously working on common ground, the informed public would be less likely to engage in speculative patent litigation.

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We have thus far considered the technical or that which may be considered the narrower aspects of the subject of inventions. The broader aspects relate to the manifold fields of business in its larger sense,—to local and global economics.

The breaking down of the once impassable physical barriers between nations and continents has vastly enlarged the domain of the individual. The sciences of instant communication and rapid transportation have immeasurably increased man's mobility, and have removed time and space from their previous roles as obstacles to the flow of man's goods and intelligence throughout the world. The technological means now at our disposal are capable of so linking together the minds of men as to produce a fathomless global intellect—a reservoir of ideas which if activated and properly channelled throughout the world could raise the level of living of every human being wherever he may be.

The mechanism for the exchange of ideas on a global basis is here, and any instrumentality for putting this mechanism into operation and accordingly stimulating inventive and creative thought will be welcomed by a postwar world anxious to improve its lot. Our task, in the attainment of this desirable objective, is both to provide means for bringing the ideas to fertility, and to facilitate their materialization for the benefit of mankind.

One of the most powerful inducements to creative thought arises from a realization that the promised reward is within easy reach. Make it easy and convenient for inventions to be marketed—provide a readily accessible, trustworthy intermediary for bringing inventor and capital together—and you will have an ever-present incentive to the potential inventor. If it is at all the function of government—as our own constitution seems to indicate—"to promote the progress of science and useful arts," then it should be the duty of governments to encourage invention by providing a clearing house or exchange for inventions,—indeed, for every form of intellectual property. Considering the effectiveness of the manifold government agencies that have been operating in recent years, it seems that governmental invention marts are a practical possibility. Inventors and authors could place their ideas and their works—whether protected or unprotected by patents and copyrights—with properly established public agencies. The immediate availability of such agencies, in contrast to the relatively great difficulties in locating and approaching private capital and industry, would remove a serious obstacle encountered by most inventors. Authors and inventors would be less dependent upon the graciousness of publishers, and the inclinations and whims of the elite of science, industry and finance. And the faith and confidence the public has in a governmental body—as evidenced by the willingness of inventors to disclose their ideas to the Patent Office when they are reluctant to make a disclosure to a private organization—would be an important factor assuring the success of such a public institution.

Under such a system the government could supply, for a nominal charge, lists of inventions in any requested category, together with the name and address of the inventor, author, patent or copyright owner. Similarly lists of registered individuals or firms with capital or manufacturing facilities could be supplied to inventors or other registered parties for any specified field of enterprise. The publication in newspapers and periodicals of categories or detailed lists of intellectual property available for exploitation would also be effective, for it would be bound to arouse the interest of men wherever their business activities are permitted to be influenced by the profit motive. Negotiations could be carried on privately, although some form of government guidance could possibly be instituted.

It is entirely conceivable that such an institution could be conducted on a global scale—within the province of a world organization such as has been proposed at Dumbarton Oaks. There could thus be a Global Authority to supply lists to interested parties with respect to inventions and works in any part of the world. It would obviously be desirable, to facilitate the working of such a plan, to have a single standard or test of invention throughout the world. To this there could be no valid objection, for an idea or improvement, to be truly new, must be new everywhere. It would even appear to be advisable, under such circumstances, to have patent certificates for all nations uniform in every respect except as to language,—and to enable patent protection to be obtained in any country by a patentee of another country merely upon the payment of a government fee, without the necessity of separate prosecution in each country.

In view of the trend toward internationalism even in so-called conservative circles, such a global plan should be favorably received in postwar society. In our country both major parties have openly repudiated isolationism. The American Bankers Association has recommended the removal of hampering barriers to international trade, and has approved a global bank, substantially along the lines of the International Bank for Reconstruction and Development proposed at Bretton Woods. Can it be said that plans for a global patent authority are more visionary than plans for a global bank? On purely ethical or human welfare grounds it would seem that the adoption of means to release the world's store of inventive genius for the enrichment of man's life is as justifiable as the adoption of social security laws by the world's progressive governments, or as the establishment of the Social and Economic Council of the proposed world organization.

Even the global regulation of patents to prevent their misuse by restrictive combines or cartels can be effectuated, under suitable international law, through the patent authority. It would be as logical to provide for such regulation in the interest of the postwar world citizenry, as it is for our own anti-trust laws to provide such regulation in the interest of the citizens of this country. The elimination of competition-throttling practices by international patent pools would be analogous in general purpose to the elimination of trading blocs and multi-lateral currency deals sought to be accomplished by the proposed International Stabilization Fund.

There are many other signs pointing to future cooperation among nations through a single agency to cope with problems of common interest. The proposed St. Lawrence Sea-Way and Power Project, the proposed Rhine Valley Authority, the proposed Danube Valley Authority along the TVA pattern as recently discussed by the *London Economist,* are specific examples of what the architects of the future have in store for us. There are also proposals for international health and education agencies,—and for research services to enable the public to benefit directly from research projects which heretofore only large private organizations have been in a position to undertake for their own exclusive benefit. In the light of all these proposals to effect cooperation between the nations of the world for the common good of their people, it is not difficult to envisage a global patent and copyright authority with a similar objective.

There is still another aspect of the subject of invention that needs be here considered. It is one that concerns an ever-present barrier to new ventures, and particularly to inventive effort.

The determining consideration in connection with the investment of money or effort in an enterprise has always been the *probability of success.* And this generally depends upon such factors as demand, supply, cost, practicability and ability to produce or perform. Under present-day conditions, just as in the past, it is rare for all these factors to be known with a considerable degree of certainty, and hence business undertakings are usually *ventures* in the true sense of the word. Where these determining factors are not known with any reasonable degree of accuracy, the element of chance is correspondingly great; and where they are utterly unknown, as is often the case, the risk is not taken except as a pure gamble.

The ascertainment of these factors in a *going* business enterprise is customarily attempted by a scrutiny of its *past history,* as reflected by its profit and loss statements, balance sheets and other definitely obtainable factual data. When business involving previously sold commodities or services is contemplated, the past records of *similar* businesses are generally resorted to. But as to the initiation of a new enterprise involving *previously unknown or untried* goods or services,—that entails serious deterrent risks.

Inventive and creative thought—being inherently directed to untried projects—is within the last-mentioned category. Accordingly, financial support for the exploitation of inventions is often difficult to procure—and is generally obtainable only on the basis of an unknown, untried and risky project. Venture capital is expensive, for there is no positive way of appraising a *future* and *untried* enterprise that has no past history to serve as a guide.

Our present systems of business and governments do not even remotely contemplate the provision of such an *appraisal of a new project.* Consequently the average man or business firm is without any adequate guide for ascertaining these factors upon which the probability of success of a proposed new venture might depend—in a field of any extended scope. Even in ventures that are not entirely new—that do not involve inventions—there is no adequate guide as to success probabilities other than those vague and often unreliable guides—experience, business judgment and intuition.

The means are available for interconnecting all parts of the world through channels of transportation and communication. Yet there is no system of channels through which an ordinary person or business can readily obtain information as to the demand for and supply of a commodity or service in another part of the country or in other regions of the world—or such other data as the commonplace *business survey* supplies. If such surveys for determining the probability of success have proven workable when conducted by private organizations for their own benefit, is it not reasonable to expect that governments with far greater facilities at their disposal could successfully render a similar service for the benefit of the public? If it is the duty of governments in an economy of free enterprise to help business, would it not be their duty to encourage the investment of capital in untried projects, if the mechanism to carry out such a program were available?

It is not here contended that such a program is an immediate possibility, or that it can be undertaken at all under a static economic atmosphere. It is submitted, however, that the mechanism for such a program *is* here. Statisticians for gathering data as to needs, supplies, scarcities, surpluses of things, material and labor,—experts for determining manufacturing feasibility, production difficulties, proximity of sources of raw material and distribution facilities,—specialists for supplying patent data in analogous arts to help in evaluating monopoly possibilities or in locating existing monopolies,—these involve personnel problems of a magnitude considerably less imposing than were the organization and operation of the United Nations armed forces. The problems of effectuating the actual flow of statistics and information, —as well as of men and goods,—for distribution throughout the world wherever there may be a need for them, are purely mechanical in nature, and are within the realm of the present-day technologies of instant communication and rapid transportation. In the light of today's achievements and potentialities, a continuously operating global statistical and intelligence survey, conducted by the governments of the world as a guide to business, is a possibility tomorrow.

New ventures, particularly those involving inventions and untried projects, need such guidance. The lawyer, as counsellor to the architect of the post-war world, can play an important role in helping to provide this form of assistance to both big and little business. The productive terrain of the world will then be illuminated for all to see, revealing both dangerous pitfalls as well as highways of opportunity. Independent enterprises will multiply throughout the world,—and ideas, labor and capital will more rapidly than ever be converted into going factories, fruitful land, producing ventures,—things—and consumable wealth.

Cleveland Patent Law Association Officers

The Cleveland Patent Law Association at its annual meeting, May 23, 1945, elected as officers for the coming year:

HARRY R. CANFIELD, *President*
SOLON J. BOUGHTON, *Vice-President*
FREDERIC M. BOSWORTH, *Secretary-Treasurer*

Patents, Cartels and Anti-Trust Laws

By Drury W. Cooper *

I take it as being accepted, in an audience such as this, that patents are at the basis of our entire industrial enterprise; that they are what has made America what it is; that they have in the past enabled our country to lead the world in manufacturing, in average living conditions, and in prosperity; that they have given us practically every modern instrumentality both of peace and of war: the telegraph, the telephone, the radio, radar, in the field of communication; the automobile, the steamboat, the sleeping-car, the airplane, in the field of transportation; the harvester, the tractor, the plow, and many other tools for the farmer; the electric refrigerator, the gas and electric range, and like household appliances; all these, almost without exception, originated and were first patented in this country. I might continue the catalogue until it included substantially everything you use, and still not be exhaustive.

All this has grown out of our patent system, which was so generally accepted as desirable and effective a generation or two ago that almost every other civilized nation on earth began to copy our patent laws in the hope of equaling our rate of progress.

At this time it is fitting that we should examine the system somewhat, as to its origin and present condition, in order to ascertain whether the current antagonistic attitude toward patents is justified. As in many other instances in human affairs, it may be found that the attacks made upon it are due to abysmal ignorance of the subject itself, or to the effort of those who have nothing to offer but destructive criticism, to tear down existing things.

The principle is as old as property itself, that what a man creates by his own labor is his to enjoy to the exclusion of all others. This is true of the results of intel-

* Address delivered before the Economic Club of Detroit, Michigan, March 12, 1945.

lectual labor as well as of bodily toil. It should indeed be deemed more his own because it is something that he has created, than if by manual labor one accumulates from Nature's bounty a store of fish, or of animals, or of grain, —which might have been obtained by any rival seeker. Intellectual labor produces not only something new, but something that is identified in a peculiar way with its author or inventor,—into which part of him has so far entered that it retains some of his characteristics; so that we can recognize the paintings of an artist with whom we are familiar, or the poet by his canto, or even the machine of a known inventor by the characteristics imparted to it by its creator.

Then, too, corporeal possessions perish, or are consumed; but time does not destroy the results of intellectual labor. They persist, as in the classic literature handed down from ancient times, or in the cotton gin of Whitney, or the steam engine of Watt, or the steamboat of Fitch. Universal tribute is given to the originators of the enduring monuments of mental effort. But something more than fame is required to stimulate the creative faculties. It has been found for a century and a half at least, as a matter of common experience, that the practical arts, as well as literature and the fine arts, should have their rewards, if not guaranteed to them, at least so nearly promised as to help inspire their creators' talents. I often think of this sort of reward as being like the bunch of fresh grass put in front of the nose of a balky horse, to induce him to step after it.

The genesis of the reward to inventors is found in the British statutes, first of Henry VIII and afterwards (the one better known) the twenty-first of James I, which excepted from a prohibition against the granting of monopolies the right to grant letters patent for the term of fourteen years or more to one who should create or first introduce into the realm a new manufacture,—in which was included what is now termed, in our statute, art, machine, or composition of matter. Later, by the Statute of Anne, copyrights were introduced into England. Prior to both patent and copyright, however, the exclusive property of the creator was recognized to the extent that if he did not himself dedicate it by making and selling specimens, he was protected against extracting his knowledge from him by artifice and utilizing it by another. All of this was well known to the framers of our Constitution. They made it provide (Article I, Section 8) that Congress shall have power "to promote the progress of science and useful arts, by securing for a limited time to authors and inventors the exclusive right to their respective writings and discoveries."

The statute giving the right to a patent has been but little changed from the beginning. It provides (Section 4886) that "Any person who has invented or discovered any *new and useful* art, machine, manufacture, or composition of matter, or any new and useful improvements thereof . . . may upon payment of the fees required by law, and other due proceedings had, obtain a patent therefor."

To invent means to come upon, to find out, to produce for the first time, to originate. To discover means substantially the same thing, that is, to obtain for the first time sight or knowledge of, to find out, to ascertain, to detect, to bring to the knowledge of the world. There is nothing obscure about either word. There is nothing in any dictionary definition that implies the idea of finding out something that is more difficult than the common man can be expected to ascertain. The statute gives as the only criteria that it must be new and useful. Yet the courts have, at least since the year 1850,[1] written into the statute something more. That is to say, they have defined an invention as something that springs from some intuitive or unusual faculty of the mind and as distinct from the "expected skill of the calling"; something that exceeds common ingenuity, goes beyond the exercise of the ordinary processes of reasoning upon the material supplied and beyond the facility of manipulation which results from the artisan's intelligent practice. As lately as in 1941

[1] *Hotchkiss* v. *Greenwood*, 11 How. 248.

the Supreme Court deliberately adhered to this view, saying (*Cuno Corp.* v. *Automatic Devices Corp.,* 314 U. S. at page 90):

> We may concede that the functions performed by Mead's combination [the invention at issue] were new and useful. But that does not necessarily make the device patentable. Under the statute . . . the device must not only be "new and useful," it must also be an "invention" or "discovery" . . . That is to say, the *new* device, however *useful* it may be, must reveal the flash of creative genius, not merely the skill of the calling. If it fails, it has not established its right to a private grant on the public domain.

In practice,—as most patent lawyers find by experience,—the Judges are sometimes governed by caprice, prejudice or momentary inspiration in their quest for the presence or absence of the "touch of genius" in the patents coming before them, and at best come to develop an extra sense like that used by an elephant crossing a bridge; for he puts one foot on the bridge, then raises his trunk and sniffs the air in all directions, and his instinct and training tell him whether the bridge will bear his weight.[2] This "elephant test" is at least as perfect a criterion as now exists in some of our courts. But it is wholly unsound.

The actual basis of the patent grant here should be precisely the same as in the old English theory, namely, the reward given to him who originates something new and useful whereby the sum of technical knowledge is enhanced, a new avenue of manufacture is opened, and a novel product is made to serve mankind. True it is that in the earliest times it was held in England that it was necessary for the thing to be novel *in the kingdom,* as well as useful. Our law is more benign, in that it grants to the originator anywhere the patent privilege and does not confine it to a novelty introduced into the United States.

It is true that the first British statutes established patents for inventions as exceptions to the prohibited mon-

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[2] For this figure, I am indebted to the Honorable John Biggs, of the Third Circuit Court of Appeals.

opolies, while our statutes are based upon the Constitution and have no relation to "odious monopolies."

The grant to the inventor is not a *monopoly,* notwithstanding that it is altogether concerned with the right to exclude others from using what is patented to him. The patent is a bargain,—a contract,—between the public and the patentee, to be supported on the ground of mutual consideration and to be construed like other contracts between two parties each having rights and interests involved in its stipulations.

In *United States* v. *Dubilier Condenser Corp.,* 289 U. S. 178, 186, the Supreme Court said:

> Though often so characterized, a patent is not accurately speaking, a monopoly . . . The term monopoly connotes the giving of an exclusive privilege for buying, selling, working or using a thing which the public freely enjoyed prior to the grant. Thus a monopoly takes something from the people. *An inventor deprives the public of nothing which it enjoyed before his discovery,* but gives something of value to the community by adding to the sum of human knowledge.

The promotion of science and useful arts,—to use the constitutional phrase,—is attained by a patent grant in three ways: it rewards the inventor for his skill and labor in conceiving and perfecting the invention; it stimulates him and others to further efforts in the same or different fields; it secures to the public an immediate knowledge of the character and scope of the invention, an unrestricted right to use it after the patent has expired, and the immediate right to use any means to the same end that is not within the scope of the patent.

One of the curiosities of our legal development is that whereas the single constitutional phrase which I have read is the foundation for both copyright and patent, nevertheless, both by statute and by decisions, the copyright has been given the greatest liberality, whereas the patent has been continuously limited, now almost to the point of extinction. There is nothing in the words used by the Constitution to justify this, for "author," "inventor," and "discoverer" have little to choose, as between them, in their derivation and significance. An author is one who begins, forms, or originates, one who composes or writes a book, etc.; whereas an inventor is one who comes upon, who meets, who finds, who originates; and to discover is to obtain for the first time sight or knowledge of something, to find out, to ascertain. Neither "invention" nor "discovery" connotes "by ingenuity" or "by genius" or "by intuition" or "by proficiency"; yet the courts have so limited patentable inventions,—and, to the contrary, in aid of authors have so enlarged the word "writing," both by statute and by court decisions, as to "include books that the old guild of authors would have disdained, catalogues, mathematical tables, statistics, designs, guidebooks, directories, and other works of similar character." *National Telegraph News Co.* v. *Western Union Telegraph Co.*, 119 F. 294, 297. It has also been expanded to include a photograph[3] and a circus poster.[4] Intellectual, literary or artistic merit is no longer considered essential to a copyright. Originality still is necessary in the sense that the proprietor must not have copied an older work; but under modern authority, if he has hit independently upon an old theme, his copyright is still good, notwithstanding.[5] The work does not have to be unique, in whole or in part; a copyright on a list giving the dimensions of piston rings has been sustained. Ordinary directories and similar compilations are copyrightable, although none show the touch of genius, or anything beyond the scrivener's ordinary task. It has been made to include dramatic rights, i.e., the power to exclude others from dramatizing the story contained in a novel, for example[6]; also the right to make motion pictures based on copyrighted books.[7] It has been held, generally, that a copyright is infringed if any part of its subject is appropriated.[8]

By statute as to patents, on the other hand, the inventor must not only describe his creation, but must "distinctly

[3] *Lithographic Co.* v. *Sarony,* 111 U. S. 53.
[4] *Bleistein* v. *Donaldson,* 188 U. S. 239.
[5] *Fred Fisher, Inc.* v. *Dillingham,* 298 Fed. 145.
[6] Sec. 1 of Copyright Act.
[7] *Kalem* v. *Harper Bros.,* 222 U. S. 55.
[8] *Harper* v. *Shoppell,* 28 Fed. 613; *Da Prato* v. *Giuliani,* 189 Fed. 90.

claim'' so much of it as he asserts to be the subject of the patent and the courts must regard the claim as bounding the patent. The contrast is obvious.

Again, a copyright extends for 28 years with the unqualified right of renewal for another 28 years. Whereas a patent lasts for but 17 years, and it takes a special act of Congress to get a renewal,—and such a special act has not been passed, I believe, in the past 30 or 40 years.[8a]

As is well known, it is essential to the securing of a valid patent that the inventor himself shall make the application. His assignee will not do. To the contrary, in respect of copyrights, the statute itself provides that ''The author, inventor, designer *or proprietor* of any book, etc. shall have the sole liberty of printing,'' etc. Ordinarily the author does not make application for a copyright, but his assignee does. Why there should be these differences is hard to understand. It can not be because authors have conferred a greater aggregate benefit upon the public than have inventors, for there is scarcely a thing that we touch or use that has not been bettered in recent years by patented inventions. It may be that it is the power and influence of the press that has caused all these relative benefits to be showered upon the author, while the rewards due the inventor are forgotten.

A diligent lawyer could hardly find a case in the books in which the subject of a copyright is held to be uncopyrightable, and few enough in which, for any technical or other reason, copyrights have been stricken down.

Yet, in the past decade in particular,—beginning about the year 1932 or '33,—the favor in which patents were previously held by the courts has been replaced entirely by a distaste which has become so strong as to liken the chance of a patent succeeding in the courts to that of the traditional camel passing through the needle's eye. It is

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8a [EDITORIAL NOTE] H. R. 2994 entitled "A Bill to Extend Reissued Letters Patent No. 19,023 was enacted as Private Law 554—78th Congress, 2nd Session, approved Dec. 23, 1944. See 570 O. G. 663.

said that the change came when Chief Justice Taft retired from the Supreme Court, after which, at a conference among its members, it was decided that too much favor had been shown patents and that the standards for patentable inventions should be greatly raised. Whether true or apocryphal, it is the case that from that time substantially all patents have been declared invalid in the Supreme Court, and the result has been most destructive, because the lower courts have felt constrained to follow suit. The slaughter has been terrific. In one notable case the Supreme Court has held a patent in the wireless art,—the four tuned circuits of prime consequence in their day,—invalid for lack of invention although the lower courts, both District Court and Circuit Court of Appeals, and the British and French courts as well, had held it valid consistently for a period of ten or twelve years.[9]

The effect upon the patent system has been marked. In 1933, 48,786 patents were taken out in the United States; in 1944, 28,073 only were secured,—a diminution of almost 42.5 per cent in eleven years.

A graph prepared for the National Manufacturers Association shows that the per capita issue of patents from 1880 to 1933 was substantially constant, that is, the number of patents in relation to population; whereas, as we have seen, with a rising population, between 1933 and 1944 the decline in patents was forty-two and a half per cent. Obviously, invention is being discouraged and the progress of science and useful arts is being arrested.

However, it is the case that notwithstanding what the courts are doing, Congress has refused thus far to amend the patent statutes in ways urged upon them by various inimical interests. Thus it has failed to pass an act that would give the courts power to cancel a patent that had been used as an instrument to violate anti-trust laws, notwithstanding that the Temporary National Economic Commission recommended the imposition of such a penal-

9 *Marconi Co.* v. *U. S.*, 320 U. S. 1.

ty. Nor has it yet enacted a system of compulsory licensing of patents, although that has been urged at intervals for nearly sixty years past. Congress has also rejected the proposal that a patentee found guilty of violation of the anti-trust laws should be compelled to license all his inventions upon a royalty payment. This, again, was recommended by TNEC.

We have not yet, apparently, reached the nadir of the current attack on patents. In a monograph by Professor Hamilton, of Yale Law School, entitled "Patents and Free Enterprise," submitted in March, 1941 to the TNEC, the thought was advanced that one who invents as the result of research deliberately planned by an employing corporation to discover a definite solution for an unsolved technical problem, is not entitled to a patent. His thesis has been adopted by the Court of Appeals for the District of Columbia, but up to this time it has not received judicial commendation elsewhere but, on the contrary, has provoked criticism by several courts. However, it is symptomatic of the evil pass to which patents have come, that such attacks find support.

In a current address by the Under-Secretary of War, Judge Patterson, entitled "Industrial Research and National Defense," a strong appeal is made to industry to afford "talented young men and women *unhampered opportunity for research* in both industrial and university laboratories." This was stated to be an urgent need. He said that the job of normal peacetime research is a private job, not a government job. His primary appeal was, of course, for research to aid in the war emergency, but the point I make is that research is being urged upon industry whether in time of peace or in time of war, as an urgent necessity; whereas thinkers like Professor Hamilton would deny the reward of a patent to the result of the research. That there is no reasonable basis for the thesis advanced will be apparent from a moment's consideration. Is not the sum of human knowledge as much advanced by the result of planned research as if it came from the "garret" inventor without the adventitious aid of a great corporation or without any planning whatsoever? If the invention be newly discovered in fact, is not its finder an inventor in the sense of the Constitution? If it be new and useful, is not its discoverer within the statute, which specifies that he shall receive a patent? Finally, is there anything, in either Constitution or statute, that excludes a corporation from the reward if it be responsible for the invention? Should not the corporation be in precisely the same position with respect to inventions as it is with respect to copyrights, where it appears and applies as "proprietor," i.e., as assignee of the creator?

One of Detroit's most prominent citizens, Mr. Kettering, recently called attention to the fact that it was Thomas A. Edison who first made extensive use of research in the development of his multitudinous inventive projects: the incandescent lamp, the phonograph, the telephone, the distribution of electricity, the storage battery, and many other things. His employees were assigned to develop along specific lines, the results were patented, and they gave as great benefit to mankind as if they had been invented spontaneously by wholly independent inventors.

The type of research applied by Edison, however, was by no means new with him. As an example, take the case of an almost forgotten man, Thomas Blanchard. He had a positive genius for invention, and especially in the line of mass production. As a boy he devised an apparatus for peeling apples. A little later he invented a machine for making tacks,—mass production. He made a lathe which would turn out a finished gun-barrel in one single self-directing operation. In 1818 or so, at the direction of his employer, the Springfield (Mass.) Armory, he turned attention to the production of a lathe for turning simultaneously and automatically several gunstocks according to a pattern. He succeeded, and a number of his machines were used by his employer, of which at least one, still operative, yet exists at the Springfield Armory. His pattern-lathes were adapted for other uses, for example the making of shoe-lasts. I have seen a replica of his patent, which bears the signatures of James Monroe, Pres't., John Quincy Adams, Secretary of State, and William Wirt, Attorney General. His patent, issued in 1818, was by Act of Congress extended to double its original term of fourteen years,—which action is in decided contrast to the current efforts in modern Congresses to do all possible to strike down the entire patent system. Also in contrast with modern judicial tendencies, his patent was universally sustained,—one case being against Whitney, whose fame rests upon his creation of the cotton gin.

I mention Blanchard especially because he was the forerunner of mass production which, especially in the automobile field, has made Detroit great.

To my mind research,—effort to invent a given thing at a certain time,—is to be commended, not penalized. The most that can be said against it,—patentwise at least,—is that it makes the invention available at an earlier time than it might otherwise be produced; and if that be an evil result, make the most of it.

It is to be noted that, notwithstanding the scholiasts' assumption that the result of the employer's assignment to his researcher of a definite task is sure to bring the intended result, it sometimes happens that the outcome is as different as was the result of Columbus' first voyage, whereby he aimed to find a new sea-route to Asia and instead found a new continent. If research finds islands instead of a new continent, or *vice versa,* it accepts the result, science studies their relation to the known areas, and on the basis of this increased knowledge makes revised plans for progress. Just what research will disclose can never be forecast with accuracy.

I favor the elimination by statute of the power of courts to declare patents invalid on grounds other than those of novelty and utility (provided, of course, that the statutory requirements for their issuance have been complied with)—i.e., take away the power to speculate about the degree of "patentable invention" involved in any new and useful thing. That would certainly put the interested public in a position to determine accurately the chance of sustaining any patent. Its validity would no longer depend upon the current tendency of the courts to speculate on what one skilled in the art might or might not accomplish in a given set of circumstances, but it would reduce the questions involved to definite and ponderable things; that is, to novelty and utility alone. It might result in sustaining annoying patents, on relatively trifling things; but it would leave as the only indefinite condition the question of infringement, that is, one trying to make up his mind about an outstanding patent would be uncertain only on the question of infringement, and that, by accepted principles, would be governed by the degree of advance shown by the patent, so that if the inherent novelty were but trifling, a defendant could easily,—as now and heretofore,—avoid it. If, on the contrary, the step forward had been a long one, a corresponding breadth of construction would be given the patent and infringers would correspondingly beware. Such a statute, if passed, would be the longest step that could be taken to redeem patents from the distress they are in now.

In a recent pamphlet, John Anderson says truly, ''Every man whose policies and practices tend to discourage invention . . . is an enemy of the civilization that supports him.'' Truer words are hard to find, yet the fact is clear that almost every court in the land is giving the greatest discouragement to invention, by setting up standards that are not required by statute, by hedging the patent and its contents by conditions that have nothing to do, in reality, with the novelty or serviceability of the improvement made. In this connection I think an anecdote of Mr. Edison is not inapt. Having been annoyed by his own repeated failure to solve a technical puzzle that confronted him in one of his undertakings, he told one of his assistants to call in a number of ''those damned federal Judges,'' for, said he, they will find that my invention when I succeed in making it, is not patentable, so they may as well tell me now how to do what I have not yet been able to solve for myself.

Cartels

A cartel, according to accepted usage, means a combination of separate firms to maintain prices above a given level. Etymologically the word comes from the Italian and means a card, especially one with written or printed matter upon it.

By current governmental propaganda, cartel has come to signify a foreign trade combination so inherently iniquitous as to call to mind the phrase Scott uses somewhere, "He is cowed by the very idea of a cartel."

However, cartels are not only recognized in many foreign countries, but in some, such as Belgium, Holland and Switzerland, they may be forced upon competing concerns by the government. In other countries, as in England, there is no supervisory legislation, but cartels are permitted by law and, apparently, are sustained where they eliminate indiscriminate price-cutting. It may be said, in general, that the cartel is so far recognized and availed of in Europe,—and I believe also in South Africa,—that international business from the United States standpoint does not seem possible without participation in them; unless, indeed, we induce the world at large to conform to our government's rules and laws for controlling,—and repressing,—business.

It is not within my scope to discuss cartels generally, or even the effect of the Sherman and Clayton Acts upon those who participate in them; but there are two species of international cartels which come within my purview, and they are these:

1) An American industrial corporation, with an established business in this country, desiring to enter, or to expand its business in, the foreign field, but being unwilling to risk the entire expense involved in developing foreign markets, makes an agreement with a foreign competitor to undertake as a joint venture the development of selling agencies in both countries. Each corporation has a group of competitive patents useful to the other, and the agreement is to pool their patents to obtain more efficient and cheaper production; the ultimate

object of the agreement being for each company to operate exclusively in the territory of its nationality, and (usually) with the rest of the world distributed between the two concerns.

2) There is a variant of this phase, which involves the additional limitation, for the mutual protection of their patents, that neither party will license third parties in territories other than their respective nations, without the consent of the other.

I shall assume that in agreements of these types there is no attempt at price restriction or price fixing in the United States. Such a provision would at once raise serious questions as to the validity of the agreements unless the patents indubitably cover the commodity involved. They are frequently accompanied by an agreement to exchange technical data and inventions over a long period of years. Each of the two companies develops itself within its own territory and, fundamentally because it has granted its patents in the other's territory, keeps out of that. Basically there is nothing of a restrictive nature in such agreements, for they tend to expand domestic trade into foreign channels and to give added improvements to what originates here. However, they must be examined with reference to the effect upon them of United States statutes. Such agreements may be looked upon as helpful and not harmful, since they aid in the industrialization of the foreign nation and impart efficiency to it, as well as give us the advantage of all improvements in the industry involved, made in the foreign countries. Their effect in this country may be said to involve several questions not yet settled by our courts, nor even directly touched upon by our statutes. For example: First, the question whether an agreement not to license in a given foreign country or group of countries,—or perhaps to export to them,—is a restraint upon foreign commerce of this country. Secondly, the question whether the domestic trade is not restrained by the agreement which excludes the foreign contractor from exporting from his home country to this country or from this country to those others from which it is excluded by the agreement. While it has been held, in the case of *American Banana Co.* v. *United Fruit Co.*, 213 U. S. 347, that our anti-trust laws do not apply to acts committed wholly without the jurisdiction of the United States, nevertheless there is a current effort to limit the application of the United Fruit case, particularly if any single step in the chain of action involved causes effects here, and jurisdiction can be had over the parties. Of course, the domestic party to the cartel is always subject to suit here, and that may be enough from the government's point of view.

Again, it has been held by a lower court that while the anti-trust act is not designed to have an extra-territorial effect, nevertheless the evidence of the foreign business of the Standard Oil Company, the defendant there involved, was held to be material on the score that the oil industry is world-wide and the entire business of the company has a direct bearing upon the effect of the merger therein contemplated upon domestic trade. There have been many efforts, and some of them successful, by the Department of Justice to control acts abroad through jurisdiction over the parties here. This tendency is exemplified by the statement last May, by Assistant Attorney General Berge in an address before the Commerce and Industry Association of New York, where he was speaking primarily in relation to agreements under the Webb-Pomerene Act. This law, I may remind you parenthetically, was intended to authorize industries here to make trade associations for the exportation and sale of merchandise originating here. Mr. Berge said what undoubtedly applies as well to agreements such as we are now considering:

> You should have in mind at the outset that associations organized under the Webb Act cannot legally enter into international agreements which restrict production and distribution, divide territories and fields of operation, fix prices or otherwise regiment industry throughout the world. Neither can they legally enter into agreements which restrain trade within the United

States, restrain the export trade of any domestic competitor or association, or which enhance or depress prices or substantially lessen competition within the United States.

Nevertheless, it is not seen how an agreement or cartel of the sort here under consideration can properly be held to be in restraint of trade. Its primary purpose is to develop the particular industry covered by the patents of the respective parties. Primarily also, each one gets the benefit for his own country of the previous, current and future developments of the other. A very striking example of a patent cartel and its effect on the domestic situation was brought out a few years ago in the hearings of the Committee on Patents of the United States Senate, when a great hue and cry was made about a cartel that had been entered into between the Standard Oil Company of New Jersey and the great German chemical combination designated as I.G. These companies had agreed, in 1928 or '29, to pool their patents relating to a hydrogenation process which the I.G. had applied to distilling of coal to get motor fuel. What came out of it, so far as the United States was concerned, was the acquisition of controlling patents here on the high octane gasoline from petroleum oil,—something the Germans apparently had not envisioned in their patent work and in their utilization of it. According to the record, the Standard Oil Company had the right to license others in this country under their hydrogenation patents here acquired from I.G., with improvements thereon added by the Standard Oil Company, and they did so, with the result that when the war came on, all the large gasoline producers were prepared or preparing to make 100-octane gasoline, the one fuel that has made our aviation attack upon our enemies so successful.

Another thing that grew out of the same or a similar cartel between the same companies here and in Germany led to our acquiring patents primarily for the manufacture of a synthetic lubricating oil which I.G. had developed in Germany but which in our hands controlled the development of certain forms of synthetic rubber, which here proved to be a life-saver in the conduct of the present World War.

Both these stories of development are most interesting in detail but far too long to be recited on this occasion. From these two examples alone, it would almost follow that the name "cartel," instead of being used in derision or reproach, should be held up as an example to be followed by industry.

The truth of the matter is, of course, that cartels, like all other contracts, are some good and some bad. They do not follow a single pattern. They involve some restraint upon effort, for that is what every contract does. Like every other contract, they should be judged by the reasonableness or otherwise of their restraints upon commerce. But with the inimical attitude of the Department of Justice at the present time toward business in general, and especially toward contracts that tend to restrict competition in any manner, however reasonably, it is impossible to predict whether even beneficial instruments such as are here outlined will survive.

I believe, however, that it would be prudent in drafting them, to specify no prohibition against export to the United States except of articles that would come within the scope of patents held here by the American parties to them; even that is of doubtful value, and it may be more prudent to rely upon the patents themselves and the customs duties for protection against importation.

Patents and the Anti-Trust Laws

There are two federal "anti-trust" laws of importance: the Sherman Act, passed in 1890, and the Clayton Act of 1914. The former prohibits any monopolization or attempt to monopolize any part of the trade or commerce among the several states or with foreign nations.

Excluded from the prohibition of the Sherman Act are patents as such; yet, as has been held, the patent owner may so deal with his patent as to bring it and him within the prohibition of the Sherman Act; as was done, for example, by the Ethyl Gasoline Corporation, which had patents that covered the ethyl fluid, the gasoline after treatment with the fluid, and the method of operating automobiles involving the use of the treated motor fuel. The court held [10] as violative of the Sherman Anti-Trust Act, provisions in licenses to refiners to sell and distribute the treated motor fuel where the licenses to the refiners restricted their sales of the motor fuel only to licensed jobbers. The court held that the Ethyl Company, by its sales to refiners, relinquished its power over the patented lead fluid, and by the authorized sales of the treated fuel by refiners to jobbers the patent monopoly was exhausted, and no longer could either the Ethyl Company or the refiners rely on the patents to exercise any control over the treated gasoline. So in *United States* v. *Masonite Corporation,* 316 U. S. 265, the Court held obnoxious to the Sherman Act certain trading arrangements under a patent which had been sustained in a sharply contested suit, whereby the patented products were delivered for sale to licensees who were restricted to their sales prices by certain arrangements which were common to a large number of licensees, under which the Masonite Corporation sold its patented products through the licensees as *del credere* agents and compelled them to withdraw from the market their own previously made products some at least of which undoubtedly infringed the Masonite patents. The Court found that the purpose of the agency agreement entered into was to fix prices at which competitors may market the product, and as such it violated the Sherman Act.

On the contrary, the Court held in the case of *Standard Oil* v. *United States,* 283 U. S. 163, that a so-called patent pool involving cracking of gasoline out of crude oil was not obnoxious to the Sherman Act. In this scheme, various defendants were patent owners and had licensed the others with the right to extend the licenses to their several licensees. Each of the patent owning defendants could license under its own patents whom it willed, at what price it chose, but it was restrained as to the license fees to be charged in the event it added one of the other groups of patents to its own. The Court indicated plain-

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[10] *Ethyl Gasoline Corp.* v. *U. S.,* 309 U. S. 436.

ly enough that the scheme was suspicious and simply held that there was in fact no attempt to fix prices on the cracked gasoline, that the defendants were in active competition among themselves and with other refiners, that both the natural-run gasoline and the cracked gasoline (the production of which latter was the subject of the patents) were refined and sold in large quantities by other companies not bound up in the license agreement, and that the defendants neither individually nor collectively controlled the market price or supply of any gasoline. Quite recently, the Supreme Court, in *Hartford Empire Co.* v. *United States,* held that the joint use by two or more corporations, of the patents to regulate and suppress competition, to allocate fields of manufacture among their licensees, and to maintain prices of the product, is unlawful.

The net result of the decisions, so far as concerns the Sherman Act, is that patents cannot be used, either singly or in combination, in such way as to control resale prices or as controlling any trade beyond that distinctly covered by the patents; also that competing patents cannot be used jointly to fix prices.

Turning now to the Clayton Act, that is much more specific in that it provides that it shall be unlawful for any person engaged in commerce to sell or lease machinery, etc., whether patented or unpatented, on the condition that the lessee or purchaser shall not use supplies or other commodities of a competitor; where the effect is to substantially lessen competition. This has been sustained and applied in several cases as meaning precisely what it says, except that "substantial lessening of competition" has apparently been construed to cover *any* lessening of competition,—even if trifling in amount and reasonable under all the surrounding circumstances.[11]

In addition, the Supreme Court has, by a series of comparatively recent decisions, held that where a patent owner is using his patent in violation of the anti-trust laws he cannot restrain infringement of it by others.

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[11] *International Bus. Mach. Co.* v. *U. S.,* 298 U. S. 131.

For example, if one owning a patent on a combination of instrumentalities should sell one of the instruments with the limitation that it should only be used in the carrying out of the patented combination, that is held to be a violation of the anti-trust laws that disables the owner from suing for infringement of his patent.[12] So strong has this doctrine become that in applying it the Supreme Court in one case well nigh did away with the doctrine of contributory infringement,—that doctrine whereby the patentee has always been able to enjoin as an infringer one who made an essential part of the patented combination and sold it for use in that combination. This is just another instance of the current tendency of the courts to destroy all patent values, and while the lower courts still recognize contributory infringement as an existing doctrine, it is open to serious question whether it will not be wholly done away with by the Supreme Court.

There is another facet to the picture of anti-trust litigation which justifies mention: it is the practice of the Department of Justice of indicting the defendants in many cases where there is doubt that the acts complained of are illegal, and simultaneously or subsequently filing a suit in equity to enjoin their continuance; with the proposal to defendants that if they will consent to injunction, the criminal proceeding will be dismissed. This procedure is for the manifest purpose of intimidating the defendants. That is to say, the government seeks to attain its end in a case where it has reason to apprehend that the courts might not sustain it on a trial, by means which if perpetrated by private parties would be illegal coercion. This is being practiced currently, especially in cases involving cartels.

Upon the whole it is clear that the patent system is threatened with annihilation. What has made the United States industrially great is no longer to be supported as an essential good, but is condemned to death. The picture, however gloomy, though, is not hopeless. But it behooves all who believe in our country to work together

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12 *Mercoid Co.* v. *Mid-Continent Co.*, 320 U. S. 661.

to stem the tide. If, for example, a general and widespread demand should come from all who are interested in industry,—proprietors, workmen, stockholders, policyholders of life insurance which derives sustenance from industry, farmers whose machinery and tools are based upon patents,—if all these should unite in making demand, Congress would undoubtedly pass legislation ameliorating the patent system; for example, by taking from the courts the power to destroy patents for lack of invention, and making the only requirements novelty and utility.

Long ago Mr. Dooley observed that even the Supreme Court follows the election returns. Stir up the electorate sufficiently, and relief is bound to follow.

Alien Property Custodian

James E. Markham, Alien Property Custodian, reported to President Harry S. Truman as of March 31, 1945, the net value of enemy property vested by his office was estimated at $232,-000,000. The custodian explained that this estimate excluded any valuation for approximately 46,000 patents, 200,000 copyrights and more than 400 trademarks that he has taken over.

Discussing the large number of patents under his control, Mr. Markham said, ''Patents vested from nationals of enemy countries which had not already been exclusively licensed at the time of vesting have been made freely available to all Americans under a policy of royalty-free nonexclusive licensing.

''As of June 30, 1944, the office has issued licenses covering 5,853 different patents and patent applications, and two or more licenses have been issued under 1,161 of these patents. Through a widespread publicity program thousands of patents have been brought to the attention of potential users. The patents held by this office cover a wide range of fields but are most heavily concentrated in the fields of chemistry, electrical equipment, plastics, and pharmaceuticals.''

On the subject of patent contracts, Mr. Markham stated, ''As of June 30, 1944, this office held 877 foreign interests in 624 patent contracts. Some of the contracts in which interests were vested were agreements fixing selling prices or restricting production, use, sale, or market areas, thus serving as the foundation of international cartels. In cooperation with the Department of Justice we are trying to remove the restrictions wherever it can be done without invading the rights of persons who have acquired legitimate interests in the patent.''

Toward a Streamlined Interference Practice

By Merwin F. Ashley *

There are at present forty rules of Interference Practice in the Patent Office and this is written to propose revision of four of those rules with a view to bringing the practice up-to-date and in line with modern procedures before other tribunals.

When interference proceedings were first authorized in 1836, pleading in the courts had become a fine art. In its pursuit, bills and answers were drawn to meet strict legal requirements without giving any substantial information to the opponent. Witnesses were spirited into hiding and maintained under assumed names, material evidence was discussed by litigants and their counsel in hushed whispers and surprise was a legitimate strategic weapon to be used in the court room. Neither side could hope to know much about the facts and proofs constituting the "case" of his opponent in advance of actual trial. Perhaps this was a hold-over from ancient times when armed litigants were forced to contest their claims in the dark by personal combat.

During the past century, and more especially the past few decades, pleading before the courts has been so thoroughly streamlined that today bills of particulars, discovery proceedings, interrogatories and examinations before trial serve effectively to bring the salient facts out into the open and lay the basis for stipulated evidence and pre-trial hearings, thus shortening litigation, reducing court records and encouraging voluntary settlements between the parties. The fact that interferences must still be contested in the dark is, I believe, the principal reason for the rather severe criticism of the practice expressed in recent years by responsible attorneys and bar association groups and accounts for the strong support given the Church bill in the 78th Congress.

During the past year, discussion groups in some of the local patent bar associations have considered the possi-

* Patent Attorney, Boston, Mass.

bility of superimposing upon the interference rules the rules of pre-trial practice adopted in the Federal Courts. The difficulty with this proposal is that the Federal Court practice is based upon preliminary procedures, like those mentioned above, which are absent from interference proceedings conducted before the Patent Office. The only required documents which might properly be termed pleadings in an interference are the preliminary statements of the inventors. These statements contain only the bare allegation of five dates and are not opened to the inspection of the opposing parties until after a ''motion period'' which is often long protracted. If some protected basis could be devised for the prompt exchange of information between the parties, it is believed that the majority of interferences now litigated would be disposed of without taking testimony; parties having weak cases would quit and save expense; parties having knowledge that their cases on priority are strong would forego the bringing on of motions which, lacking such knowledge, prudence requires them to prosecute; and the same information accorded to the Interference Examiners would provide the basis for summary dissolution as to parties whose priority claims are wholly lacking in merit.

It is submitted that revision of four rules along the lines here proposed would, without legislation, and without affecting the present jurisdictional divisions of responsibility within the Patent Office, go a long way toward accomplishing worth-while reform without doing violence to the proven and time-honored system. The several changes are set forth rather specifically to facilitate their consideration. However, the writer disclaims any pride of authorship in the phraseology, and better language to express the intent may be supplied by others.

First Amendment

In Rule 108, line 3, after ''other's'' insert —preliminary statements and —;

line 5, after ''interference'' strike out the remainder of the paragraph.

Second Amendment

In Rule 110, add a penultimate paragraph as follows: —As part of each preliminary statement, applicant shall make an offer of proof with respect to every date alleged by him, describing generally all pertinent evidence which he expects to present and upon which he relies to establish his dates of invention. In the event testimony is directed to be taken in his behalf, no evidence will be admitted to proof which is not described in the preliminary statement and no amendment to the statement will be permitted except as provided in Rule 113.—

The effect of the first amendment would be to make the preliminary statements of the parties available to each other immediately after they are approved and accepted, i.e., at the same time that the file wrappers are opened to inspection. This was the practice prior to December 1, 1934.[1] The effect of the second amendment would be to expand the preliminary statement to include such information as would be available through interrogatories, or depositions in a Federal suit.

No applicant can conscientiously swear as to the bare dates called for by the present rule without first ascertaining the facts which would support his allegations. Therefore, the demand for a preliminary statement containing this information would impose no hardship upon cautious applicants and incautious oath taking ought to be discouraged.

The provision for prompt exchange of the expanded statements is calculated to afford a protected basis for discussions looking toward the voluntary settlement of many issues now litigated. It is not enough that under

[1] When on December 1, 1934, Rule 108 was changed to provide for the withholding of preliminary statements until the end of the motion period, it was thought that the effect would be to reduce the number of motions for dissolution brought on by parties discovering themselves to be hopelessly predated. It is extremely doubtful that the change has accomplished the expected result. On the contrary, being ignorant of their prospects in a priority contest, *all* parties now find it prudent to move for dissolution as to their opponents whenever comparison of the file wrappers indicates that a motion will lie. At least under the old practice, which it is now proposed to restore, parties confident of their ability to prove early dates could afford to forego questionable motions which under the present practice it would be considered imprudent to neglect.

the present rules the parties are at liberty to "get together" and compare proofs if they so desire, notwithstanding that many interferences are now disposed of in such manner. It is characteristic of inventors that they are secretive and suspicious and usually lack the mutual trust and confidence in one another which is necessary to the success of such arrangements. Particularly is this true in multi-party cases. But were the parties to be limited to offered proofs made of record and thereafter opened to inspection, it is believed such difficulties would be eliminated.

The following amendment is suggested to provide that the expanded preliminary statement of a party would not be disclosed to an opponent unless basis is found in the offered proofs for a *bona fide* contest on the issue of priority.

Third Amendment

> Rule 111, cancel the first and last paragraphs and revise the second paragraph to read as follows:
>
> —A junior party who fails to file a preliminary statement or any party who fails in his preliminary statement to offer proof of invention at a date earlier than the filing date of the application or applications of another party shall not have access to the preliminary statement of said party.—

The cancellation of the first and third paragraphs of Rule 111 is necessary to avoid conflict with Rule 108 as revised by the proposed First Amendment. The proposed revision of the second paragraph would insure that the expanded preliminary statements would not be opened to the inspection of parties failing to make out a *prima facie* case worthy of contest.

In this connection, it is important to note that if the foregoing revisions were to be made, the first sentence of Rule 114 would take on added significance because the "statement" therein referred to would include the offers of proof provided for in Rule 110 as expanded by the proposed Second Amendment. Obviously, when a party cannot even offer evidence which, if tested and proved, would establish a date earlier than the filing date of another party, it is a sheer waste of time and money to permit testimony to be taken by him, and there is no reason for giving him access to the preliminary statement of such other party. Summary judgment by the Interference Examiners in such cases would be similar to the dismissal of a bill for failure to state facts sufficient to constitute a cause of action.

Fourth Amendment

> Rule 118, cancel the present rule and substitute the following:
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> —Proofs offered in support of facts alleged by any party in his preliminary statement will be tested, upon direction, to whatever extent may be necessary to permit a proper determination of priority to be made. Orders issued directing the taking of testimony may specify the particular allegations of fact and offers of proof as to which evidence is required, and where such specification is made the testimony taken pursuant to the order shall be limited to such specified facts and proofs.
>
> At any time in the course of an interference proceeding that the tested proofs of a junior applicant are obviously inadequate to establish invention at a date earlier than the filing date of a senior party, the interference may be forthwith summarily dissolved as to such junior party and judgment rendered against him.—

The effect of this amendment would be to eliminate much needless testimony and confine that which is necessary to those issues which may be decisive. It is commonplace now for contestants in interference to load the record with irrelevant material. Often only a small part of the proofs adduced are considered by the Interference Examiners, as evidenced by their opinions. Sometimes the entire record of one of the parties is wholly disregarded. See, for example, *Yates* v. *Gates*, decided in the U. S. C. C. P. A., December 11, 1944 (64 U. S. P. Q. 178). In this, as in many similar cases, the junior party failed to overcome the filing date of the senior party. Nevertheless, because the Interference Examiners act as a board of review rather than a trial tribunal, the senior party could scarcely risk the result were he to forego testimony in his behalf.

It is contemplated that the Interference Examiners, in directing the taking of testimony by the parties, would have regard for the strength of their offered proofs as well as for their record dates, and would examine the testimony in the order of its taking before giving other parties similar direction. The presumption of Rule 116 that the parties have made their inventions in the chronological order in which they filed their applications must be rigidly observed, but it does not necessarily follow that in multi-party cases the testimony must always be taken in the inverse order if it is clear that some other order of taking will expedite the proceedings to a fair and just conclusion.

Nothing in this proposal changes the present jurisdiction of the Primary Examiners or of the Board of Interference Examiners. The proposal does, however, provide greater latitude for the exercise of discretion by the Board, and to the extent that this increases their authority I believe they are eminently qualified to assume the co-relevant responsibility. Every applicant with a *bona fide, prima facie* qualification to contest his priority claim would be permitted to proceed as heretofore to the full extent that his testimony and proofs are worthy of consideration under the Rules and decisions now controlling, with the added advantage that if he is entitled to prevail he may get his favorable decision more economically and more promptly.

In the latter connection, it will not be forgotten that the twenty-year bill, so called, recommended by the Commissioner and the Patent Planning Commission and approved by the leading patent bar associations, may soon become law. Its effect upon applications pending more than three years will be to shorten the term of the patent grant. Excepting those which become involved in interference, few applications pend more than three years. Therefore, any reasonable suggestion calculated to expedite interferences should be welcome. As stated earlier, it is believed that the first and second proposed amendments provide a protected basis for an exchange of information which would result in voluntary dissolutions in the great majority of interferences. Prosecution of the remainder should be expedited.

Discussion of the above proposals with other interested attorneys versed in interference practice has elicited two further suggestions which have recurred with such persistency that it is believed they should be dealt with here. The first is that actual evidence, rather than merely the offer thereof, should be submitted with the preliminary statement. It is argued that documentary evidence, photographs of physical exhibits, and affidavits of witnesses in lieu of their oral testimony, might be used to create a record on which pre-trial procedure could be predicated and which would provide a sufficient basis for summary judgment. The writer disagrees with the proponents of this idea. It would be unsound and unsafe to permit the use of *ex parte* evidence in *inter partes* cases. Protection of the substantial rights of the parties requires that wherever a contest is warranted, opportunity be afforded to scrutinize all material evidence and to see that it is admissible and properly proven by competent witnesses who are subject to cross-examination under oath.

The second suggestion is believed to have more merit and would provide very simply for a preliminary hearing before the Interference Examiners before any testimony is ordered to be taken. At such hearing an effort would be made to bring about voluntary dissolution. This effort failing, any facts not in dispute might be stipulated and the issues to be tried would be framed. There is no valid legal objection to such a provision, but it would impose upon the Interference Examiners a great responsibility and much additional work which may be unnecessary. Given a protected basis for the exchange of information, it is believed that these matters can be left to counsel for the parties, at least until such time as experience indicates otherwise.

How to Try a Patent Case in Modern Times

By Daniel G. Cullen *

Side by side in Volume 52 U. S. P. Q., at pages 30 and 33 respectively, are two decisions of the Supreme Court of the United States which seem to discuss the same proposition of law, namely "whether a court of equity will lend its aid to protect the patent monopoly when the (patent owner) respondent is using it as the effective means of restraining competition with its sale of an unpatented article." These are the familiar cases of *Morton Salt Co.* vs. *G. S. Suppiger Co.,* and *B. B. Chemical Co.* vs. *Ellis et al.*

Though the cases are similar in that the decision in each was for the defendant, ultimately, and though there seems to be no substantial difference in the reasoning in these two cases, there is a tremendous difference between these two cases in the manner in which the trial in each was conducted.

In the *Morton Salt* case, *the defendant was able to have the case dismissed and the suit disposed of without going through a complicated trial on the technical patent issues, infringement, novelty, invention, etc.,* the issues that usually consume so much time and expense in patent suits. Instead, the defendants ingeniously and successfully relied upon the patent license structure of the patent owning plaintiff. The licenses of the plaintiff respondent required the licensees to use with the patented machines only salt tablets sold by the patent owning plaintiff. The defendant showed this license agreement to the court by a motion under Rule 56 of the Rules of Civil Procedure for summary judgment of dismissal of the complaint. The motion was based on the rule of the *Carbice* case, 8 U. S. P. Q. 211, etc. The District Court granted the motion and dismissed the complaint. On an appeal by the patent owner, the Circuit Court of Appeals

* Patent Lawyer, Detroit, Michigan.

for the Seventh Circuit reversed, but, on certiorari, the Supreme Court reversed the action of the Circuit Court of Appeals and thus affirmed the action of the District Court of Appeals and thus caused the case to be dismissed and the suit disposed of finally *merely upon the simple factual showing of the license of the patent owner, in this way dispensing with the complicated and expensive technical trial on the patent issues.*

Contrast the foregoing with what happened in the *B. B. Chemical Co.* vs. *Ellis* case. Here the patent owning plaintiff was using a method patent to control the sale of unpatented materials used in the method, and the ultimate decision was for the defendant because of the manner in which the plaintiff conducted its business. The Supreme Court applied similar reasoning to the *B. B. Chemical Co.* vs. *Ellis* case that it had applied to the *Morton Salt* case, decided the same day. However, the preliminary bouts leading to the main event, the argument in the Supreme Court, were altogether different in the *B. B. Chemical* case than in the *Morton Salt* case and furnish an excellent illustration of time and effort unnecessarily expended, in view of the ultimate decision. In the *Morton Salt* case there was no trial in the District Court on the issues of novelty, invention, infringement, etc. However, in the *B. B. Chemical* case, a trial on such issues was held and the report of the District Court proceedings, found at 45 U. S. P. Q. 418, indicates that the District Court gave the patent owner and the defendant ample opportunity to discuss and offer evidence relating to the technical patent issues, which the District Court decided in favor of the patent owner. At the same time, it permitted the defendant to show the patent owner's method of doing business and on that issue decided in favor of the defendant and thus dismissed the bill.

Could not the District Court have saved itself considerable time and effort had it tried only the business conduct issue, leaving the technical patent trial issues to be decided only if necessary, that is to say, only if the business conduct issue were decided against the defendant?

The Circuit Court of Appeals for the First Circuit, as appears from the report in 48 U. S. P. Q. 487, also spent a considerable part of its time in determining the technical issues of infringement, novelty, invention, etc., deciding these also for the patent owner, and also turned its attention to the business conduct of the patent owner and also on that issue found for the defendant. Thus it affirmed all the conclusions and the action of the District Court.

The Supreme Court on the other hand, judging from the report at 52 U. S. P. Q. 33, devoted no part of its discussion to the technical patent issues of infringement, novelty, invention, etc., but turned its attention first to the business conduct of the patent owner, and on that issue found for the defendant, dismissed the case, and disposed of the suit finally, without any review of or time spent on the technical patent issues.

Thus it appears that a considerable part of the time of the District Court and of the Circuit Court of Appeals for the First Circuit was spent on issues which had no ultimate bearing on the case, the technical patent issues. Would not time and expense have been saved had these courts tried first the business conduct issues and held in abeyance the trial on the technical patent issues until final decision, by appeal or otherwise, on the business conduct issues?

We believe it important to save the time and money of the litigants in the trial of patent cases. Modern rules of substantive law, established by the *Morton Salt* and *B. B. Chemical* cases, among others, permit of a quick and easy disposition of the case in situations where the defendant has suggested that an issue in the case is the business conduct or license structure of the patent owner. Try the business conduct issue first, and only if necessary, examine the patents.

We are reminded again and again by the courts that in the operations of the patent system, the public interest is dominant. We submit that the public has a very vital interest in having patent infringement suits disposed of as expeditiously and as inexpensively for the defendant, particularly, as possible. It has long been recognized that an effective weapon of monopoly is the expense to which a patent owning plaintiff can put a defendant who is but one of many competitors and whose stake in the subject is far less than the stake of the patent owning plaintiff who has numerous licensees of the condemned license type to protect and also to enlist in his support. Practicing patent lawyers know very well that in the altogether too frequent type of case where a patent owner is one of several competitors in a business, and has managed to procure several of the competitors to join with him in the condemned business program, such as was condemned in the *Mercoid* case, 60 U. S. P. Q. 21, and equally in the *B. B. Chemical* case and in the *Morton Salt* case, among others, the stake of the patent owner and the financial position of the patent owner is considerably greater than that of the defendant, who by refusing to join with his competitors in the license structure becomes a lonely defendant, having neither the financial support nor the stake that all the rest of his competitors jointly have established by joining in the condemned license structure. When price fixing alone is considered, we find also that the patent owner and his several licensed competitors, agreed to maintain prices, have a great interest in preserving the patents and the patent structure and the license structure upon which they have built their price fixing program, and thus have a great stake, and by acting together have a great financial position, as compared with the lone defendant who has no price structure to protect, who wants freedom of action, and who must therefore, act alone. It is of extreme importance that defendants be permitted to remove the Damoclean sword hanging over their heads in as simple and expeditious a manner as possible, a manner demonstrated to be possible and so effective in the *Morton Salt* case, where the defendant, at comparatively little expense, was able to have the case disposed of finally and completely.

If a prospective defendant, feeling confident of succeeding in the defense of the suit, can also feel confident that the expense of success is not too great, he is more likely to remain a defendant and take his chances in litigation, and aid the public interest by helping it destroy the condemned business program of the patent owner and several of his competitors. On the other hand, if the prospective defendant, just as confident of succeeding in his defenses, fears, however, that the expense of defending himself is extremely great because he must prove not only that the business conduct of the patent owners is within the condemned range but also must defend himself on the technical patent issues, then we submit that a defendant in that position is less likely to defend himself and is more likely to join with his competitors in the condemned business program, and if he does, the condemned business program may never reach the attention of the courts and may never be stricken down by them, though the public interest would demand that these programs be examined and condemned and rendered inoperative as quickly and as completely and as inexpensively as possible.

As an alternative, we may find that the inability of defendants to defend themselves inexpensively and their consequent elimination or their consequent joining the licensees and becoming victim-partners in the condemned program, may give greater impetus to the supervisory activity of government, and to the demand that government take over the hitherto privately occupied field of patent litigation. The danger is too clear to be ignored—longer! Too many people believe that a weapon of monopoly is the knowledge that to defend a patent suit is expensive—and consequently clamor for government intervention. The warning signal has been flashing!

It is to the public interest, and the courts have said so, to prevent these condemned business programs from continuing. We submit that the bench, equally with the bar, should observe the admonition of the Supreme Court to consider the public interest as dominant in *all* operations of the patent system and we submit that this applies to procedure as well as to substance, and that the courts, in the trial of patent cases, should help these cases to be disposed of as quickly and as easily as possible and we further submit that this can almost always be done best by having first the trial on the business conduct issues and only if necessary thereafter to have the trial on the technical patent issues.

Other reasons may also be advanced for separating a patent infringement suit in such cases into two portions and trying the business conduct portion before attention is given to the technical patent portion of the case. It is important that the public learn that the courts are not opposed to patents, but are opposed to the condemned business programs. If the courts refrain from examining patents, unless and until necessary, but instead, turn their attention first to the business programs, then the public will soon learn that the courts are heeding the admonition of the Supreme Court to make the public interest paramount in all operations of the patent system and that the courts are not opposed to patents, but rather are opposed to condemned business programs.

It is more important to strike down condemned business programs than it is to strike down patents. When a condemned business program is stricken down, it usually is unnecessary for the defendant to attack the patent because the evils are eliminated in most cases simply by striking down the condemned business program. It is that program which is the evil and not the existence of the patent.

The sooner the bar and the bench turn their attention primarily to the business programs that must be condemned and that are being condemned by the Supreme Court, and the more directly and expeditiously they do, the sooner will patents, apart from the business programs based upon patents, regain favor with the public. It is hardly necessary to dwell on the importance of reestablishing patents in public favor.

Other examples of unproductive effort in patent cases abound and simply because the foregoing two cases are rather spectacular examples do we refer to them, though by no means do these exhaust the list of cases where time and effort could have been saved had the courts turned their attention first to the business programs which they ultimately condemned, and left the technical patent issues to be tried only if necessary. In such cases, no patent trial was necessary—but nevertheless it was held.

At 53 U. S. P. Q. 200 is reported the District Court trial in the case of *Landis Machine Co.* vs. *Chaso Tool Co.* The District Court in that case examined a large number of patents in suit (fourteen) and a tremendous amount of prior art, (an entire volume) and in addition, examined the business conduct of the patent owner. The District Court gave its conclusion on the fourteen patents, and on the prior art, and on the accused devices, and in addition, expressed its opinion that the business conduct of the patent owner was within the condemned range and the District Court made an exhaustive (and exhausting) study and set of findings of fact on the patent issues as well as on the business conduct issue. It is clear that had the District Court confined itself to the business conduct issue and found for the defendant on that issue, as it did, it would have been unnecessary for the District Court ever to have examined the patent issues. The case was appealed by the unsuccessful plaintiff patent owner to the Circuit Court of Appeals for the Sixth Circuit which, as reported at 61 U. S. P. Q. 164, gave first consideration to the business conduct issue and affirmed the District Court in its conclusion on this issue and thus disposed of the case. After considering and reaching its conclusions on the business conduct issues, the court indicated that there was no necessity for examining the fourteen patents and thirty three claims in suit, the complex accused machines, the eleven volumes of record, and the additional volume of prior art publications and patents, and the recorded testimony of the experts scattered through the more than 4,000 printed pages. Therefore, the Circuit Court of Appeals wisely shied away from the task of determining the technical patent issues and rested its decision solely upon the business conduct of the patent owner. We submit that the District Court could likewise have examined only the business conduct of the patent owner, reached its conclusion that that conduct was to be condemned, and disposed of the case finally and completely without the necessity of the long and elaborate patent trial. Had this been done, the expense involved in developing eleven volumes of record, a volume of prior art publications and patents, and the testimony of experts scattered through 4,000 printed pages, all would have been saved, the time of the court would have been saved, the expense to the defendant would have been less, the plaintiff would have known much sooner just what would happen to him, and the public would have been benefited very considerably. This opinion of the Circuit Court of Appeals is well worth reading for it teaches us how to try a patent case and to conserve the time and effort of the courts.

At 64 U. S. P. Q. 147 is reported the case of *Westinghouse* vs. *Frank Adam*. That case started out as an ordinary infringement case. Considerably in advance of the trial, the defendant tried to amend the pleadings to set forth the business conduct issues, but because the pleadings were presented belatedly, the District Court refused to permit the pleadings to be so amended. Repeatedly, before and during the trial, the defendant attempted to establish the business conduct of the plaintiff, but each time the District Court refused to permit the evidence to include anything other than the evidence on the usual patent issues of infringement, novelty, validity, invention, etc. The case went to trial and a rather elaborate patent trial was had, experts testifying, etc., resulting in a conclusion by the District Court on the technical patent issues. On the inevitable appeal, much time was spent in the briefs and at the oral argument on the technical patent issues and in addition, a little time was spent in discussing the right of the defendant to offer evidence as to the business conduct of the plaintiff. The Circuit Court of Appeals, in an opinion reported at 64 U. S. P. Q. 147, did not indicate its opinion on the technical patent issues, but instead, found error in the refusal of the District Court to permit the defendant to offer evidence as to the business conduct of the plaintiff and vacated the judgment of the District Court and remanded the case to the District Court to try the business conduct issue. If the finding is for the defendant on this issue, then all the patent trial work will have proven unnecessary, and several years of litigation needlessly spent. How much better would it have been had the first trial been on the business conduct issue, and to have held in abeyance the trial on the patent issues, until the business conduct issue had been tried? Patent issues should not be tried unless necessary and if the finding is for the defendant on the business conduct issue, then, of course, the patent trial is unnecessary.

It might be contended that the trial of the business conduct issue is more expensive than the trial on the patent issues. This might be true in a rare case—and where such might appear—then the patent issues might well be tried first. However, in most patent cases, the business conduct issue is far simpler to try than the patent issue. For one thing, most of the facts would not be in dispute. The bare licenses would often determine the case. For example, in the *Morton Salt* case, the entire lawsuit was disposed of simply upon a showing of the written license of the patent owner, a fact not in dispute. In the *B. B. Chemical* case, there was no dispute as to the business conduct of the patent owner, the facts were not in dispute, and it was a simple matter to establish what that business conduct was. In the *Landis* vs. *Chaso* case, it was a very simple matter to show the licenses of the patent owner and his business conduct, as contrasted with the tremendous amount of material that had to be offered in evidence on the technical patent issue.

Even in cases where the business conduct trial might be more expensive than the patent trial, inasmuch as the business conduct issue more often than not is the real bone of contention between the parties, and inasmuch as no defendant would permit himself to be enjoined or deprived of money on an accounting merely upon a patent trial, if he could avoid that result by having a trial on the business conduct issue as well, and inasmuch as under modern rules of the law the business conduct of the patent owner is examinable, we submit that nothing is gained by trying the patent issues first, because the business conduct issue is going to be tried anyway. On the other hand, much can be gained by trying the business conduct issue first because it might be unnecessary to try the patent issues.

It might be argued that separation of the patent and business issues might be wasteful, rather than fruitful, for it might require repeated assemblies of lawyers, witnesses, and courts. Experience has shown the desirability of separation of issues in many cases. In patent cases, the business conduct witnesses, and possibly even the lawyers, are a distinct group from those whose presence is needed for the patent trial. Nor is it uncommon for patent trials to be split into sections and the several sections tried at different times. No reported case known to the writer establishes the undesirability of separation of the business conduct issues from the patent issues. The several reported cases mentioned above clearly show the desirability of separation, as do other cases, including the entire line of cases relating to the control of the sale of unpatented materials, contributory infringement, extension of monopoly outside the grant, etc.

The patent profession, exclusively equipped to examine the patent issues, might complain of the undue emphasis being placed upon the business conduct of the patent owner and that would be emphasized by trying that issue before the patent issues are tried. If the patent profession stands in the way of an advance towards a procedure that makes it possible for defendants to prevail less expensively than in the past, then the patent profession may find itself pushed aside and the trial of cases taken over by general lawyers who may prove to be as well equipped to try the business conduct issues as are the patent lawyers. It behooves the patent profession for its own interest to keep in step with the times. More and more are the courts and the public paying attention to the business conduct of the patent owners and more and more are patent cases being decided without examination of the patents. The Supreme Court decided the *Morton Salt* case, the *B. B. Chemical* case, the *Mercoid* cases, among others without study of the technical patent issues of novelty, invention, infringement, etc. The procedural as well as substantive philosophy of the *Morton Salt* case, prevalent in that court, found its way into the Sixth Circuit Court of Appeals in the case of *Landis* vs. *Chaso.* That philosophy may spread into other courts and down into the District Courts. If the patent profession does not keep in step with the trends, then it will be the patent profession that will be left behind. An alert and aware public will insist more and more strongly that patent cases be disposed of as simply and as expeditiously as possible, and the growing awareness of the public of the impact of these cases on the patent system will cause the public more and more strongly to emphasize the business conduct issue and to demand that patent cases be disposed of on that issue if possible, in order to save expense and thus enable defendants to be freed of patent threats more quickly and more easily than in the past.

No longer can either the bar or the bench afford to ignore the admonition of the Supreme Court in the *Muncie Gear* case, 53 U. S. P. Q. 1 at 5, that it is the public interest that is sought to be safeguarded by the patent statues and that it is the public interest that must be represented adequately in patent litigation. We submit that in procedure, as well as in substance, the public interest should be represented; and that it is to the public interest to try the business conduct issue first, in patent cases of the type here discussed, and to try the technical patent issues only if and when necessary.

CITATIONS

Landis Machine Company vs. Chaso Tool Company (Dist. Ct.) (C. C. A. 6), 53 USPQ 200, 61 USPQ 164.

B. B. Chemical Co. vs. Ellis (Sup. Ct.), (C. C. A. 1), (Dist. Ct.), 52 USPQ 33, 48 USPQ 487, 45 USPQ 418.

Morton Salt Co. vs. G. S. Suppiger Co. (Sup. Ct.), 52 USPQ 30.

Mercoid Corp. vs. Midcontinent Investment Co. (Sup. Ct.), 60 USPQ 21.

Muncie Gear Works, Inc. vs. Outboard Marine & Mfg. Co. (Sup. Ct.), 53 USPQ 1.

Westinghouse vs. Frank Adam (CCA 8), 64 USPQ 147.

Carbice Case .(Sup. Ct.), 8 USPQ 211.

Licenses to File Applications for Patents in Foreign Countries

The rules for obtaining licenses for filing applications in foreign countries, see 531 O. G. 277, have been amended by adding a new rule.

16 *Optional procedure.* When a proposed foreign application is substantially identical with one or more applications filed in the United States Patent Office, the petition for license to file the application and any amendments thereto in certain foreign countries designated by the Commissioner of Patents may be made on Form O-1. Such petition will not be accompanied by the material specified in Rules 4, 9 and 10. The license need not be presented at the post office but the licensed material may be mailed or forwarded at option of licensee. The Commissioner of Patents will designate the foreign countries to which this optional procedure will apply by notice in the Official Gazette.

Has the Standard of Invention Been Raised?

By S. Spintman *

It is the conclusion of the writer that the standard of invention as generally followed in the Patent Office has not been raised by the much discussed *Cuno v. Automatic Devices,* 314 U. S. 84, and that even this standard remains qualified by the exception set forth in *Goodyear v. Ray-O-Vac,* 321 U. S. 275; and an attempt is herein made to show how this conclusion has been reached.

In the vast amount of discussion of these decisions, much emphasis has been placed on the broad dicta expressed in the *Cuno* case, but little has been said in an attempt to analyze the particular direction in which the actual facts of the case have been pointed. In fact the *Cuno* decision has been in too many instances entirely misapplied.

In order to understand these decisions, it must be kept clearly in mind that quite a number of tests are necessary to determine patentability of the thousands of applications filed annually in the Patent Office and that the *Cuno* case is deemed to apply to only one of these tests.

What is this particular test? It is the type of test that was expressed in the short-lived *Ex parte Gee,* 261 O. G. 800; 1919 C. D. 49, wherein Assistant Commissioner Clay stated:

> . . . it is necessary to find in the prior art not merely the device which might be modified to make this construction, but somewhere a suggestion, not only that the modification ought to be made, but how to make it.

The sole reason for citing *Ex parte Gee* is because the choice of language of the Commissioner is nicely adaptable to the *Cuno* situation. However, it is to be noted, parenthetically, that judging by the frequency with which *Ex parte Gee* is cited, it is apparently still thought by many persons that the doctrine expressed therein represents the current accepted practice.

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* Principal Examiner, Division 12.

That this *Gee* decision has not represented the approved practice in the Patent Office and that it is entirely inconsistent with both earlier and later decisions of the administrative courts, is indicated in *In re Milne,* 563 O. G. 581; 140 F. (2d) 1003, which sets forth the present approved standard:

> Appellant contends that references may not properly be combined unless the cited art teaches how to combine the cited structures, and in support of this contention cites the case of *Ex parte Gee,* 261 O. G. 800 (C. D. 1919, p. 49). This was a decision of the Commissioner of Patents which supports appellant's contention, but the decision has never been followed by this court or by any other court so far as we are aware.
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> * * *
>
> The only question is whether one skilled in the art, familiar with appellant's British patent, upon examining the Baxter patent, would without the exercise of the inventive faculty, determine that the addition of Baxter's baffle would be an improvement upon the structure disclosed by the British patent. That is the only consideration required to determine patentability where references are combined.
>
> In the case of *In re Goepfrich,* 30 C. C. P. A. (Patents) 1181, 136 F. (2d) 918; 556 O. G. 529, the same contention was made that, before references may be combined to negative patentability, one or more references must teach the combination claimed.
>
> We rejected this contention and, in our opinion, said:
>
> > In the consideration of references, the question is, could one skilled in the art with the references before him, make the combination of elements here claimed without exercise of the inventive faculty, and that is the only question before us on this appeal.

Now is the Supreme Court in the *Cuno* case in any way at a variance with this doctrine? Let us look at the *Cuno* record. Let us spread the references in front of us and study them in the light of the claims of the Mead patent sued upon. The court applied the references in the following manner:

> Thermostatic controls of a heating unit operating to cut off an electric current energizing the unit when its temperature had

reached the desired point were well known to the art when Mead made his device,

and thereupon cited electric irons, toasters, coffee cookers, and an entirely different type cigar lighter, as examples.

It went further to state:

Copeland . . . showed an electric lighter for cigars and cigarettes with thermostatic control. It differed from Mead in several respects. Thus in Copeland's device a cigar was inserted in a tube at the end of which was a heating coil. By pressing the cigar against the heating coil . . . a spring was overset and the circuit closed. When the desired temperature of the heating unit was reached, a thermostatic bar pushed back the spring and opened the circuit. Thus in the Copeland device the cigar . . . was "the means for moving the heating member" of the Mead claims [1] so as to establish the energizing electric heating circuit. The advance of Mead over Copeland was the use of the removable plug bearing the heating unit, as in Morris, to establish the automatically controlled circuit of Copeland.

And so the question is whether it was invention for one skilled in the art, and familiar with Morris and Copeland and with the extensive use of an automatic thermostatic control of an electric heating circuit to apply the Copeland automatic circuit to the Morris removable heating unit in substitution for a circuit manually controlled.

[1] "2. In a device of the class described, a removable heating member having an electrical heating unit, a socket for receiving and holding said heating member, electrical current supply terminals, means for moving said heating member to a position for establishing an energizing circuit to said heating unit, and means responsive to the temperature of said heating unit for interrupting said energizing circuit.

"3. In a lighting device for cigars and the like, a removable heating member having an electric heater, a support for receiving and holding said heating member, current supply terminals on said support, said heating member being movable on said support to a position where said heating unit is energized from said terminals and means responsive to the temperature of said heating unit for controlling the heating thereof.

"11. In an electric lighter of the class described, a base member, a heater member movably mounted on said base member, an electric heater on said heater member, electrical supply terminals on said base member, said heater member being movable between an energized position where a circuit is established from said terminals to said heater, and an off position where said circuit is interrupted, and automatic means for withdrawing said heater member from the on position to the off position upon heating of said heater."

To incorporate such a thermostatic control in a so-called "wireless" or "cordless" lighter was not to make an "invention" or "discovery" within the meaning of the patent laws.

* * *

Certainly the use of a thermostat to break a circuit in a "wireless" cigar lighter is analogous to, or the same in character as, the use of such a device in electric irons, toasters, or irons, whatever may be the difference in detail of design. Ingenuity was required to effect the adaptation, but no more than that to be expected of a mechanic skilled in the art. . . .

To translate this language to the type of language used in *Ex parte Gee,* the Supreme Court decided that once the prior art, in the form of Copeland's automatic thermostatic control, suggested that the modification of the Morris manual cigar lighter to make it an automatic lighter ought to be made, it was merely a matter of the skill of the mechanic to show how to adapt the Copeland automatic arrangement to the Morris manual lighter.

What, if anything, in this application of the references to the Mead claims, differs from the everyday practice in the Patent Office? Isn't this a typical and commonplace rejection of the claims? In the light of the position of the C. C. P. A. in the *Milne* case in sustaining the Patent Office rejections, does the *Cuno* case really call for any change in the standard of invention by the Patent Office? The answer must be that the alleged higher standard of invention required by the Supreme Court is non-existent. It is thought that the average Patent Office Examiner; the Board of Appeals and the C. C. P. A. would have acted exactly as did the Supreme Court if presented with the same facts and references[2] as were presented to the Supreme Court in the *Cuno* case. To sustain this thought, attention may be called to *In re Adams,* 1905 C. D. 602, and incidentally it is rather amusing and interesting that we find in this old 1904 case, in the face of the present hullabaloo as to an alleged call for

[2] The Copeland patent although earlier filed was still a pending application at the date of issue of the Mead patent and was consequently not before the Examiner as a reference.

a higher standard of invention, a set of facts strikingly analogous to that in the *Cuno* case. The Court of Appeals, D. C., in the latter case, in affirming a Patent Office rejection, stated:

> Without restating the references in his decision, it is sufficient to say that one of the former patents discloses means for cutting off the fuel supply and stopping engines of the kind, upon a failure, from any cause of the supply of cooling-water in the cylinder jacket. Others show a thermostat connected with a gas-engine cylinder to cut off the supply of gaseous fuel, and open the supply of liquid fuel when a certain temperature is reached.
>
> "The Commissioner then proceeds to state: 'It is a matter of common knowledge that thermostats are in general use in many arts for cutting off the supply of heating medium when the temperature rises above a desired point. The question presented is whether stopping an engine by a rise in temperature thereof is such a new result as to confer the quality of invention upon the means by which it is secured —namely, the combination of an engine-stopping device and a thermostat. It must be held that the decision of the Examiners-in-Chief in the negative was correct.' "
>
> In view of the common use of the well-known thermostat in this and other devices, we cannot agree that in the combination of the claims [3] it is made to perform other than its usual function, or to cooperate in producing a new and useful result that rises to the dignity of invention."

In other words as far back as 1904, the standard of invention was little, if any, different from that used by the Supreme Court in deciding the *Cuno* case. The alleged higher standard appears to be a delusion.

The *Ray-O-Vac* case set forth an important exception to the above, and Justice Stone in his concurring opinion in the *Cuno* case seemingly anticipated the *Ray-O-Vac* situation. It indicated that there are times and cases where the best of minds go astray and a seemingly simple and obvious problem goes unanswered for years when

[3] In a stopping device, for engines or the like, the combination with a jacketed engine cylinder, and means for supplying a cooling fluid to the jacket, of a thermostat located in proximity to the jacket, and engine-stopping means controlled by the thermostat and arranged to be operated thereby to stop the engine.

someone solves the problem and the solution is extensively adopted. It is interesting to note in *In re Rowell,* 1919 C. D. 164, that even this has been conventional practice in the Patent Office.

One factor that seems to be taken for granted in the Patent Office but which is not often expressed is that the person "skilled in the art," in many of the arts, is not a mechanic at all, but is instead an experienced chemist, electrical engineer, physicist etc. The skill of a calculating machine designer is a very different thing from the skill of the mechanic engaged in making cotter pins, for example, but both types of devices are important to our economy and both in proportion to their vitality advance the useful arts.

Little sympathy is found with the attitude of some writers who state that some of these minor inventions hinder progress in the art. It is felt that they are "barking up the wrong tree." If a man makes an improvement in pipe couplings—an extensively developed art—how that man may thereby hinder progress is inconceivable. Thousands of other pipe couplings are available to the public which may be used without the need of paying a penny of royalty, and if that new and necessarily specifically defined pipe coupling really proves to be superior and is generally preferred, that man has progressed the useful arts and is entitled to protection.

It appears that the real difficulty today is that when a case reaches the court in any infringement suit the defendants usually hire validity searchers who put weeks of time on the claims of the patent sued upon whereas the Examiner who acted upon the application was allowed only a matter of hours. Much of the art placed before the courts was usually never before the Examiner. With the same art before him, the Examiner would more than likely have reached the same conclusion as the court by not allowing many of the claims now being sued upon. This difficulty however, is not solved by alleging the requirement of a higher standard of invention.

Commentaria

Re: Special Equipment Co. vs. Coe

The dissent of Mr. Justice Douglas (Justices Black and Murphy concurring) in the above case aroused my curiosity because it appears the dissenting justices have overlooked one fundamental consideration:

A discovery or invention is valueless to the people of the U. S. until disclosed. To compensate for that disclosure, the Government by contract (the patent) grants to the inventor for a limited term the right to exclude others in the United States from using that disclosure. Upon expiration of the patent, the disclosure is free to use by all.

It is this disclosure which promotes the progress of science and the useful arts. It may be true that the utilization of such disclosure is temporarily deferred until patent expiration. Nothing in the Constitution or Statutes requires actual or immediate utilization of the disclosure for the monopoly granted is one of exclusion only and for the limited term.

The Congress can reduce such term and/or can as a condition to maintain the validity of the monopoly enact a compulsory licensing and/or a so-called working statute or statutes. However, it has as yet not seen fit to do so.

The right of exclusion in many instances has prompted others to discover or invent related non-infringing or totally dissimilar and better methods and apparatus to accomplish the desirable end result. Wherefore, the right of exclusion has advanced and promoted the progress of science and the useful arts.

Compulsory licensing is the alibi for those too lazy to devise or discover better methods.

Compulsory working usually degenerates into so-called nominal working. If the discovery or invention is a valuable contribution to the promotion of the progress of science and the useful arts, it will be utilized whether patented or otherwise.

Why do the Statutes, Rules of Practice of the Patent Office, as well as the Courts recognize as the first inventor the one who first discloses to the public or its agent (the Patent Office) the discovery or invention and to the exclusion of one having possession of same and who did nothing with it, or concealed or suppressed the same even though it was used?

It is well to note that if patents be granted successively to different interests, any owner of a later patent cannot make, use and vend the invention or discovery defined by the grant of such later patent if the earlier unexpired patent or patents be infringed thereby unless permission be obtained from the owner or owners of same.

So, in the absence of compulsory licensing, actual working of the subsequent patent subject matter cannot be required and should not be a prerequisite to the continued validity of the later patent.

This is the dilemma for the Congress to solve if the dissenting opinion at a future date becomes the majority opinion.

None of the foregoing is to be construed as commenting upon the right of the Court to legislate or to criticize, but the foregoing is intended solely to invite attention to certain fundamentals that must be considered if the intent of the dissenting Justices becomes the law of the land. Maybe working and compulsory licensing is required, and again maybe it is unnecessary or even undesirable.

ELMER L. GOLDSMITH.

Lockwood, Goldsmith & Galt
Indianapolis, Indiana

Decline in Patents in Great Britain

I have just read in the December issue of your JOURNAL the note on page 850 on "Decline in Patents." I would draw your attention to a similar experience made in Great Britain, as can be seen from the following data contained in the annual Reports presented by the Comptroller General of the British Patent Office to Parliament under Article 76 of the British Patents and Designs Acts, 1907 to 1942. Whereas patent applications amounting in 1934 to 37,409, in 1938 to 37,973 and even in 1939 to 33,109, the number of patent applications filed with the British Patent Office was in 1940 only 18,254, in 1941 16,847, in 1942 18,624 and in 1943—a slight increase—21,944. (The figures for 1944 are not yet available).

The number of sealed patents is shown in the following table:

1934	16,890
1938	19,314
1939	17,605
1940	11,453
1941	11,179
1942	7,969
1943	7,945

The decline in the two latter years may be in connection with the suspension of sealing of patents applied by "enemies."

Maybe, you will find it convenient to publish these data in the JOURNAL. Some other data may also be of interest. The term of duration of British patents is 16 years beginning on the date of the patent. Renewal fees are payable from the end of the 4th year. Patents sealed and in force to the end of the 4th year amounted in the year 1928 to 20,651; only 1370 patents thereof or 6.6 per cent of patents were kept in force by payment of renewal fees to end of the 16th (last) year. Applications for extension of the term of patents under Section 18 (6) of the Act numbered in 1943 only 68 involving 96 patents. 3480 patent applications were made in 1943 by persons residing in the United States of America (in 1941: 2,429 and in 1942: 2,600).

P. ABEL
Dr. of Laws (Vienna)
Consultant on International Law

London

Listing of Assignees in Index of Official Gazette

In the March issue of the JOURNAL, on page 186 is a suggestion by Louis C. Smith, Jr., entitled:—

"Revision of the Listing of Assignees in the Index of the Official Gazette."

As one who has been making patent searches for many years, I wish to make a "second" to this suggestion.

I might add that the method of listing used in Chemical Abstracts, giving the *titles* of patents under the name of the assignee is often a time saver if the search is in the field of chemistry. Such a listing of patents on mechanical devices assigned to a company would be helpful to the patent searcher.

HORTENSE E. WICKARD
Patent Research Assistant

Crane & Co
Chicago, Ill.

New Decisions

(Editor's Note: No further information can be given as to those decisions since some of the files are not open to the public. Case numbers are the JOURNAL's only).

Rule 137. Not the Practice of Board of Appeals to Render Decision on Record Alone

EX PARTE APPEAL NO. 49,339. AUGUST 3, 1944
(Case No. 160)

"In response to communication filed July 28, 1944 requesting that a decision be rendered on the specification, the claims on appeal and the remarks of certain amendments, counsel is hereby advised that it is not the practice of the Board of Appeals to render decisions on the record alone, but that according to Rule 137 of the Rules of Practice, appellant 'shall on or before the day of hearing file a brief of the authorities and remarks on which he will rely to maintain his appeal.'

"It is noted that the brief was due on August 1, 1944, this extension having been granted on request filed July 3, 1944. Counsel is further advised that the date for filing his brief has been further extended to September 1, 1944 and that no further extension should be expected.

"By order of the Board of Appeals."

Applicant Having Obtained Patent on Compound, Claims in Later Filed Case Directed to Compound Limited to Specific Use Held Properly Refused In View of In re Thuau. Generic Claims Must Be Prosecuted in First Filed Application or the First Application Passed to Issue

EX PARTE APPEAL NO. 1,404. APRIL 23, 1945
(Case No. 161)

Applicant had previously obtained a patent directed to certain compounds, the only indicated use for such compounds being as X-ray contrast agents. The application on appeal was designated as a continuation-in-part of the previously issued patent.

Appealed claim 11 was identical in scope with one of the patent claims differing only in that it was designated as an X-ray contrast composition. The two remaining appealed claims, 8 and 12, were also designated as X-ray contrast compositions but were somewhat broader in scope in so far as the definition of the chemical compound was concerned.

Regarding the two latter claims, applicant contended that the case fell within the purview of *Ex parte Rosenblum,* 47 U. S. P. Q. 391 and that no question of double patenting was involved.

In affirming the rejection of the three appealed claims, the Board stated:

> "The only reference cited against the appealed claims is appellant's prior patent cited above. It will be noted that the claims allowed in this patent are all directed to a chemical compound.
>
> "Claim 11 of this case is identical with claim 2 of the patent except that claim 11 states that the compound is an X-ray contrast composition. The examiner contends that the two claims are for the same thing and the allowance of present claim 11 would result in double patenting.
>
> "Claim 8 is also rejected on this prior patent but it appears that this claim is somewhat broader than claim 4 of the patent . . . In situations like this, the generic claim should be prosecuted in the first application filed and in this connection see Morse Company vs. Link Company 164 F. 331, Jones vs. Larter 92 O. G. 383. The generic claim may be placed in a later filed application provided said later application is the first one to be passed to issue, see Victor Company vs. American Company 140 F. 860, Heidbrink vs. McKesson 382 F. 502. Should claim 8 be allowed in the present case it would result in an extension of the monopoly granted in the patent cited above.
>
> * * *
>
> "We agree with the examiner that but a single invention was disclosed in the patent and in this application and that the mere addition to the patent claims of the use to be made of the compound does not amount to invention. See *In re Thuau* cited in the examiner's statement.
>
> "It appears that after the appeal was taken, appellant filed a proposed amendment containing new claims 15, 16 and 17. The examiner refused to enter this amendment for reasons given, but since the examiner has taken no action on the three proposed claims, we must decline consideration of the same.
>
> "The decision of the examiner is affirmed."

Necrology

Jesse R. Stone

Jesse R. Stone, a patent lawyer of Houston, Texas, died in his home on April 21, 1945. His death came after a ten-weeks' illness that followed a stroke which he suffered at the conclusion of a golf game at his Club.

Mr. Stone was born on a farm near Juneau, Wisconsin. He attended the local schools and was graduated from the University of Wisconsin in 1899. He then moved to Washington, D. C., where he served for several years as an Examiner in the Patent Office. While so engaged, he was admitted to the Bar. From the Patent Office he went to Houston, Texas, where for more than twenty years last past he was associated with the well-known law firm of Andrews, Kelley, Kurth & Campbell. One of the clients whom he served in the patent field was the Hughes Tool Company.

Mr. Stone was a careful and painstaking patent solicitor and patent lawyer. He solicited many patents for the Hughes Tool Company, including several covering Drill Bits. Many of these have stood the test of litigation. His work evidenced thoroughness in understanding and broad vision. Those who try patent causes well know how too often patents upon real inventions are lost through the carelessness of which patent solicitors are sometimes guilty. The record of Mr. Stone's painstaking work in this regard is outstanding.

William Gregg Doolittle

William Gregg Doolittle, one of the senior members of the Patent Law profession in Pittsburgh, died February 4, 1945, at the Allegheny General Hospital. Interment was in Sewickley Cemetery.

After finishing his law course at Cornell University, Mr. Doolittle, in line with a family tradition, adopted the special branch of legal practice in connection with patent and trade mark matters.

His father, William Henry Doolittle, had been an Assistant Commissioner of Patents in Washington, D. C., the family home, and a brother Harry had been in long successful practice in Chicago. Mr. Doolittle, long a resident of the Sewickley Valley, came to Pittsburgh in the late nineties and was continuously active in the profession up to the time of his death, in the Federal Courts and before the Patent Office. For many years past he has been associated in practice with Charles M. Clarke, with offices in the Oliver Building, Pittsburgh.

Mr. Doolittle was a charter member of the Patent Law Association of Pittsburgh, an active member on its boards, a member of the Duquesne Club and Allegheny Country Club, and of Saint Stephen's Episcopal Church, Sewickley.

His widow, Ellen Metcalf Doolittle, a son, Captain William Metcalf Doolittle, U. S. A. Pacific area, four grandchildren, and two sisters, Miss Sara Ormsby Doolittle and Miss Jennie Elizabeth Doolittle, of Washington, survive.

Sara A. Creeden

Miss Sara A. Creeden, 53, Examiner, Div. 24, died of a heart attack in Washington hospital, May 18, a few hours after being admitted. She had been ill at her home in Alexandria since January, but her death was unexpected.

A native of Ohio, Miss Creeden, who held a B. A. degree from G.W.U. and L.L.M. and M.P.L. degrees from the Washington College of Law, entered the Patent Office as a clerk Aug. 30, 1922. On Aug. 1, 1923 she was appointed to the Examining Corps as Ass't. Examiner of Trade-Marks and Designs, later serving in Divs. 55, 35, 53, and 24.

Survivors are a sister residing in Alexandria, Va., and brother in Ohio. Interment was in Ohio.

Otto R. Barnett

Otto Raymond Barnett, member of the patent law firm of Barnett & Truman, Chicago, Ill., died March 27, 1945.

Mr. Barnett, author of "Patent Property and the Anti-Monopoly Laws," had been a member of the American Patent Law Association since 1909; had served on the Board of Managers, and as President of that organization in 1925-1926.

Book Reviews

SOUL OF AMBER, by Alfred M. Still. Published by Farrar and Rinehart, Inc., New York. 274 pages, $2.50.

This volume presents not only the scientific but also the philosophical history of electricity from the time of the discovery of amber up to the day of Michael Faraday. One of the great values of the book is the appeal it will have to persons who fail to have even an elementary knowledge of electricity. The deep line of thought that characterizes this account, necessitates a careful and searching attitude upon the part of the reader. However, the time so spent will be well rewarded.

Mr. Still evaluates and records the impact of religion, art, and even politics upon the state of electrical science. Much of the data that is provided will be quite new to most readers. Exhaustive information is given with respect to the dates, history, and originality of several basic electrical inventions and discoveries, such as the galvonometer and the induction coil. Each chapter includes a list of notes and references as supporting documentation for the text. In addition, there is furnished a chronological table of key dates in the progress of electrical science, an index of names, and an index of subject matter.

Most readers should find this book to be of a stimulating character and one which will challenge the reader's evaluation of his own knowledge.

—M. W. L.

NEW WORLD OF MACHINES, by Harland Manchester. Published by Random House, New York. 313 pages, illustrated, $3.00.

This book is a lucid account of invention, research, and discovery, presented in dramatic and non-technical language. The subject matter is remarkably up-to-date, covering radar, television, synthetic rubber, plastics, the silicones, gas turbines, and air-conditioning. The material is well-coordinated and is presented in good literary style. In his prefatory remarks the author, with commendable courage and vision, states:

> "We are on the threshold of the greatest technological advance since the development of the internal combustion engine. A flood of discoveries and inventions, first dammed up by the world depression, then devoted mainly to war uses, will be released as soon as the arts of peace are resumed, and man must prepare himself for its impact upon all the conditions of his life."

This observation, it is submitted, accurately forecasts the quantum, if not the shape, of things to come. While the author properly devotes his attention to persons and facts, it is more than unfortunate that some emphasis has not been placed upon the effect and importance of patents in the broad panorama of research. It will scarcely be denied that the discoveries and inventions which the author envisages for the future will be the fruit of research firmly rooted in our patent system. This criticism will not, it is hoped, keep people from reading the book: it is merely an indication of interest in the subject of wider public knowledge of the value of patents in the field of research, and also the desire for wider dissemination of information with respect to the importance of patents to an improved standard of living.

—M. W. L.

Order No. 3936 *

It is hereby ordered that, effective June 1, 1945, there be established in the United States Patent Office at Washington, D. C., a Public Register of Patents Available for Licensing upon which shall be entered those patents under which the owner has signified that he is willing to grant licenses on stated or reasonable terms.

* 575 O. G. 1.

Situations Available

NEW YORK firm has an excellent opportunity for a trade-mark assistant with knowledge of the United States and foreign trade-mark practice. Write stating particulars of age, education, experience and general qualifications. Preference given to war veterans. Box No. 19, June JOURNAL.

UNITED STATES patent attorney permanent position in Washington with an excellent opportunity for future depending on personality and ability. A working knowledge of German and French essential. Write stating age, experience, qualifications and salary expected. Box No. 20, June JOURNAL.

INTERNATIONAL patent solicitors in New York require assistant with experience preparation and prosecution foreign patents. Write full details background, experience and salary expected. Box No. 21, June JOURNAL.

PATENT LAWYER specializing in chemical inventions desires assistant capable of soliciting chemical patents and making infringement and validity searches. May lead to partnership. Location Washington, D. C. State age, education, experience, and salary expected. Box No. 22, June JOURNAL.

PATENT ATTORNEY OR AGENT for work in small but expanding patent department of long established firm in pharmaceutical and fine chemicals business. Nominal starting salary with good advancement opportunities for right individual. Work involves generally supervised preparation and prosecution of patent applications, including interferences and appeals, upon inventions requiring substantial knowledge of organic chemistry. Five-day week. Location Manhattan convenient to transportation facilities. Submit recent photograph and written qualifications preparatory to interview. Box No. 23, June JOURNAL.

PATENT ATTORNEY, graduate engineer (under 40) preferably with law degree, and with experience in preparing and prosecuting patent applications in electronic and electrical communication arts, knowledge of television fundamentals helpful, as assistant in well-known New York City firm. Unusual opportunity and pleasant environment for man of ability. All replies will be maintained in strictest confidence, and full details should be given as to education, experience and initial salary expected. Box No. 24, June JOURNAL.

Situations Available

PERMANENT POSITION available in Patent Dept. of company, location New York City, for patent attorney or agent with mechanical or chemical engineering education and patent experience. Salary dependent upon qualifications. State education, age, experience, draft status, salary expected, references and other pertinent information. Box No. 26, June JOURNAL.

PATENT LAW FIRM with established and widely diversified practice has immediate need for competent attorney qualified to do good work, willing to exercise and develop his initiative and ability, and interested in a permanent position. Please make response as complete as possible. Box No. 27, June JOURNAL.

PATENT LAWYER: Opportunity in Legal Department of oil company in Philadelphia area for a capable patent lawyer. Permanent position. Give full particulars regarding age, education, experience, and salary desired. Box No. 28, June JOURNAL.

PATENT LAW FIRM in Metropolitan New York with established diversified application and litigation practice desires assistant with chemical training; must have experience in drafting and prosecuting applications and be able to make legal searches. Reply stating age, training, experience and salary desired. Box No. 29, June JOURNAL.

PERMANENT POSITION available in patent department of petroleum research company in California for chemical specification work, preferably with sufficient experience for independent work. Please give information regarding education, experience and expected salary. Box No. 30, June JOURNAL.

WANTED
PATENT LAWYER
EXPERIENCED

ASSISTANT IN PATENT DEPARTMENT OF INTERNATIONALLY KNOWN CHICAGO CORPORATION, now engaged in war production. Normally in a wide range of the mechanical and electrical fields, including automotive, aircraft, farm machinery, refrigeration, air conditioning, household appliance and other arts.

Fine present and post-war opportunity with modern, expanding organization.

Excellent location in Chicago Loop. Liberal salary.

WRITE FULL DETAILS

Box No. 31, June JOURNAL

Situations Available

TWO PATENT ATTORNEYS, one having mechanical engineering and the other electrical engineering training, wanted by a large manufacturing corporation whose Patent Department is located near New York City. Both positions are permanent and offer excellent post-war possibilities. In reply, please state age, education, experience, and salary expected. Box No. 33, June JOURNAL.

TWO PATENT ATTORNEYS versed in electronics, for Patent Department of corporation located near Boston. State age, education, experience in electronics, draft status, and salary expected. Membership to bar is not essential. Box No. 34, June JOURNAL.

NEW YORK firm of foreign patent attorneys have an excellent opportunity for a young man with some legal training, knowledge of languages and foreign annuities and working requirements. No technical training is necessary. Write giving particulars of age, education and experience. Preference given to war veterans. Box No. 35, June JOURNAL.

PATENT ATTORNEY to head patent department of a corporation engaged in the development and manufacture of electro-acoustic and electromechanical devices, and magnetic recording equipment. Experience with patent license agreements desirable. Location Ohio. Box No. 36, June JOURNAL.

PATENT ATTORNEY or agent, preferably with chemical training and experience, as assistant in corporation patent department in New York City. Kindly furnish full details as to education, experience, age and initial salary expected. Box No. 37, June JOURNAL.

NEW YORK firm of foreign patent attorneys have an excellent opportunity for a technical assistant in the age group between 23 to 28 years with general engineering background and some knowledge of languages. Excellent opportunity for development depending upon personality and ability. Write giving particulars of education and experience. Preference given to war veterans. Box No. 38, June JOURNAL.

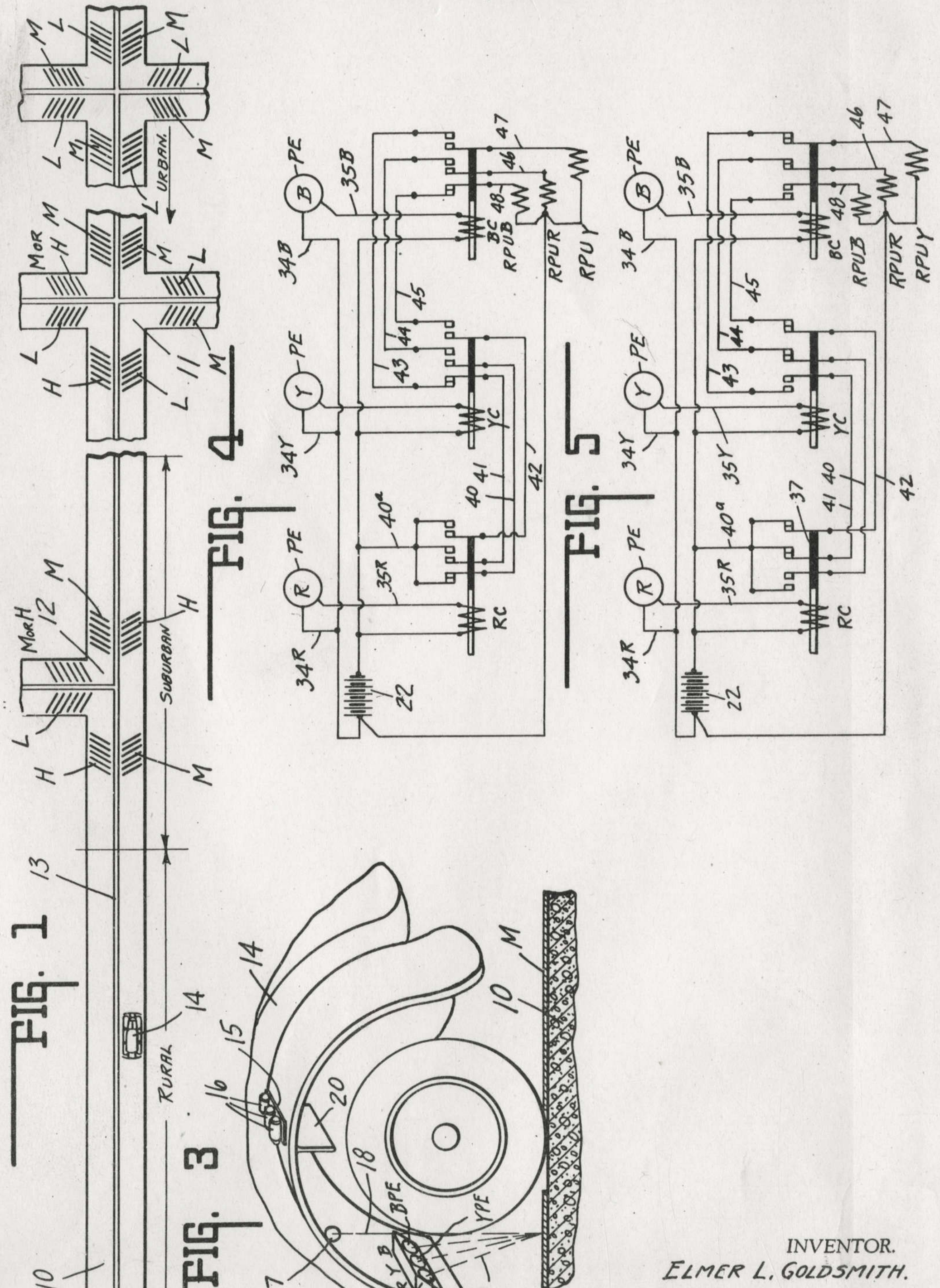
Book Exchange

LAW BOOKS — NEW — USED — BOUGHT — SOLD. J. M. Mitchell, 5738 Thomas Ave., Philadelphia, Penna.

Special

AUTOMATIC SPEED CONTROL FOR AUTOMOTIVE VEHICLES

Filed July 22, 1937 3 Sheets-Sheet 1



INVENTOR.
ELMER L. GOLDSMITH.
BY
Lockwood, Goldsmith & Galt
ATTORNEYS.

July 23, 1940. E. L. GOLDSMITH 2,209,158

AUTOMATIC SPEED CONTROL FOR AUTOMOTIVE VEHICLES

Filed July 22, 1937 3 Sheets-Sheet 2

FIG. 2

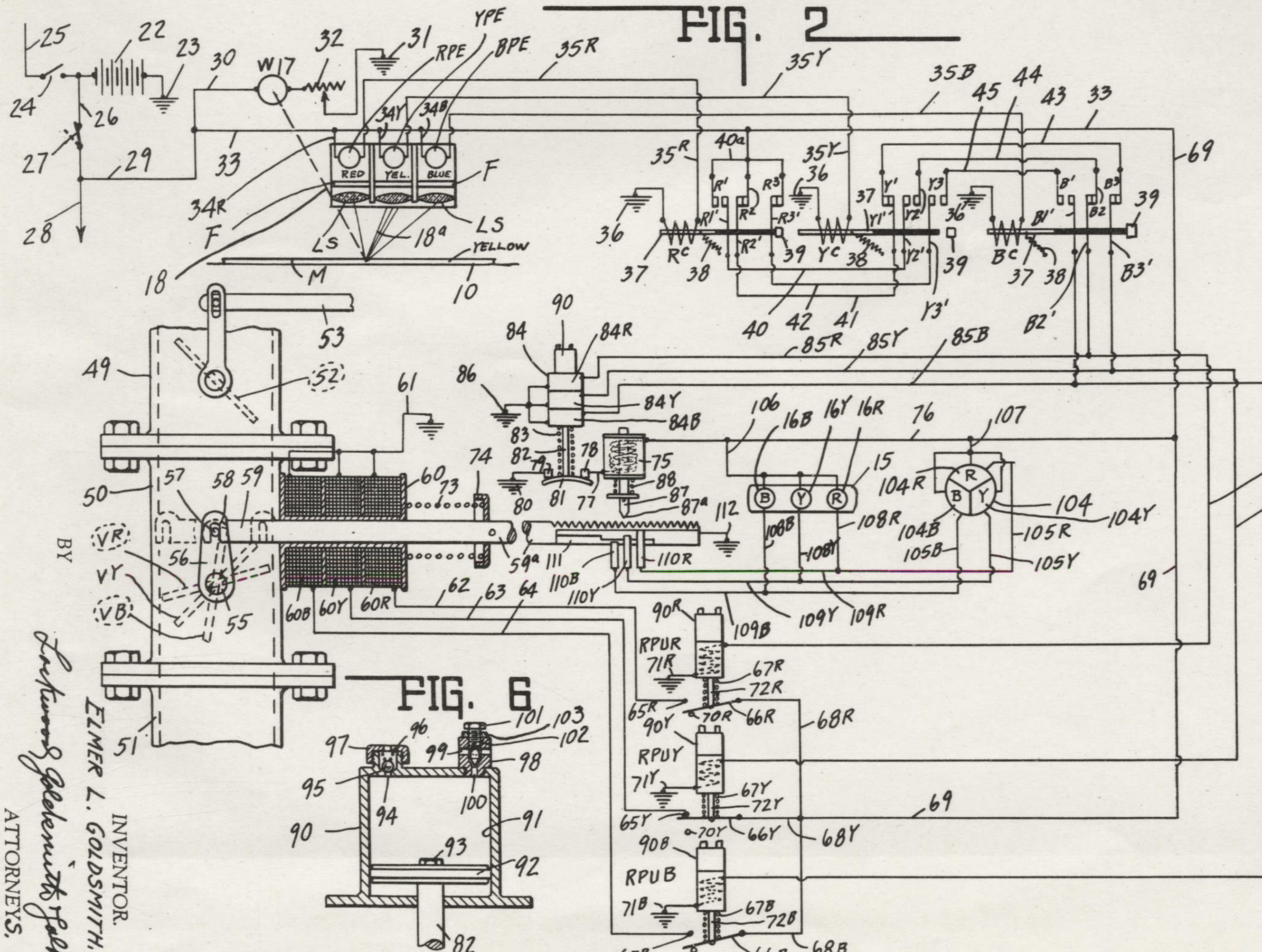


FIG. 6

INVENTOR.
ELMER L. GOLDSMITH.
BY
ATTORNEYS.

July 23, 1940. E. L. GOLDSMITH 2,209,158

AUTOMATIC SPEED CONTROL FOR AUTOMOTIVE VEHICLES

Filed July 22, 1937 3 Sheets-Sheet 3

FIG. 7

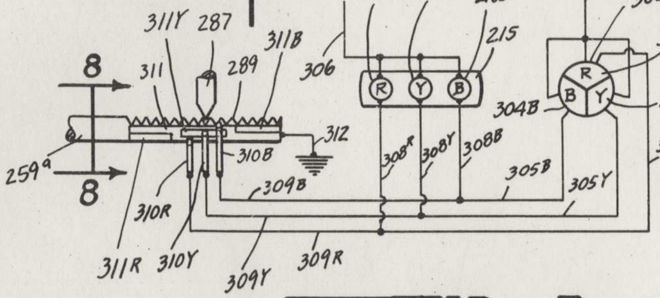


FIG. 8

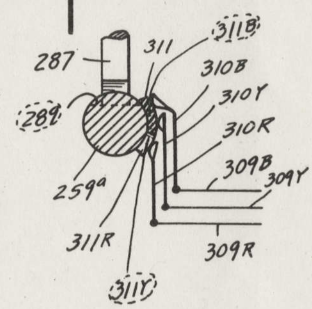
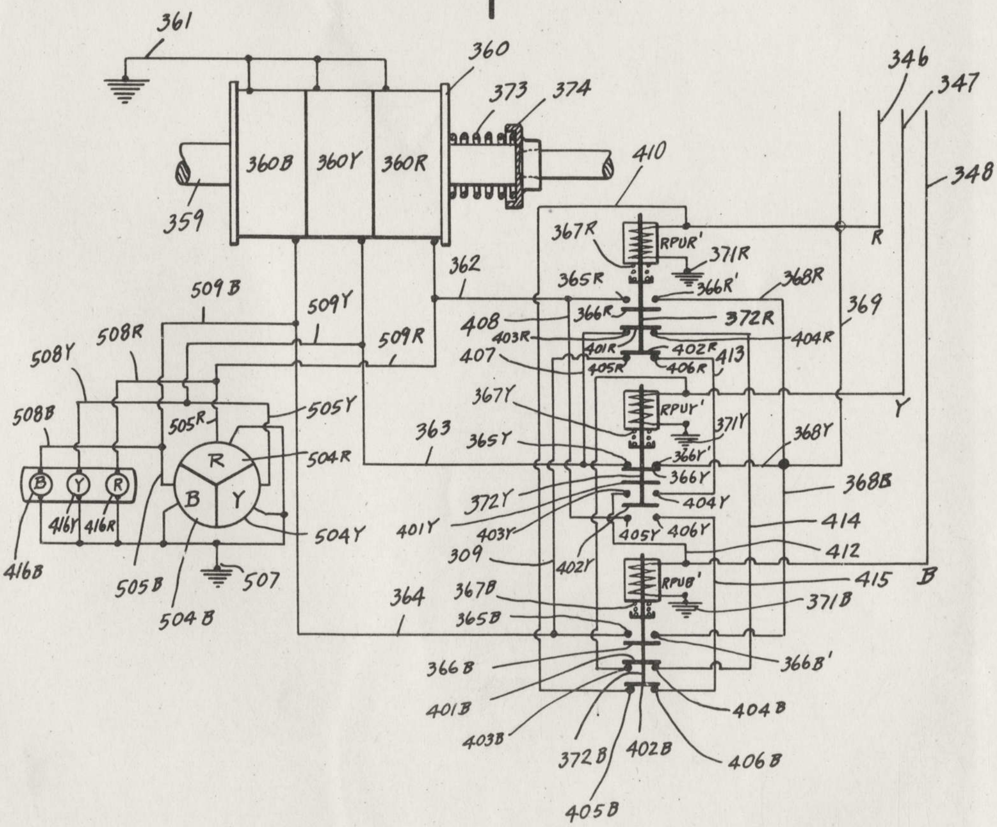


FIG. 9



INVENTOR.

ELMER L. GOLDSMITH.

BY

Lockwood, Goldsmith & Galt

ATTORNEYS.

UNITED STATES PATENT OFFICE

2,209,158

AUTOMATIC SPEED CONTROL FOR AUTOMOTIVE VEHICLES

Elmer L. Goldsmith, Indianapolis, Ind., assignor to Zone-O-Trol-Pierce, Inc., Anderson, Ind., a corporation

Application June 22, 1937, Serial No. 155,090

1 Claim. (Cl. 177—311.5)

This invention relates to a traffic control system for self-propelled vehicles which are not confined to a predetermined pathway such as rails, but which are of automobile type such as pleasure cars, busses and trucks, although certain features of the invention by slight modification may be applied to trolley type busses.

One object of the invention is to automatically regulate vehicle speed in accordance with traffic conditions by zoning the highways and roadways and automatically imposing upon the vehicle, independent of driver control, a control corresponding and responsive to the zone designation.

Another object of the invention is to zone highways and roadways in such a manner that the zoning means does not constitute an impediment, hazard or obstruction to normal vehicle driving thereon.

A further object of the invention is to zone highways and roadways in an economical manner, to-wit, such that no mechanical, magnetic or electrical highway equipment is requisite for such zoning, and the means used may be easily and economically maintained in operative condition.

The chief feature of the invention consists in zoning highways and roadways, providing on self-propelled vehicles using the same zone operable control means for regulating engine or vehicle speed, as desired, and having the same automatically responsive to such zoning at all times.

In the patent issued to John J. Huebscher, November 5, 1935, No. 2,019,976, there is disclosed broadly the idea of the utilization of color on a pavement for indicating a zone of traffic on a highway travelled by automobile. This patent also shows mechanical and electrical means installed as part of highway equipment for imposing automatic control upon a vehicle equipped with a control device responsive to such imposed control.

The chief objection to this system as disclosed therein is, as indicated hereinbefore, as follows: The automatic control imposing mechanism requires special installation in a highway or adjacent thereto and is subject to the usual high cost of repair and replacement when damaged or destroyed in addition to the relatively great expense of the original installation.

The application of John J. Huebscher, Serial No. 59,639, filed January 17, 1936, now Patent No. 2,070,432, dated February 9, 1937, discloses the application of color to a pavement for zoning the same. This application also discloses the provision of suitable roadside signals illuminated or otherwise for indicating color designations and, therefore, zones on the highway.

The latter has the inherent disadvantage common to the patent disclosure in that the original cost of installation is relatively high. The application of color for zoning purposes, however, is shown in this application but it is associated with a system of vehicle control which must be manually actuated by the vehicle driver in accordance with the zone indication. This has the disadvantage or objection that the vehicle driver, if not so disposed, need not impose this control upon the vehicle he is driving.

The present invention is directed to a highway control system which requires only the application of paint to the highway as original equipment for zoning and signalling and which requires retouching or repainting for reconditioning the same, and furthermore which paint reflects a color which, when associated with a control embodied in the automotive vehicle, is automatically picked up by said control and the zoning indication is imposed upon the vehicle.

The present disclosure represents but one form of the invention and a relatively simplified form thereof.

Other and more complicated forms have been devised and portions of such modified forms are illustrated and described herein.

The invention is illustrated and described as applied to an independent automatic control for automatically regulating the fuel supply to the engine of the vehicle which control is in addition to the usual manual throttle control but it is so arranged that manual operation of the throttle cannot obtain greater engine operation than that for which the automatic control is set.

A modification of the aforesaid is the addition of a cooperative connection between the manual control and the automatic control, which connection may be of either of two characters, as desired. One such connection includes the provision of a control automatically responsive to vehicle speed which would modify the automatic zoning control, depending upon load and road conditions which may be briefly explained as follows:

A device responsive to vehicle speed only would modify the highway zone control imposed automatically to the extent that if a certain zoning control were imposed automatically and the heavily loaded vehicle were pulling a hill, this automatic zoning control arrangement would have an auxiliary arrangement providing for the additional supply of fuel in accordance with the speed control. In this way the driver of the vehicle would operate at wide open throttle whenever his load and road conditions were such that his vehicle speed would nor exceed the predetermined zone speed.

The second form of this modification which, however, is not as desirable as the first, is to have the speed indication auxiliary control responsive to engine speed. Such a device essentially would consist of a centrifugal governor of any conventional type which would impose its control upon the fuel supply directly or upon the automatic zoning control directly and, therefore, on the fuel supply indirectly so that additional fuel could be obtained when the engine speed is below that corresponding vehicle speed for which the automatic zoning control has been conditioned.

Other objects and features of the invention will appear more fully hereinafter in the following description.

The full nature of the invention will be understood from the accompanying drawings and the following description and claim:

In the drawings,

Fig. 1 is a plan view of a highway illustrating three different zones thereof, to-wit, urban, suburban and rural, provided with conventional color indications on the pavement of red, yellow and blue, respectively, and these representing low maximum speed, medium or moderate maximum speed, and substantially unrestricted speed corresponding, for example, to 25, 40 and 60 miles per hour.

Fig. 2 is a diagrammatic view of a major portion of the electrical connections embodied in the control on a self-propelled vehicle, parts of the vehicle associated therewith also being included in this diagrammatic figure together with a diagrammatic representation of a highway signal.

Fig. 3 is a perspective view of a portion of the vehicle and highway immediately associated therewith being shown in section, the former being shown provided with the signal initiating and "pick-up" portions of the system and the latter with the signal portion of the system.

Fig. 4 is a wiring diagram in conventional form of a portion of the system diagrammatically illustrated in Fig. 2 but showing the same in the position corresponding to the highway condition where normally all three signals would be picked up as might be the condition on a white concrete pavement with the sun shining directly thereon.

Fig. 5 is a view similar to Fig. 4 but illustrates the same portion of the system under such conditions as applied to a black pavement, such as asphalt or "black top," or other equivalent pavement which is black or relatively dark and which has thereon no color zoning signal indication.

Fig. 6 is a central sectional view through one of the dash pots embodied in one form of the invention.

Fig. 7 is a view similar to Fig. 2 and of a modified form of a portion of the form of the invention illustrated in Fig. 2, the remainder of the control being omitted.

Fig. 8 is a section taken on line 8—8 of Fig. 7 and in the direction of the arrows.

Fig. 9 is a diagrammatic view of a portion of the invention illustrating a modification thereof wherein the moving power is utilized as the holding power between reception of successive signals.

In Fig. 1 of the drawings, there is illustrated a vehicle roadway or highway 10 which from left to right leads into a suburban section and then passes into an urban section. The highway is intersected as at 11 and there may be a T-road as at 12. The highway is shown as of two-lane character, in which a center strip may be provided and consequently, it is shown dotted herein and indicated by numeral 13. The highway is provided with spaced diagonal colored lines or rather areas, the selected colors representing different zones of the roadway and the letters H, M and L indicating high speed color signals on the highway, medium or moderate speed signals and low speed signals, respectively. Solid areas may be employed.

Merely representative, in Fig. 1 there is illustrated the use of blue as a color signal for indicating the beginning of a high speed zone. The yellow color signal indicates the beginning of a moderate speed zone. The red color indicates the beginning of a low or slow speed zone.

As stated initially, herein, the control devices on the vehicle, one of which is shown in Fig. 1 and indicated by the numeral 14, may be set so that these color or zone signal indications insure predetermined maximum vehicle speed limitations of, for example, 25, 40 and 60 miles per hour, respectively.

Reference will now be had to Fig. 3, and in this figure there is illustrated a portion of the vehicle 14, the numeral 10 indicating a portion of the highway, and there is further illustrated the color strips M which are yellow in color and constitute the signal arrangement.

Fig. 3 illustrates the "pick up" portion of the control system and herein the same is shown positioned under the left rear fender of the vehicle, although any other desired positioning may be provided. On the left rear fender and visible from the front and rear, there is conventionally illustrated a bracket 15 which mounts three lamps 16 which may be of the same or different colors and reference will be had more particularly thereto hereinafter. As stated, other signals may be provided forwardly on the vehicle and rearwardly in place of the two-way visible signals 16. This external signalling from the vehicle is old per se in the art.

W17 indicates a suitable light source which constitutes the vehicle carried initiating portion of the system and which throws white light downwardly on to the pavement, as indicated diagrammatically by the line 18 and the pavement reflects this light upwardly as at 18*a*. Since the color stripes M in Fig. 3 are shown as yellow and since opaque objects appear in the colors, they reflect, the yellow stripe on the roadway will reflect a preponderance of yellow rays therefrom and derived from the main light source W17, and these reflected rays will be projected on to a unit 19 which contains three different color signal reception devices, designated RPE, YPE and BPE, since for an explanation of this invention it has been arbitrarily assumed that red, yellow and blue will be the three colors utilized. Of course, a greater or lesser number of colors may be employed but in a zoning system, two or more colors preferably should be employed. The designation PE stands for photo electric unit. The provision of unit W17 upon the vehicle insures that in the preferred form of the invention no energy is required for highway signal maintenance or illumination.

As previously stated, the main signal source W17 and the unit 19 containing the three photo electric units may be positioned on the vehicle wherever required. It might be added the reason it is shown positioned in longitudinal alignment with one of the rear wheels is that in those localities where there is considerable snow and ice that accumulates on the pavements during certain seasons of the winter the color signal on the pavement will be exposed long before the entire pavement is clear of snow and ice, due to tire wear.

Furthermore, positioning this portion of the control in longitudinal alignment with one of the rear wheels insures that the dark streak in the highway, due to oil and grease drippings and the like, has no effect on a signal control if the vehicle is being driven in the normal traffic lane.

If desired, in order to prevent mud and the like from being thrown by the rear wheel so as to cover the light source W17 and the "pick up" unit 19, there may be provided a flexible guard 20. It is also to be understood the positioning of the parts shown in Fig. 3 may be changed, for example, so as to be carried by the undersurface of the running board 21 and suitably protected fore and aft by guards 20 or the like.

Reference will now be had to Fig. 2. In this figure 22 indicates the conventional source of power on a vehicle 14. The same is herein illustrated as the battery of the vehicle grounded to the frame as at 23. The switch 24 controls a light circuit 25 of which only a portion is illustrated, and any desired lighting system may be embodied therewith. Line 26 is controlled by the ignition switch 27 and has a branch 28 leading to the engine ignition circuit of whatever character desired. A line 29 is a branch of line 26 controlled by ignition switch 27 and a branch 30 thereof supplies the light source W17 with energy. The light source W17 is grounded as at 31 through an adjustable resistance 32 so that the amount of light discharged from the light source W17, and which is preferably a white light or the equivalent, may be regulated in the initial installation of the control and thereafter sealed against tampering. Thus the light W17 always is energized when the ignition circuit is closed to permit vehicle movement.

Another branch 33 of line 29 supplies by branches 34 current to each of the photo electric units which operate as light switches. Each photo electric unit has positioned ahead of it a coolr filter designated by the letter F and preceding the same is a lens designated by the letters LS. The purpose of the lens is to pick up the light rays reflected from the pavement 10 when the light rays 18 are reflected especially from the color stripe thereon.

The purpose of the color filter which may be of glass or other suitable character, is to prevent passage of light rays to the respective photo electric cell, except for that color for which the photo electric cell has been determined it should be responsive to. It is not known whether there are commercially available photo electric cells that are selectively responsive to individual colors and non-responsive to all other colors and, therefore, the employment of the concentrating lens and the employment of the color filter is embodied herein so that the color designated photoelectric cell corresponding to the color of the road signal, will be energized when the light from the light source W17 is reflected thereto.

In the upper right hand portion of Fig. 2 is illustrated a switching arrangement arranged in three groups, since three colors, as it were, have been illustrated in the present embodiment of the invention.

A relay RC is connected by the line 35R to the red photo electric cell RPE and the relay is grounded to the frame as at 36. Similarly, the relay YC is connected by the line 35Y to the yellow photo electric cell YPE, and is grounded to the frame as at 36. Similarly, relay BC is connected by the line 35B to the blue photo electric cell BPE and grounded at 36. Grounds 36 may be a common ground, if desired. Each relay is adapted to move its core 37 when energized and in opposition to its spring 38 which, when the relay is deenergized, returns the core to the original position and into engagement with its stop 39.

Associated with the relay RC are three switches having relatively stationary contacts R1, R2 and R3 connected by line 40a to the line 33. The core 37 of the red relay RC is insulatably connected to the three respective cooperating, relatively insulated contacts R1', R2' and R3', and are simultaneously movable by and with the core 37 of the red relay when the red relay is energized.

In a similar manner, there is provided for the yellow signal arrangement, the relatively stationary contacts Y1, Y2 and Y3 and the cooperating contacts Y1', Y2' and Y3' carried by and movable with the core 37 of the yellow relay YC normally constrained toward its original position by the spring 38 and into engagement with the stop 39.

In a similar manner, a third group of switches is provided for the blue relay BC, the relatively stationary contacts thereof being designated B1, B2 and B3, and the complementary cooperating contacts being designated B1', B2' and B3', the latter being supported by and movable with the core 37 of the blue relay BC when the latter is energized and movable therewith by the spring 38 into engagement with the stop 39 when deenergized.

The switch contact R1' is connected by the line 40 to the contact Y2'. The switch contact R2' is connected by line 41 to the switch contact Y1'. The switch contact R3' is connected by line 42 to the switch contact Y3'. The line 43 connects switch contact Y1 to the switch contact B3. The line 44 connects the switch contact Y2 to the switch contact B2. The line 45 connects switch contact Y3 to the switch contact B1.

It will be observed that when all relays RC, YC and BC are deenergized, that all of the switches R1—R1', Y1—Y1' and B1—B1' are in open circuit position and switches R2—R2', R3—R3' and Y2—Y2', Y3—Y3', B2—B2' and B3—B3', all are in closed circuit position. This condition is more or less diagrammatically illustrated in Fig. 5 which is a representation of this portion of the system when it is receiving no signal indication from the roadway as, for example, when the road is of "black top" character without color zoning thereon even though light W17 be directed thereon.

If it be assumed a condition should arise wherein, due to the intensity of the sunlight or light from source W17 and the vehicle be upon a white pavement, there is reflected into all the photo electric "pick-up devices" all three signals, then this portion of the circuit is conditioned as shown in Fig. 4, to-wit, switches R1—R1', Y1—Y1' and B1—B1' are closed. Since it is noted that in each group of three switches one is normally closed and the other two normally opened or vice versa, it is quite evident, as appears from Fig. 4, that no current is supplied by the photo electric "pick up" devices to the lines 46, 47 and 48, connected respectively to the switch contacts B2', B3' and B1', because in the blue switch series, the two right hand switches are open and in the yellow series the last right hand switch is open, even though the first or left hand switch of the blue series is closed. Thus no energy is supplied to any line 46, 47 or 48. However, it is to be noted that the intensity of the light source W17 may be so increased (see resistance 32) and the filtering of the reflected light be of such character that normal sunlight reflected from a white road will not result in energization of all photo-electric controls.

In Fig. 5 it will be quite apparent all of the first left hand switches of the three color groups remain in open circuit position under this condition where no signal indication whatsoever is received by any of the photo electric "pick up" devices so there is no current supplied to any one of the lines 46, 47 and 48. When the condition is obtained as represented by Fig. 3, to-wit, the vehicle is passing over a yellow signal indication, the yellow control relay YC is energized and its core is moved to the left in opposition to spring 38 and this closes the left hand switch of the Y series and opens the middle and right hand switches of that series, see Fig. 2. The circuit up to this point is then as follows:

From the source 22 through lines 26 and 29 conditioned by switch 27, thence through line 33 and branch 40*a* to the switch contact R2, thence by line 41 to switch contact Y1' and from switch contact Y1 by line 43 to switch contact B3 and thence through contact B3' to the line 47.

In a similar manner, it will be noted that the blue signal will be translated into proper control for supplying electrical energy to line 48 and in a similar manner, a red signal will insure electric current to line 46. These three lines 46, 47 and 48 constitute the main control lines and it will be noted that the power conveyed thereby is not that derived from the source of energy through the photo electric "pick up" devices as a series circuit arrangement but it is that derived through such devices as an auxiliary arrangement so that the photoelectric devices when conditioned for operation, need only be of sufficient capacity for operation of the respective relays designated by the appropriate letters RC, YC or BC. Thus, any required amount of power may be supplied to the lines 46, 47 and 48 and independent of the capacities of the photo electric units.

Reference will now be had to the lower left hand portion of Fig. 2. The numeral 49 indicates the intake to the internal combustion engine of the vehicle; 50 indicates an adaptor insert interposed between the intake and the carburetor. Herein the arrangement is illustrated as of the updraft type, and a portion of the carburetor is indicated by 51. The position of the intake and the carburetor may be reversed. There is shown herein, merely for illustration purposes, a manually operable control valve 52 operable by the member 53, in turn operable by the foot throttle and/or the hand throttle, as is well understood in the internal combustion engine art.

In the adaptor insert 50, there is provided a valve 54 mounted on the shaft 55 which has a lever arm 56 rigid therewith and exterior of the passage and carrying a projection 57 seatable in a slot 58 in the end of the member 59 that projects toward the intake passage portion of the adaptor insert 50 and lies to the arm side thereof as shown in Fig. 1.

Suitably supported adjacent the same is a coil 60 which has three coil portions 60R, 60Y and 60B, each connected to the ground as at 61, and each supplied with power by a line 62, 63 and 64, respectively. Line 62 leads to a stationary switch contact 65R. A switch member 66R is normally constrained into open circuit position by the spring 67R. Line 68R is connected to line 69 in turn connected to line 33.

In a similar manner, the solenoid section 60Y has its supply line 63 connected to stationary switch contact 65Y. Adjacent thereto is the switch 66Y normally constrained into open circuit position by the spring 67Y and the switch is connected to line 69 by the line 68R.

In a similar manner the solenoid section 60B is connected by its supply line 64 to the stationary switch contact 65B. Cooperating switch member 66B is normally constrained into open circuit position by the spring 67B and is connected by the line 68B to the line 69. Suitable open circuit position stops for the switch members may be provided as indicated at 70R, 70Y and 70B, respectively.

The line 46 supplies energy to the solenoid RPUR which is grounded at 71R. A movable core 72R is connected to the switch member 66R and the spring 67R envelopes the same.

In a similar manner, solenoid RPUY is connected to line 47 and is grounded at 71Y. The movable core 72Y thereof is connected to the switch member 66Y and is encircled by the spring 67Y.

In a similar manner, the solenoid RPUB is connected to line 48 and is grounded as at 71B. This solenoid has the movable core 72B which is connected to the switch member 66B and is encircled by the constraining spring 67B thereof.

As shown in Fig. 2, the yellow solenoid RPUY has been energized by current from line 47 and has elevated the switch 66Y so it engages contact 65Y, this supplying energy from the battery 22 or other suitable source of power on the vehicle to the section 60Y of the solenoid 60. This has moved the core 59 of the solenoid 60 to the position as shown and valve 54 to position YV and in opposition to the spring 73 bearing against a seat and retaining member 74 carried by that member. This spring member 73 encircles the member 59 and normally tends to move the core to the low maximum speed position.

The invention so far described is of the instant type and unless there is embodied in the system an additional circuit arrangement which will maintain the respective switches 66 closed after the initial signal is received and retain the same closed until a new signal is received thereby energizing the respective sections of solenoid 60, some other means must be provided to hold the control member 59, which is herein for simplicity shown as an extension of the movable core of the solenoid 60, in the predetermined position corresponding to the signal indication received or picked up by the vehicle.

One mechanical embodiment of such means is herein illustrated. A solenoid 75 is connected by line 76 either to line 69 or directly to the line 33, the former connection being shown herein. This relay is connected by line 77 to a stationary switch contact 78. Another stationary switch contact 79 adjacent thereto is grounded as at 80. A switch member 81 has a stem 82 on it encircled by a spring 83 which normally constrains switch member 81 in addition to gravity, into the open circuit position or non-bridging position.

A solenoid 84 has the respective sections 84R, 84Y and 84B, each connected by lines 85R, 85Y and 85B to the lines 46, 47 and 48, respectively. The respective solenoid sections 84R, 84Y and 84B are grounded as at 86. When the yellow signal indication is received, as before stated, power is supplied directly from the battery to line 47 and the intermediate solenoid section 84Y is energized, closing the switch 78, 81 and 79 to solenoid 75. Thus, at the same time the respective solenoid RPU is energized, the relay 75 will be energized.

The movable core 87 of solenoid 75 is constrained by spring 88 in addition to gravity, into the lower position. An extension 59*a* of the movable core 59 is provided with a serrated face or formation 89 and the lower end 87*a* of the movable core or plunger 37 is complementally formed, so as to seat in one of the tooth roots when the solenoid 75 is deenergized.

There is provided on the relay 84 a dash pot structure 90 and there is provided on each of the solenoids RPU a dash pot construction 90R, 90Y, and 90B, respectively.

One embodiment of the dash-pot structure is shown in Fig. 6 to which reference now will be had. In said figure, 82 indicates the movable core of the triple section solenoid 84, which while shown as in superposed relation, is actually wound so that when each section is energized, the member 82 has exactly the same amount of movement, thereby differentiating from the type of movement obtained from solenoid 60 with respect to the movable core 59.

The dash-pot 90 includes a chamber 91 within which is mounted a piston 92 secured as at 93 to the movable core 82 or by any other suitable connection. The upper end of the dash-pot includes an air discharge orifice 94 controlled by a ball 95 backed by a spring 96, the spring and ball being retained in the enlarged portion of the orifice by the perforated cap 97. When the solenoid 84 is energized, the air is forced from the chamber 91 through the port 94, opening of the same being by the air pressure in opposition to the weight of the ball and the force of the light spring.

Suitably secured in the head of the dash-pot 90 is an air supply member 98 having the intake ports 99 and the communicating port 100 which is tapered so as to partially seat, as it were, the needle valve 101 secured in adjusted position as at 102 and locked therein as at 103.

When the solenoid 84 is deeneregized, the piston 92 with the movable core, starts to descend, the ball being seated by its own weight and the spring seals the port 94. The air gradually bleeds into chamber 91 through the needle valve controlled intake 100, thereby insuring the maintenance of the contact between member 81 and the contacts 78 and 79 for a predetermined appreciable period after the electrical energy supplied by the "pick-up" signal through lines 85R, 85Y and 85B, respectively, has terminated. For this purpose, if desired, the member 81 may be of flexible character so that there is an appreciable amount of piston travel in the cylinder 91 before this switch opens. This maintains in closed circuit relation for an appreciable period of this switch, insuring energization for the same period of the solenoid 75 and, therefore, maintains in elevated position the locking plunger 87.

While this plunger is held elevated, the respective circuit for the respective section of the solenoid 60 has also been energized. Through the dash-pots 90R, 90Y and 90B, respectively, the previously energized relay, while deenergized at the same time that the section 84R, 84Y or 84B is deenergized, nevertheless maintains switch member 66R, 66Y or 66B, respectively in contact with the stationary contact 65R, 65Y or 65B, thereby insuring power supply for a predetermined interval to the appropriate section 60R, 60Y or 60B, respectively.

The dash-pots 90R, 90Y and 90B have the same time interval adjustment applied thereto so that they function alike and this common time interval is greater than the time interval for which the dash-pot 90 is adjusted. This in effect makes the respective section of the solenoid 60 operate for a predetermined short interval as a holding solenoid maintaining the member 59 in the appropriate selected position for the corresponding fuel control and before the respective switch 66 is deenergized, the relay 75 will be deenergized and the plunger 87 will engage in the serrated surface 89 to hold the member 59 in the adjusted control position.

This position is maintained mechanically in the present disclosure as described, and held until a new signal indication is received. In the event of failure, it will be noted that switch 81 moves to open circuit position. Member 87 moves to locking position. Member 59 through spring 73 moves to the low speed position. Switch 66 also moves to open circuit position.

Whenever it is desired, there may be provided on the instrument board or at any other suitable location within the vehicle, a signal mechanism which indicates the zone signal or speed for which the control is conditioned. Such a device is conventionally illustrated as a triple divided unit 104 and a line 105R leads to the red portion 104R of such signal device. 105Y leads to the yellow portion 104Y of the device and 105B leads to the blue portion 104B of the device. Thus when the respective inside signal is energized, the driver can note the zone color under which he is then travelling even though he might have forgotten what was the highway zone color imposed by the original signal.

For warning and patrol purposes, the signal 16 has been described as being a series of signals at the front and/or at the rear or visible from either or both directions and the like. Three signals are indicated. 16R is the red signal, 16Y the yellow signal and 16B the blue signal. These signals have a connection 106 with the power from the battery and herein the same is connected to line 76 for such purposes, although the line 106 may be connected directly to line 69 or directly to line 33. In the same manner, the common supply line 107 to the triple divided signal 104 need not be connected to the line 76 but may be connected to the line 69 or line 33, as desired.

Leading from each of the signals 16 are individual lines 108RUB and these, if both exterior and interior signal systems are employed, are connected in multiple with lines 105RYB by lines 109R, 109Y and 109B and to a switch contact 110R, 110Y and 110B, respectively. There is suitably secured to the extension 59*a* a contactable portion 111 having the offset portions as shown. The member 59*a* is grounded as at 112. The length and amount of offsetting is such that when the member 59*a* is under the influence or has been conditioned by section 60B, all three switch members 110 are in engagement with member 111 and thus all three signals 16 are energized and all three divisions of signal 104 are energized.

When the yellow signal has been received, which is the condition in which the invention is illustrated in Fig. 2 but two of the switches 110, to-wit, 110R and 110Y contact member 111 and only signals 16R and 16Y and divisions 104R and 104Y of signal 104 are energized. When the device has been actuated by section 60R of solenoid 60, only switch 110R engages member 111 and only signal 16R and only the red division of the signal 104 is energized.

By reversing the offsetting in member 111 and interchanging switch contacts 110R and 110B (which are of different length, all three signals 16 and/or 104 will be energized at low speed control and only 16B and/or 104B will be energized at high speed control.

Reference will now be had to Figs. 7 and 8. In these figures there is illustrated a modified form of the signal system and numerals similar to numerals employed in Fig. 2 are utilized herein but they are increased by two hundred. In this form of the invention the member 311 carried by the extension 259a is a block of insulation and nested therein in longitudinal and peripheral offset relation are the contacts 311R, 311Y and 311B in electric connection with member 259a grounded as at 312. The contacts 310R, 310Y and 310B are peripherally offset, as shown in Fig. 8 so that for any one of the three positions of the member 259a only one of the contacts or switch members 310 contacts the appropriate or corresponding registering contact segment 311. Each of these contact members 310 is connected by the line 309 to the appropriate line 308 and to the appropriate line 305, thence through the appropriate signal 216 and the appropriate signal section 304, the same in turn being connected to the common supply 306 and 307, respectively. These in turn may be connected either to line 76, 69 or 33 in Fig. 2.

The distinction between these two types of signal indication is that that shown in Fig. 2 insures that when the red signal is energized or a red signal is picked up, but one light is lighted showing the car is travelling at a high speed. When the yellow signal conditions the circuits but two signals are energized and when the blue signal conditions the circuit, all three signals are energized. Of course, if desired, the relative relationship between the member 111 and the switch members or fingers 110 may be reversed so that at high speed one signal may be energized and at low speed all three signals may be energized without departing from the scope of this invention. This arrangement permits the same colored lamps or lights to be utilized since it is the number of lamp units energized which exteriorly gives the zone indication and speed indication or different colored lights or lamps may be employed as well, thus giving both lamp color and number indications of the zone control imposed.

In the form of the invention, however, shown in Figs. 7 and 8, only a single signal, and this of colored character, is provided, the color corresponding or being equivalent to that of the safety zone in which the vehicle is travelling. Any one of these three signal indications may be employed and if desired, the exterior and/or interior signal indication arrangements may be employed or omitted, since primarily the invention is directed to vehicle speed control automatically imposed on the vehicle through roadside or highway signal indication, which indication is of illumination type and is not of electrical, magnetic or mechanical character.

In Fig. 9 is shown a modification of the invention whereby the mechanism for holding the imposed speed control between successive signal receptions which is illustrated in Figs. 2 and 7 as of mechanical type, is replaced by mechanism of electrical character and is further characterized by utilizing the moving means for the control valve actuating member as the holding means as well, and to this extent the present modification is a simplification and is the preferred form of the broad invention.

In Fig. 9 there has not been illustrated the addition of the signal devices for interior and exterior signalling as shown in Figs. 2, 7 and 8 but either modification may be added thereto as desired. If desired a simplification of that shown in Figs. 7 and 8 may be employed as shown in Fig. 9 which form is of selective color signal type, similar to that shown in Figs. 7 and 8 as distinguished from the successive signal type broadly illustrated in Fig. 2.

In Fig. 9 numerals indicating like or similar parts have been increased by three hundred and the letters have the prime designation addition.

It will be understood that the selective power supply lines are designated 346, 347 and 348 for the red, yellow and blue signal operations, respectively. The power solenoid 360 having sections 360R, 360Y and 360B moves the member 359 into selected position corresponding to the section energized by the selected signal circuit. These sections are grounded at 361 and member 359 is constrained by a light spring 373 retained by seat 374 toward the slow maximum speed or red position. This final position need not correspond to the red position but may be such that the fuel controlling valve 54 shown in Fig. 2 will be moved into closed position in the fuel passage in the event of failure. This would stop the vehicle and necessitate the driver locating and repairing the failure.

The system may be sealed in such a manner that to locate and repair the same (except for cell and light failure) breaking of the seal and removal of the cover to obtain access thereto will immediately energize another warning signal, and if the repair could not be made immediately the movable member 359 may be secured in vehicle low speed position to permit further travel to a service station. Such sealing and warning additions are quite common in the art and needs no illustration or further description for those skilled in this art.

As shown in Fig. 2, the power supply line 47 has been connected to the source of power and lines 46 and 48 are dead and line 69 is connected to the source of power. In Fig. 9, lines 369 and line 347 are considered similarly conditioned and lines 346 and 348 remain dead—only of course, until a red or blue signal has been imposed upon the system.

Solenoid RPUY' grounded at 371Y is energized which elevates core 372Y in opposition to light spring 367Y and closes switch 366Y'—366Y—365Y to supply current from line 369 through branch 368Y to line 363 to solenoid section 360Y, grounded at 361.

In a similar manner when line 346 is selectively connected to the power source, power is supplied to solenoid section 360R. Likewise, line 348 supplies power to section 360B.

In each of these instances, the system functions as illustrated in Fig. 2 and as previously described.

Associated with each movable core 372 are two other switch members designated 401 and 402 with the proper letter R, Y or B. Spaced contacts 403 and 404 and 405 and 406 are respectively associated therewith.

Line 407 branches from line 363 and terminates at contact 403R. Line 408 branches from line 362 and terminates at contact 405Y. Line 409 branches from line 364 and terminates at 405R. Line 410 branches from line 346 ahead of solenoid RPUR' and terminates at contact 405B. Line 411 branches from line 347 ahead of solenoid RPUY' and terminates at contact 403B. Line 412 branches from line 348 ahead of solenoid RPUB' and terminates at contact 403Y. Line 413 connects contact 406R to contact 404Y. Line 414 connects contact 404R to contact 404B. Line 415 connects contact 406Y to contact 406B.

With the "yellow'" control imposed, the solenoid RPUY' is energized supplying power to section 360Y and simultaneously through line 407, member 401R, line 414, member 401B and line 411. Thus power is supplied from line 369 to solenoid RPUY' to maintain the latter energized until a different signal control is imposed. In each group of switches two are normally closed and one normally open and upon control imposition, the reverse conditioning occurs.

No further explanation is believed necessary except to state that each solenoid RPU—' may be energized and will be held energized until a new control is imposed, and that the respective section of solenoid 360 will be energized and remain energized until a new control is imposed.

The foregoing system modification accomplishes electrically the holding function between signal receptions, and utilizes the "moving" solenoid as the holding means and thus distinguishes from "common" mechanical type holding of the valve 54 by member 87*a* as illustrated in Fig. 2.

Leading from each of lines 362, 363, 364 are the lines 509R, 509Y and 509B which selectively supply power to lines 505R, 505Y and 505B and lines 508R, 508Y and 508B to energize the respective signals 516R, 516Y and 516B and 504R, 504Y and 504B all grounded at 507.

While the invention has been described and illustrated in great detail in the foregoing description and the drawings, respectively, the same, as has been repeatedly stressed, is merely an exemplification of the broad invention, and such description and drawings are to be considered as illustrative and not restrictive in character.

The various modifications hereof which have been illustrated and/or described herein as well as others which have been pointed out as possible modifications, together with those which will readily suggest themselves to persons skilled in this art, are all considered to be within the broad scope of this invention reference being had to the appended claim.

The invention claimed is:

In a highway traffic control system, a plurality of different permissive maximum speed zones, each speed zone having a different color indication, a plurality of selectively color responsive photo-electric cell devices, corresponding to the number of different speeds and color indications employed, an electric operable device for each cell device, a group of switches for each electric device, each group including individual switches equal to the number of cell devices, all switches but one in each group being normally of closed circuit character and the remaining one being normally of open circuit character, all switches of the group being movable into opposite circuit position upon electric device operation, series circuits each including a normally open switch of one electric device and a normally closed switch of each other electric device, and selectively operable means of the vehicle controlled by the respective series circuits when closed.

ELMER L. GOLDSMITH.

Nov. 10, 1931. E. L. GOLDSMITH ET AL 1,830,996

CASTER CONSTRUCTION

Filed May 31, 1930

FIG. 1

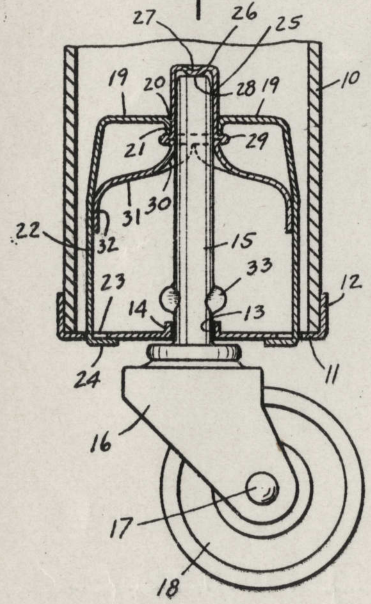


FIG. 2

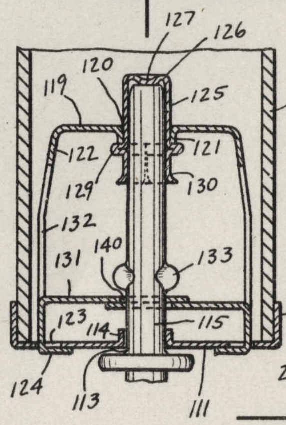


FIG. 3

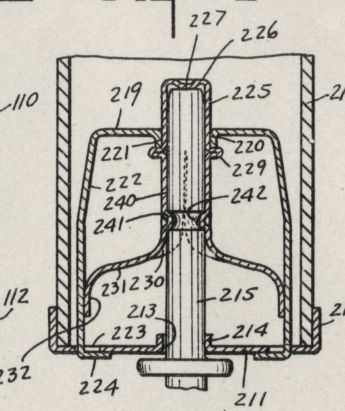


FIG. 4

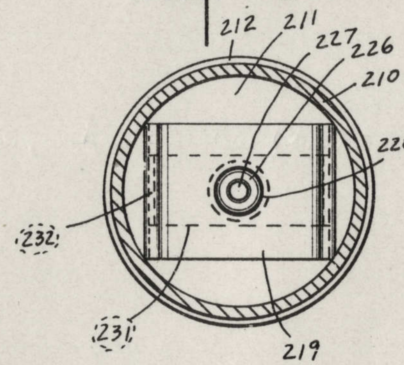
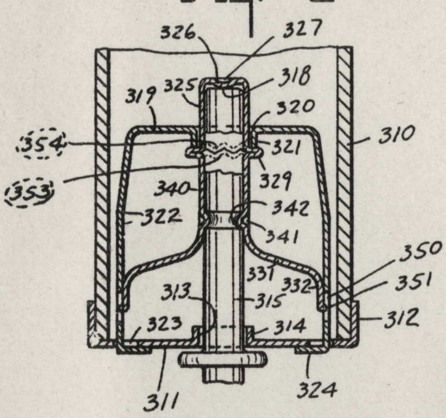


FIG. 5



INVENTORS.
ELMER L. GOLDSMITH.
WILLIAM H. NOELTING.

BY

Lockwood Lockwood Goldsmith & Galt

ATTORNEYS.

Patented Nov. 10, 1931 1,830,996

UNITED STATES PATENT OFFICE

ELMER L. GOLDSMITH, OF INDIANAPOLIS, AND WILLIAM H. NOELTING, OF EVANSVILLE, INDIANA, ASSIGNORS TO THE FAULTLESS CASTER COMPANY, OF EVANSVILLE, INDIANA, A CORPORATION

CASTER CONSTRUCTION

Application filed May 31, 1930. Serial No. 458,571.

This invention relates to a caster construction suitable for tubular legs such as the metal bed industry now employs.

The chief object of the invention is to provide a caster retaining frame which may be detachably mounted on a tubular leg of the aforesaid character for transmitting the load to the caster stem and rotatably support said caster stem at at least two spaced annular portions to prevent stem cocking and more especially to provide a top bearing for free swiveling of the stem.

One feature of the invention consists in the provision of an inverted U-shaped frame which supports a cylindrical stem receiving socket, the closed end of which provides a top bearing for the end of the caster stem and which extends an appreciable distance into the central chamber of the frame and which, in a plurality of forms of the invention, is extended for association with the arms of the frame and which in one of the aforesaid forms of the invention, is further arranged for detachably retaining a caster stem in the frame work construction when a detachable type caster and socket are desired.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

In the drawings, Fig. 1 is a central sectional view of a load sustaining leg, a caster socket, and an elevational view of a caster mounted therein.

Fig. 2 is a substantially similar view of a modified form of the invention, the caster yoke and wheel being omitted.

Fig. 3 is a similar view of a modified form of the invention, the caster yoke and wheel being omitted.

Fig. 4 is a top plan view of the socket illustrated in Fig. 3, showing the same mounted upon a tubular load sustaining member, the latter being shown in transverse section.

Fig. 5 is a central section of a modified form upon which all claims read.

In the drawings, 10 indicates a tubular leg which herein is illustrated as of a cylindrical outline and which rests upon a load sustaining plate 11, having the upturned ornamental flange 12 surrounding the end of the leg 10. Plate 11 has a central aperture 13 defined by an upturned collar 14. Rotatably mounted in said opening, which is the central opening, and rotatably supported by the collar is a caster stem 15 which supports a yoke 16, in turn supporting through the axle 17 a caster wheel 18. An inverted substantially U-shaped frame having the horizontal transverse portion 19, is centrally apertured as at 20 and the same is defined by an annular collar 21 extending, in this instance, angularly and towards the collar 14. Each arm 22 extends downwardly from the transverse portion 19 and herein the arms are positioned upon opposite sides of the transverse strip portion 19 and extend through apertures 23 formed in the plate 11. The lower free ends of the arms are turned angularly as at 24 and herein the ends are turned inwardly and towards each other. The length of the radial slot 23 is greater than the thickness of the arm 22, thereby permitting the arm to spring or flex outwardly and likewise flex inwardly, if desired, particularly for mounting purposes and also for accommodation relative to the various internal diameters of tubular legs of the same commercial size. The length of the angular end 24 is greater than the length of the open slot 23 so that each arm is prevented against longitudinal separation relative to the supporting plate.

In the central opening 20 is mounted a cylindrical stem receiving bearing or socket tube 25 which extends outwardly and upwardly beyond the central opening and terminates in a closed end 26, which herein shown as indicated at 27, providing a top bearing for the end 28 of the stem 15. The top bearing and lateral confining tube is retained against longitudinal displacement from the socket opening 20 by the flange 29 formed integral with and by laterally enlarging a portion of the tube. The tube is formed of a single strip of metal doubled upon itself and each free end beyond the flange, as shown in Fig. 1, is flared outwardly as at 30 and in Fig. 1 the same is extended laterally and downwardly as at 31 and terminates in a vertical portion 32, substantially parallel to the arm portion and arranged to bear or slide thereon inward flexing of the arm slides the arm upon the reinforcing strut extension of the tube. This arrangement insures longitudinal alignment of the tube in the socket opening 20 and likewise insures outwardly extension of the arms into engagement with the side walls of the tubular load object 10.

In Fig. 1 the caster socket and the caster are shown as a permanent combination and the caster stem is prevented from axial separation or dropping out of the socket by having a suitable enlargement and herein a pair of oppositely directed wings 33 are shown. These are positioned immediately above collar 14. The caster stem, therefore, has some axial movement and is of the free swiveling type and is of the top bearing type.

Fig. 2, a modified form of the invention, is illustrated and in this figure, numerals of the one hundred series indicate similar parts. The load 110 supported by the plate 111 centrally apertured as at 113, is provided with collar 114 which rotatably supports the caster stem 115. The plate may be provided with the ornamental peripheral portion 112, if desired. The U-shaped arms 122 depend from the transverse portion 119 which is centrally apertured as at 120 and defined by collar 121. Said aperture and collar receives the tubular socket member 125, terminating in the closed end 126 and suitably fashioned for pivotal bearing as at 127. The tube retained against longitudinal displacement and separation by the lateral enlargement 129 and the ends of the strip forming the tube are extended angularly and flared outwardly as at 130 for stem reception. The caster stem 115 is laterally enlarged as at 133 but instead of this enlargement being immediately above collar 114, the same is positioned above the laterally directed wings 131 of the tongue portion struck from the arm portion 122, as by slotting the central portion thereof as at 132.

Each tongue extends toward the opposite tongue and overlaps the same and each terminates in a recess 140 which is of considerable larger diameter than the stem 115 so that lateral binding upon the stem by said tongues is prevented.

The lower ends of each of the arms 122 extend inwardly and laterally as at 124 and the arms themselves pass through the elongated radial positioned slots 123 in the plate.

In this form of the invention the tongues in a sense, constitute a stem centering portion and are associated with the lower portion of the inverted U-shaped spring frame, whereas the tongues 31, see the modification shown in Fig. 1, are associated with the upper portion of the U-shaped spring.

Fig. 3 illustrates a modification of the invention which not only embodies a detachable type or relationship between the caster stem and the socket but which illustrates a modification wherein the elongated cylindrical top bearing socket is extended inwardly, downwardly and outwardly into co-operating relationship with the lower portion of the inverted U-shaped frame.

In this figure similar parts are indicated by numerals of the two hundred series. For example, 210 indicates the tubular leg, 211 the load supporting plate, 212 the leg mount flange peripherally enveloping the leg, 213 the central plate aperture, 214 the collar defining the same, 215 the caster stem rotatably supported thereby. The inverted U-shaped frame includes the portion 219, terminating in downwardly extending arms 222, each of which passes through a radially elongated slot 223 in the plate and terminates in an angularly and inwardly extended end 224, which unites the inverted U-shaped strip to the plate for transmitting the load from the plate to the caster stem and through the elongated cylindrical top bearing and laterally centering tube 225, mounted in the aperture 220 defined by the inwardly directed collar 221.

Said tube 225 terminates in the closed end 226 and a pivot formation 227 is formed therein. The tube is prevented from longitudinal displacement outwardly on the application of load by the end portions of the strip forming said tube being extended laterally as at 229. The ends of the tube are extended inwardly and substantially parallel to the top portion of the tube as at 240 for centering the tube and each portion is indented as at 241 for yieldingly seating in groove 242 formed in the stem 215. The aforesaid yieldingly retains the stem in association with the caster socket. Each end of the strip forming the tube is flared outwardly as at 230 for facility in seating the stem in the tube.

The flared portions 230 in the present form of the invention are extended as at 231 downwardly and outwardly toward the arm portions and terminate in longitudinally directed portions 232 which engage the arm portions 222 of the inverted U-shaped frame and coact therewith substantially as set forth relative to the similar portions illustrated in Fig. 1.

In the forms of the invention illustrated in Figs. 1, 2 and 3, the tube was assumed to be press fitted into the horizontal portion of the spring frame. However, the tube may be loosely mounted therein. When so mounted rotation thereof is to be prevented. Herein the collar 321 has a serrated edge 354 engaged by the corresponding wave-like or corrugated portion 353 of the tube bead or collar 329. Also if desired the spring arm 322 may be slotted (see also Fig. 2) and the outwardly extending portion 331 of the cap which includes portion 332 slidable on arm

322 may include a reduced interlocking transverse extension 351 seatable in slot 350 of arm 322.

In all of the forms of the invention shown in Figs. 1, 2, 3 and 5, the ends of the frame immediately above plate 11, 111, 211 and 311, respectively, may be reduced in width, permitting a narrow slot 23, 123, 223 and 323, to be formed in the supporting plate or the full width angular end may be employed and associated therewith the full width slot.

The invention claimed is:

1. The combination with a tubular leg, a load supporting centrally apertured plate, and a caster having a stem swiveled therein for supporting the leg, of an inverted U-shaped frame having its lower ends connected to the plate but permitting transverse separating movement of the arms for engagement with the interior of said leg, said frame including a central aperture in alignment with the plate aperture, an elongated closed end cylindrical tube seatable in the frame aperture and connected with the plate and only through the arms thereof, said tube including a lateral enlargement intermediate its ends and positioned within the frame for preventing outward axial movement of the tube in the frame, said tube including a flared mouth for stem reception.

2. The combination with a tubular leg, a load supporting centrally apertured plate, and a caster having a stem swiveled therein for supporting the leg, of an inverted U-shaped frame having its lower ends connected to the plate but permitting transverse separating movement of the arms for engagement with the interior of said leg, said frame including a central aperture in alignment with the plate aperture, an elongated closed end cylindrical tube seatable in the frame aperture and connected with the plate and only through the arms thereof, said tube including a lateral enlargement intermediate its ends and positioned within the frame for preventing outward axial movement of the tube in the frame, said tube including a flared mouth for stem reception, and means extending transversely from a point of stem contact to the adjacent frame arm and operatively associated therewith.

3. The combination with a tubular leg, a load supporting centrally apertured plate, and a caster having a stem swiveled therein for supporting the leg, of an inverted U-shaped frame having its lower ends connected to the plate but permitting transverse separating movement of the arms for engagement with the interior of said leg, said frame including a central aperture in alignment with the plate aperture, an elongated closed end cylindrical tube seatable in the frame aperture and connected with the plate and only through the arms thereof, said tube including a lateral enlargement intermediate its ends and positioned within the frame for preventing outward axial movement of the tube in the frame, said tube including a flared mouth for stem reception, and means extending transversely from a point of stem contact to the adjacent frame arm and operatively associated therewith, said means comprising oppositely directed extensions on said tube and terminating in free ends bearing upon said arms.

4. A caster socket including a centrally apertured load sustaining plate, an inverted U-shaped frame having an aperture therein in alignment with the plate aperture and an inwardly directed coller defining the same, a tube having a closed end and mounted within said frame aperture and having an enlargement opposite the closed end and engaging the collar for limiting axial separation of the tube and frame, said tube having a flared open end for stem reception.

5. A caster socket including a centrally apertured load sustaining plate, an inverted U-shaped frame having an aperture therein in alignment with the pla e aperture and the inwardly directed collar defining the same, a tube having a closed end and mounted within said frame aperture and having an enlargement opposite the closed end and engaging the collar for limiting axial separation of the tube and frame, said tube having a flared open end for stem reception, said flared end of the tube comprising a pair of outwardly and downwardly extending extensions terminating adjacent the frame and bearing upon the arms thereof.

6. A caster socket including a centrally apertured load sustaining plate, an inverted U-shaped frame having an aperture therein in alignment with the plate aperture and the inwardly directed collar defining the same, a tube having a closed end and mounted within said frame aperture and having an enlargement opposite the closed end and engaging the collar for limiting axial separation of the tube and frame, said tube having a flared open end for stem reception, said flared end of the tube comprising a pair of outwardly and downwardly extending extensions terminating adjacent the frame and bearing upon the arms thereof, said tube intermediate the lateral enlargement and the frame arm engaging portion including an inwardly directed stem seating portion for frictionally retaining a stem within the tube and plate.

7. The combination with a tubular leg, a load supporting centrally apertured plate and a caster having a stem swiveled therein for supporting the leg of an inverted U-shaped frame having its lower ends connected to the plate but permitting transverse separating movement of the arms for engagement with the interior of said leg, said frame including a central aperture in alignment with the plate aperture, an elongated closed

end cylindrical tube seatable in the frame aperture and connected with the plate and only through the arms thereof, said tube including a lateral enlargement within the frame for preventing outwardly axial movement of the tube within the frame, said tube including a flared mouth for stem reception, the tube enlargement having a wave like corrugation and said frame including a collar defining the central aperture and extending inwardly toward the plate and having serrated edge for nonrotative connection with the tube enlargement.

8. The combination with a tubular leg and load supporting central apertured plate and a caster having a stem swiveled therein in supporting the leg in an inverted U-shaped frame having its lower ends connected to the plate but permitting transverse separating movement of the arms for engagement with the interior of said leg, said frame including a central aperture in alignment with the plate aperture, an elongated closed end cylindrical tube seatable in the frame aperture and connected with the plate and only through the arms thereof, said tube including a lateral enlargement within the frame preventing outward axial movement of the tube in the frame, said tube including a flared mouth for stem reception, and means extending transversely from the point of stem contact to the adjacent frame arm and operatively associated therewith, said means comprising oppositely directed extensions on said tube and terminating in free ends bearing upon said arms, each frame arm including an elongated slot therein and said tube extensions terminating in transverse portions slidable in said slots.

9. The combination with a tubular leg and load supporting central apertured plate and a caster having a stem swiveled therein in supporting the leg in an inverted U-shaped frame having its lower ends connected to the plate but permitting transverse separating movement of the arms for engagement with the interior of said leg, said frame including a central aperture in alignment with the plate aperture, an elongated closed and cylindrical tube seatable in the frame aperture and connected with the plate and only through the arms thereof, said tube including a lateral enlargement within the frame preventing outward axial movement of the tube in the frame, said tube including a flared mouth for stem reception, and means extending transversely from the point of stem contact to the adjacent frame arm and operatively associated therewith, said means comprising oppositely directed extensions on said tube and terminating in free ends bearing upon said arms, each frame arm including an elongated slot therein and said tube extensions terminating in transverse portions slidable in said slots, said tube enlargement having a wave like corrugation and said frame including a collar defining the central aperture and extending inwardly toward the plate and having a serrated edge for nonrotative connection with the tube enlargement.

10. The combination with a tubular leg, a load supporting, centrally apertured plate, and a caster having a stem swiveled therein for supporting the leg, of an inverted U-shaped frame having its lower ends connected to the plate but permitting transverse movement of the arms for engagement with the interior of said leg, said frame including a central aperture in alignment with the plate aperture, an elongated closed end cylindrical tube seatable in the frame aperture and connected with the plate and only through the arms thereof, said tube including a lateral enlargement intermediate its ends and positioned within the frame for preventing outward axial movement of the tube in the frame, and wings extending transversely from adjacent points of stem contact to the adjacent frame arms and operatively associated therewith.

In witness whereof, we have hereunto affixed our signatures.

ELMER L. GOLDSMITH.
WILLIAM H. NOELTING.

Oct. 21, 1924. 1,512,218

E. L. GOLDSMITH

ARCH SUPPORTER

Filed Oct. 23, 1922

FIG. 1

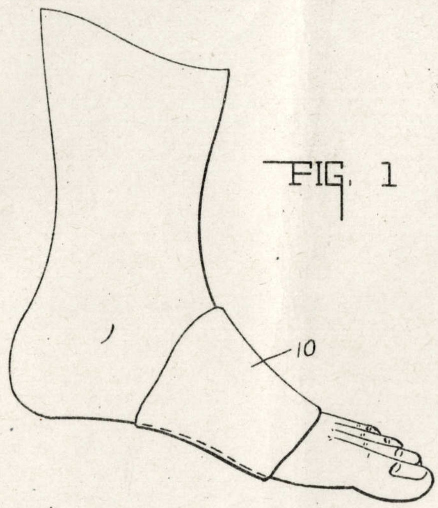


FIG. 2

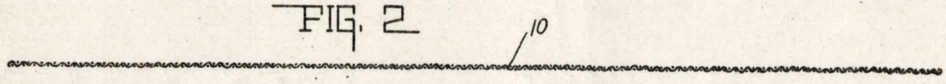


FIG. 3

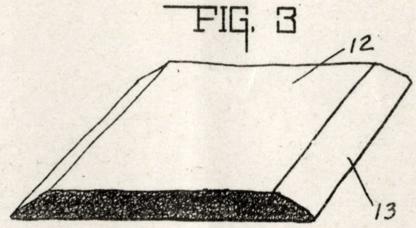
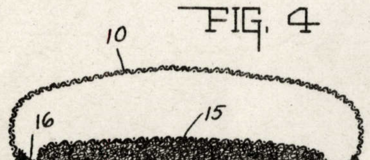


FIG. 4



INVENTOR.
ELMER L. GOLDSMITH
BY

ATTORNEYS.

Patented Oct. 21, 1924. **1,512,218**

UNITED STATES PATENT OFFICE.

ELMER L. GOLDSMITH, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO FRANK T. CUTSHAW, OF INDIANAPOLIS, INDIANA.

ARCH SUPPORTER.

Application filed October 23, 1922. Serial No. 596,458.

To all whom it may concern:

Be it known that I, Elmer L. Goldsmith, a citizen of the United States, and a resident of Indianapolis, county of Marion, and State of Indiana, have invented certain new and useful Arch Supporters; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which like numerals refer to like parts.

This invention relates to the process of making an arch supporter which is particularly a metatarsal corrective device of the character shown in Patent No. 1,091,931, dated March 31, 1914.

The chief feature of the invention consists in the simplified method and process of manufacture, and the resultant construction.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims.

In the drawings Fig. 1 is a perspective view of a human foot to which the arch supporter has been applied. Fig. 2 is a side elevational view of the band which forms the pocket and the enveloping foot portion. Fig. 3 is a perspective view of one form of pad associated with the band. Fig. 4 is a cross sectional view of the arch supporter showing the same in assembled relation.

In the drawings there is illustrated an elongated yielding strap 10, and said elongated yielding strap 10 preferably contains elastic material, so that it will yield. The strap 10 is of sufficient length so as to encircle the foot at the arch and include sufficient material at the overlapping ends to provide a pocket shown in Fig. 4, and indicated by the numeral 11. In this pocket 11, there is positioned a pad 12 having the beveled or reduced ends 13, which reduced ends extend transversely across the foot when in the pocket, and, therefore, extend longitudinally of the strap.

The process consists in turning the two ends of the strap and positioning the same in overlapping relation and securing said ends to the adjacent body portion of the strap so as to form an encircling band and simultaneously form a pocket. The length of the pocket preferably is sufficient so that the pad therein supports the entire width of the foot. In Fig. 4 it will be noted that one end 15 is secured at 16 to the strap 10, and the other end 17 is secured at 18 to the band. Thus, the end 15 forms the inner wall of the pocket, and the end 17 forms the outer wall of the pocket, and both ends 15 and 17 form a portion of the band.

With this construction it will be noted that a pocket is formed which is adapted to receive pads 12 of different sizes, that is, so far as thickness is concerned, since the pocket material is yielding. Likewise, since said pocket material is yielding, the same will rigidly position the pad and prevent movement thereof in the pocket.

Another feature is that the band is adapted to adjust itself to the foot of the wearer and readily conform thereto. Likewise, the supporter is so constructed as to be reversible, in that the supporter may be turned inside out and serve equally as well, should it be necessary so to do. Furthermore, the band is adapted to be used upon the right foot or the left foot, and will conform to either.

The process of forming the arch supporter eliminates considerable labor and extra methods. It is noted that but two sewings are required, namely, that at 16 and that at 18, and by the term sewing is meant securing, as other means may be used to secure the ends of the strap into band formation and simultaneously provide a pocket.

The invention claimed is:

1. A supporter comprising an elastic elongated strap having overlapping ends secured to the strap to simultaneously form an adjustable pocket adapted to receive a pad and a foot-enveloping contractible band.

2. A supporter comprising an elongated strap having overlapping ends secured to the strap to simultaneously form a pocket and a band.

3. A supporter comprising an elongated strap having overlapping ends secured to

the strap to simultaneously form a pocket of substantially the full width of the strap, and a band.

4. A supporter comprising an elastic elongated strap having overlapping ends secured to the strap to simultaneously form an adjustable pocket of substantially the full width of the band and adapted to receive a pad, and a foot-enveloping contractible band.

In witness whereof, I have hereunto affixed my signature.

ELMER L. GOLDSMITH.

March 26, 1940. C. R. MYERS 2,195,255

ELECTRIC TEMPO DEVICE

Filed Sept. 27, 1937.

FIG. 1

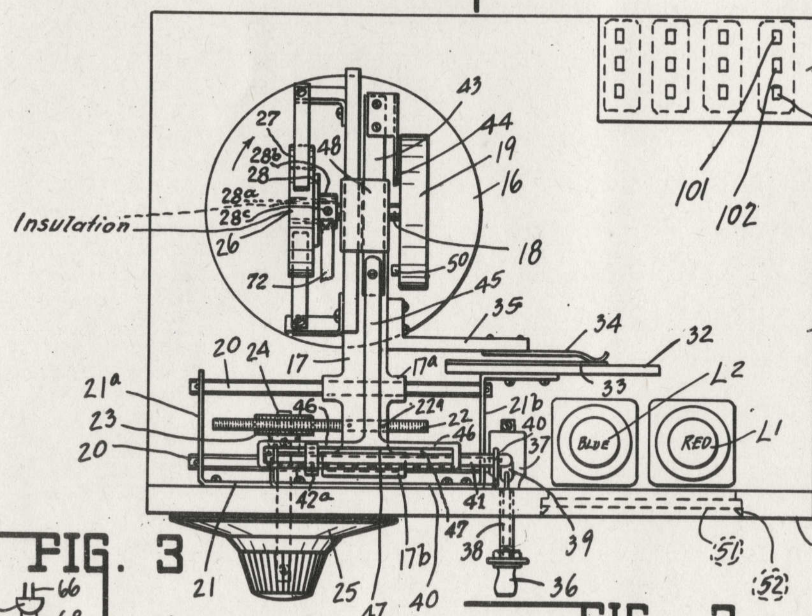


FIG. 3

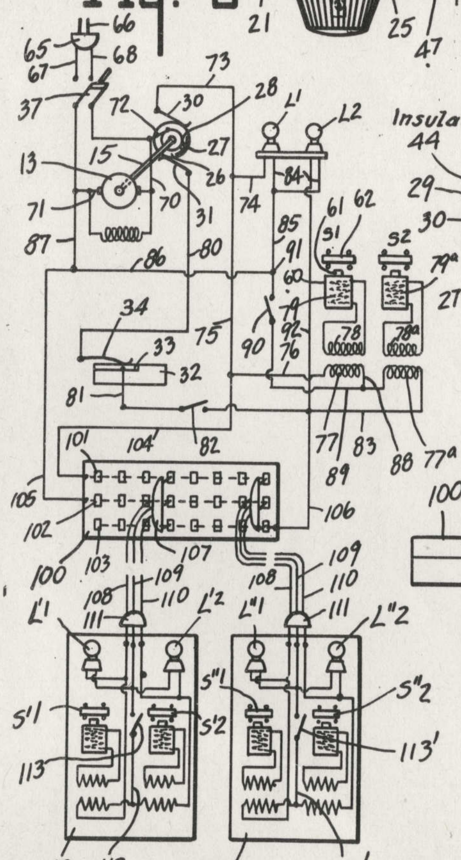
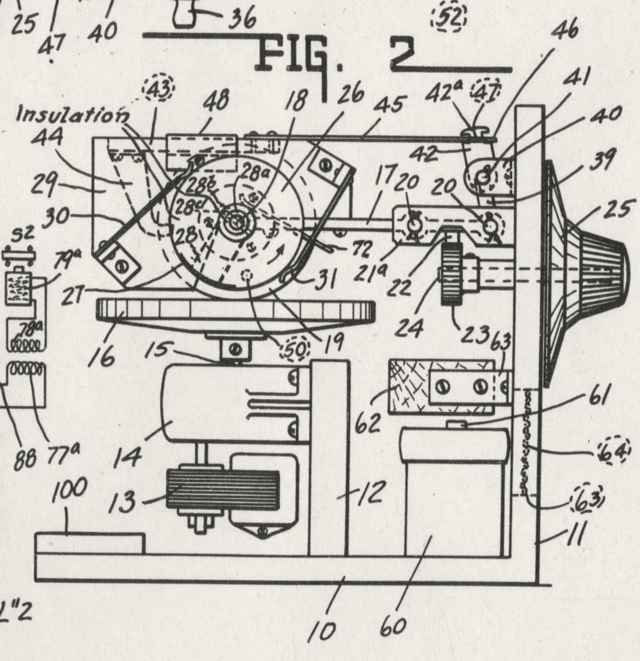


FIG. 2



INVENTOR.
CHARLES R. MYERS.

BY Lockwood Goldsmith & Galt
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,195,255

ELECTRIC TEMPO DEVICE

Charles R. Myers, Indianapolis, Ind.

Application September 27, 1937, Serial No. 165,875

5 Claims. (Cl. 58—130)

This invention relates to an electric tempo device.

The chief object of this invention is to provide a device in its simplest form such that it will positively indicate to the conductor of a band, orchestra, symphony, or the like, the exact beat or time.

Another object of the invention is to provide a device which may be so arranged that it will individually indicate to each musician, when desired, the same beat or time.

The device has particular utility when employed for the purpose of synchronizing the orchestration with a performance, such as various dancing acts, floor-shows, and the like, which particularly emphasize eccentric, aesthetic and acrobatic dancing.

It has been the experience of orchestra, band and like leaders when playing for performances that a slight difference in time of the orchestration with reference to the dancing act frequently mars the performance. The present invention, therefore, permits the orchestra leader, for example at rehearsal, to employ the device and record the timing which is satisfactory to the performer, or performers, and at the performance, or performances, and on the same and/or successive days have this selected timing automatically imposed on the orchestration. Thus, the sole responsibility for synchronization between orchestra and performance rests solely upon the performer, or performers, following agreement at rehearsal.

The device is capable through manual adjustment, of securing this same synchronization for a plurality of different numbers in the same or subsequent performance. The conductor in this instance serves, as it were, a central control station operator.

Upon receipt of the score and at rehearsal, the conductor, when the timing has been agreed upon between the performer and the conductor, notes the dial reading of the manual adjuster on that score. It is contemplated also that ultimately various scores will be initially indicated when written so that any conductor having a standard tempo device of the character described, need not go through the rehearsal, scale reading, determination just specified but will merely set the dial to the designated scale reading and proceed with the initial rehearsal in order to become familiar with the orchestra music, thus saving considerable time.

The chief feature of the device is that it is capable of indicating 4—4; 3—4 (waltz); 2—4 and 1—4 tempo. All other tempos, such as 12—8; 6—8, et cetera, may be worked out by the operator.

Other objects and features of the invention will be set forth more fully hereinafter in the detailed description of the device and associated system.

The full nature of the invention will be understood from the accompanying drawing and the following description and claims.

In the drawing,

Fig. 1 is a top plan view of the portion of the device, parts being omitted for clearness.

Fig. 2 is an end elevation of the device, parts being omitted for clearness.

Fig. 3 is a diagrammatic wiring diagram of parts of the device and the electrical system including the same.

In the drawing there is illustrated the operative portion of an electric tempo device and Figs. 1 and 2 more especially represent portions of the master control station. The device is illustrated without a complete container but this is merely for purposes of clearness.

In Figs 1 and 2, **10** indicates a base and **11** a face plate. Mounted on the base is a support **12** which suitably supports in turn an electric motor **13** which through a speed reducing device **14** drives a shaft **15** in turn rotating at a predetermined speed a friction disc **16**. As cantilever support **17** is moved—see Fig. 1—from slightly off center radially to the right, the speed of rotation of the shaft **18** increases.

The cantilever support **17** includes two bearings **17a** and **17b** and the same slidably receive the bars or rods **20** carried by the bracket members **21**, **21a** and **21b**. The cantilever member **17** has suitably secured to it as at **22a**, the rack **22** which meshes with the pinion **23** carried by a shaft **24** that extends through the face plate **11** and mounts on its exposed end the dial member **25**. Thus, as the dial member is rotated clockwise, the friction wheel **19** is caused to move toward and away from the center of the disc **16**, thereby determining the speed of rotation of the shaft **18** which is associated with a cyclically operable switch arrangement, hereinafter to be set forth.

The shaft **18** mounts an insulation disc **26** having on its periphery a metallic segment **27** and this segment is in electrical contact with an arm **28** preferably insulated at **28a** from the shaft **18**. Said arm **28** includes a hub portion **28b** which may be engaged by a spring contact finger **72**, so that electrical energy may be continuously supplied to the segment 27 during the rotation of shaft 18. Hub 28b is pinned by an insulation pin 28c.

The cantilever support 17 in turn supports an insulated block or plate 29 and suitably secured thereto in diametrical relation with respect to shaft 18 are the spring fingers 30 and 31. Thus, in each rotation of the disc 26 current will be supplied for a limited period to any device electrically connected to the spring finger 30 and similarly to any device electrically connected to the spring finger 31, except as hereinafter set forth.

The member 21b supports an insulation plate 32 which mounts a metallic strip 33 and the same is adapted to be engaged by a spring finger 34 carried by an arm 35 in turn carried by the cantilever support member. Thus, as member 17 is moved to the left or right for switch speed adjustment, switch 34 may or may not be in electrical contact with plate 33. At relatively high speeds of rotation of shaft 18, there will be an open circuit between finger 34 and the metallic conductor or strip 33, and the purpose of this automatic cutout arrangement will be set forth hereinafter.

There is mounted on the face plate 11 a switch member 36 which controls a switch structure indicated generally in Fig. 1 by the numeral 37, and indicated specifically in Fig. 3 by the numeral 37. This is the master switch. It, as hereinafter to be set forth, supplies energy to the motor and to the electric signals. This switch is mentioned at this point for the purpose of describing the immediate following control, to-wit; movable with the switch member 36 is a member 38 which is connected to a lever arm 39 pivotally supported in bracket 40—see Figs. 1 and 2—and the lever arm 39 rocks a shaft 41 carrying an arm 42.

Slidably supported by the member 17 is the element 43 which has secured to it in depending relation a hook 44—see more especially Fig. 2. A bar or strip 45 is secured to the opposite end of member 43 and its opposite end is elongated in opposite directions, as indicated at 46. In effect, therefore, members 45 and 46 constitute a T-shaped structure and the head of the T is slotted as at 47. This is an elongated slot and the headed portion 42a of the member 42 is seated therein. Member 43 is slidably supported, as stated, in the member 48 shown in Figs. 1 and 2, carried by arm 17 and member 29.

The purpose of the aforesaid mechanism is as follows: When the switch member 36 is pushed in to open the motor circuit, the shaft 41 is rocked clockwise—see Fig. 2—and member 45 together with member 43 is moved to the right—see Fig. 2—or toward the face 11—see Fig. 2. This moves the hook 44 into position immediately adjacent the side of the wheel 19 and the wheel 19 on that face carries a pin 50 which in the rotation counterclockwise of wheel 19 seats in the hook portion and thus further rotation of the wheel 19 is prevented, even though the momentum of the rotating parts be such that the armature of the motor and the various other associated parts, including the disc 16, continues or attempts to continue to rotate. The driving connection between the friction wheel 19 and the friction wheel 16 is such should there be additional rotational movement after the energy to the motor 13 is cut off, the friction wheel 19 will always remain in this position until the circuit is again closed.

When the circuit is closed by pulling out on switch 36 to secure motor operation, the hook 44 is withdrawn and the cyclic switch device always starts the signal indications in predetermined relation so that upon successive initiation of operation, the signals will always be started at the same relative time with reference to the period of rotation.

The device includes a pair of visual signals in the form of lamps. Herein the lamp L1 is indicated as of red color and the other lamp L2 is indicated as of blue color. They are secured either on the base or by a bracket carried by the face plate, as desired, and are visible through the transparent or translucent closure 51 in the opening 52 in the face plate.

There is also supported by the base 10 an audible signal 60 which has a plunger 61 therein, and the same is actuated by a solenoid 79 which causes the plunger to elevate and strike a sounding block 62 suitably supported as at 63—see Fig. 2. Two of these sounding block signals are provided—see Fig. 3—although only one is shown in Fig. 2. For clearness, as stated, certain parts have been omitted in certain of the figures, to-wit, the visual signals shown in Fig. 1 are not shown in Fig. 2 and the audible signal devices shown in Fig. 2 are not illustrated in Fig. 1. The face plate 11 is apertured as at 63 adjacent the audible signals S1 and S2 and the opening is closed by an ornamental screen 64 through which the tone is heard.

Reference will now be had to Fig. 3 which is the wiring diagram, and which shows the several electrical connections. In said figure, 65 indicates a terminal plug with the prongs 66 adapted for connection to any conventional outlet socket. The cord or cable includes the two lines 67 and 68. These are controlled by the switch 37 previously referred to and illustrated in Fig. 1 in elevation. The line 68 controlled by the switch 37 has one branch 70 connected to the electric motor 13. The other line 67 is similarly connected to the motor as at 71. The line 68 is connected to the contact finger 72 before mentioned, which rides on the hub of the member 28 and insulated from the shaft 18. The segment 27 is shown in this figure on the disc 26; likewise, the member 28. The two fingers 30 and 31 are similarly illustrated. A line 73 connects by one branch 74 to the red master light signal L1 and another branch thereon 75 connects by line 76 to one terminal of the primary 77 of a transformer the secondary 78 of which is connected to the winding 79 of the audible signal 60 having the striker 61 for engaging the sounding block 62, the unit being designated in Fig 3 not only by these numerals but also by the designation S1.

The other switch finger 31 is connected by line 80 to the spring finger 35 and the terminal bar 33 (on the insulated plate 32) is connected by line 81 to one terminal of the switch 82 and the other terminal of switch 82 is connected by line 83 to one terminal of the primary winding 77a, of a transformer, the secondary 78a of which is connected to a solenoid 79a of the second audible signal S2 having the striker and sounding block as shown, said second audible signal unit being designated in Fig. 3 by the symbol S2.

The two lines 84, constituting the return from the two visual signals L1 and L2, are connected to line 85, in turn connected by line 86 to line 87, in turn connected to line 67. The other two terminals of the two primary windings of the transformers 77 and 77a are connected by lines 88 to line 89 which includes a switch 90 and line 89 therefrom is connected at 91 to the line 85.

The operation of the master tempo device is as follows:

When the switch member 36 is actuated to energize the device, including the electric motor, after the dial has been properly adjusted to the desired position corresponding to the tempo desired, the initial positioning device (hook 44) is retracted and maintained in the retracted position as long as the master switch 37 is closed. In the rotation of the disc switch, current is alternately supplied to switch contact fingers 30 and 31. Current supplied to switch contact finger 30 energizes the visual signal L1 and at the same time energizes the primary winding 77 of the audible signal S1 to secure an audible tone from the block 62. This latter signal indication is obtained provided the switch 90 is in closed relation. If in open circuit relation, as illustrated in Fig. 3, the audible signal S1 will not be sounded. In certain types of programs the audible signal would be of very interfering character and consequently there is provided this manual cutout. This switch is not shown in Figs. 1 and 2 for clearness.

Current supplied to switch contact 31 is supplied through the switch 35—33 and the switch 82 to the signal L2 by line 92. This line 81 also supplies energy by line 83 to the primary of the second audible signal S2 unless the switch 90 is in open circuit relation as shown in Fig. 3. It will thus be noted that switch 90 is adapted to simultaneously cut out both audible signals.

It has been previously set forth that if the speed of rotation of the disc 26 is sufficiently great, the movable parts shown in Fig. 1 will be shifted sufficiently to the right so as to have the switch member 34 engage the insulated portion 32 and not the metallic terminal switch 33. In this event the switch 35—33 would be in open circuit relation and in that even no current would be supplied either to the audible signal S2, even if switch 90 were closed, and the visual signal L2 as well.

If the device is arranged for 4—4 time, the signal L1, for example, and then signal L2 will be energized in succession, giving the desired tempo or beat as set forth initially herein, and repeating same. In the event the tempo increases, then automatically the beat is but a single beat or indication such as L1 only for each revolution of the cyclic switch disc 26. For waltz time, the switch 82 is utilized. This cuts out signals L2 and S2 so that only signal L1 is energized. Possibly signal S1 (if switch 90 is closed) is energized, but to secure waltz time, the single light L1 is energized at the desired interval by adjusting the dial to secure the equivalent of three signal indications per unit of time equal to the four signal indications theretofore obtained from two signals for the same unit of time.

Reference will now be had to the lower portion of Fig. 3. In it there is designated a terminal block 100 having successive groups of three stations, each designated by the numerals 101—102—103. All like stations are connected in multiple. Stations 101 are connected by line 104 to the line 75 and thus are in multiple with the L1 signal. Stations 102 or the common line is connected by line 105 to line 87. The stations 103 are connected by line 106 to line 83 as shown and are in multiple with the second signal L2. A suitable terminal plug having three prongs, the plug being indicated by numeral 107, connects the three sub-master lines 108, 109 and 110 to the three master lines 104, 105 and 106, respectively, before mentioned. Through another plug 111, as shown, these sub-master lines being associated with a supplementary tempo unit designated by the letter A. Herein two such units A and A' are illustrated. Each includes the two visual signals and two audible signals. Visual signals L'1 and L'2 and the two audible signals S'1 and S'2 are included in unit A. The supplementary unit A' includes the two visual signals L''1 and L''2 and the two audible signals S''1 and S''2.

The electrical connections to the aforesaid are as illustrated and control and operation of the same is substantially the same as that set forth with respect to the master tempo unit, except there is provided in the audible signal return line 112 of unit A a manual switch 113 which is arranged to cut out the audible signals S'1 and S'2 whenever desired. This is because the energization of these signals is derived from the master unit visual signal supply and not independently thereof and not through the master unit audible signal supply. Similarly unit A includes switch 113' in return line 112' for control of the audible signals S''1 and S''2.

An auxiliary unit may be permanently mounted on the music stand of each musician. When each musician is to be provided with such a supplementary unit, the cable connection indicated by the plug 107, plug 111 and the lines 108, 109 and 110 are connected to the terminal plug 100 and the supplementary unit in the proper relationship, as shown in Fig. 3.

The utility of the device having been previously set forth, the operation of the master control mechanism having been previously set forth, and the individual operation of the signals under the respective conditions of control, it is believed no further description of any of the parts of the device as a whole is necessary.

While the invention has been described in great detail in the foregoing specification and similarly illustrated in the drawing, the same is to be considered illustrative and not restrictive in character. The various modifications herein disclosed, as well as others which will readily suggest themselves to persons skilled in this art, are all considered to be within the broad scope of the invention, reference being had to the appended claims.

The invention claimed is:

1. An electric tempo device or metronome including, in combination, a source of current, a constantly rotating shaft, a switch means cyclically operable thereby, an adjustable speed changing device therebetween for varying the periodicity of switch means operation, signal means of multiple character, circuit means connecting the signal means to the source of current, said signal means being successively energized by said switch means, another switch means interposed in the circuit means between one of said signal means and the first mentioned switch means, and means connecting the second mentioned switch means to the speed changing device for conditioning the second mentioned switch means for operation and non-operation for circuit control of current to the second mentioned signal means depending upon speed changing device adjustment.

2. A device or metronome of the character defined by claim 1, characterized by the speed changing device being of relatively movable wheel

and disc character, and the second mentioned switch means being of relatively slidable character, one member thereof being movable in proportion to the speed changing device relative movement through said connecting means.

3. An electric tempo device or metronome including, in combination, a source of current, a constantly rotating shaft, a switch cyclically operable thereby, a circuit connecting same to the source of current, an adjustable speed changing device between the shaft and switch, visual signal means of multiple character in said circuit and energized successively by said switch, a pair of signals jointly indicating four-four time, and manually operable switch means interposed between the switch and one of the signals for obtaining three-four time indication from the other signal.

4. In a universal metronome the combination with an electric motor, speed reducer, turnable rotatable thereby, and a power wheel adjustable relative thereto and rotatable thereby, of a single rotatable switch member rotatable by the power wheel at different speeds, one revolution of said member constituting a cycle, a pair of switches, duplicate signal means each controlled by one of the switches, each signal means being successively actuable by the switch member and operable at half cycles, another switch structure connected in series circuit relation with one of the pair of switches, and means for adjusting the power wheel relative to the turntable for cycle rate variation by varying the speed of said wheel and for simultaneously controlling the second mentioned switch.

5. A device or metronome of the character defined by claim 1, characterized by the addition of a manually operable switch means in the circuit means interposed between the first mentioned switch means and the second mentioned switch means controlled signal for obtaining three-four time indication from the signal other than the last mentioned, second mentioned switch means controlled, signal, both signals when energized jointly indicating four-four time.

CHARLES R. MYERS.

April 2, 1940. V. A. CARPENTER 2,195,612

POLARITY COMPENSATING IGNITION SYSTEM FOR AUTOMOBILES

Filed Oct. 26, 1939

FIG. 1

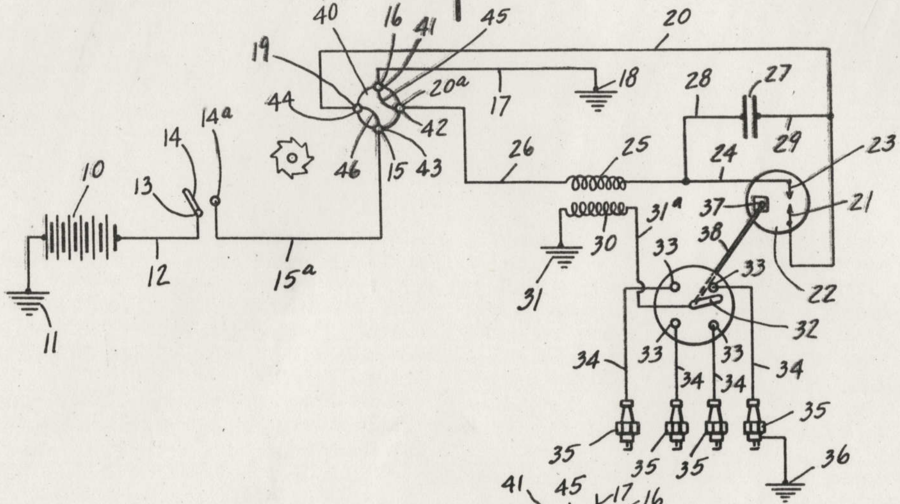


FIG. 2

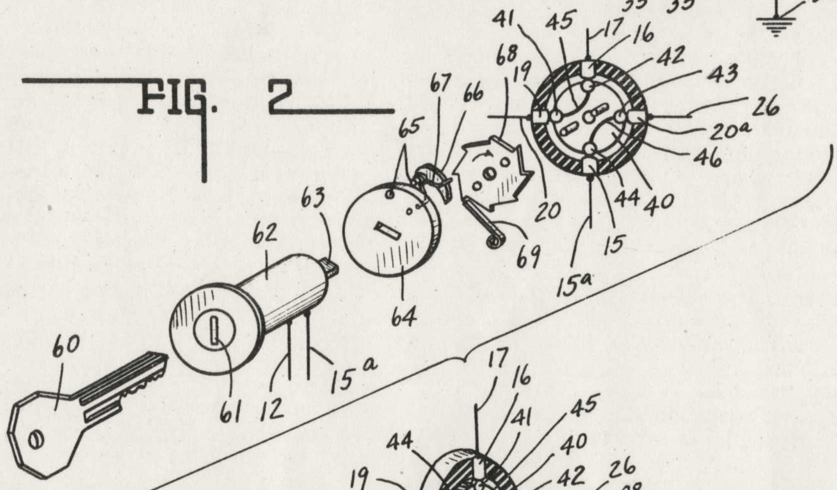
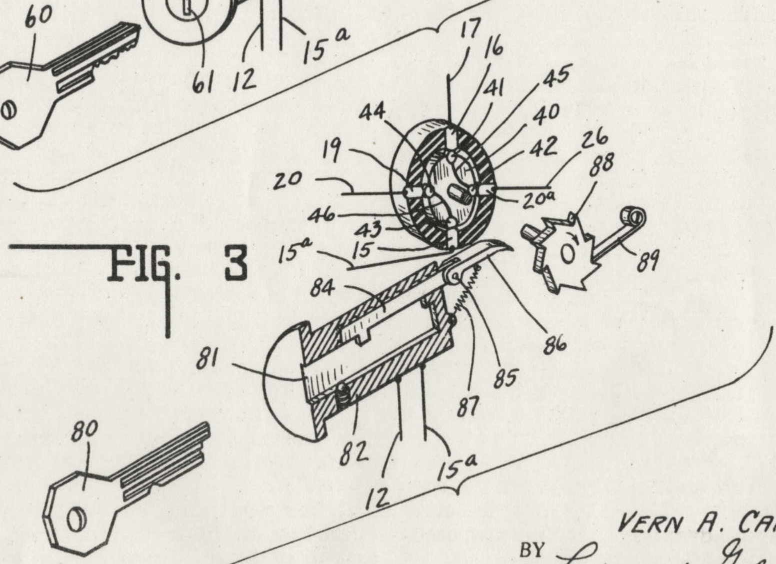


FIG. 3



INVENTOR.

VERN A. CARPENTER

BY Lockwood, Goldsmith & Galt.

ATTORNEYS.

UNITED STATES PATENT OFFICE

2,195,612

POLARITY COMPENSATING IGNITION SYSTEM FOR AUTOMOBILES

Vern A. Carpenter, Indianapolis, Ind.

Application October 26, 1939, Serial No. 301,363

11 Claims. (Cl. 123—146.5)

This invention relates to ignition systems for internal combustion engines.

Ignition systems of this character include a source of energy such as a storage battery, carried by the vehicle and charged by the engine in its operation, a key operable master switch, a coil arrangement, a condenser, a make-and-break switch, engine operable, and a distributor for selective energization of the firing spark plugs.

Such systems, after about four thousand miles and in specially designed systems at about six thousand miles of vehicle travel, produce a "tit" on one contact member of the make-and-break switch and a pit corresponding thereto on the other contact member of said switch.

Such formation is universal and materially affects engine performance and efficiency. Such formation is the result of ionization and arcing incident in uni-directional flow of current in the low tension portion of the ignition system of conventional character.

Such formation can be delayed, as suggested, by utilizing arc-resisting contact points, et cetera, but the problem cannot be solved permanently by such expedient since all known, satisfactory contact material is subject to metal transfer incident to ionization and arcing.

It has been proposed to reverse the current flow after each current impulse but such reversal results in the disadvantage that the switch is of constant reversing character, that is, it must be operative at all times for engine operation and has a limited life due to its repetitions, or constant operation, to wit: millions of reversals per day of usual driving.

The present invention solves both problems and one installation upon a vehicle which normally requires contact replacement or repair, as by dresing, etc.), at five thousand miles of vehicle travel, has successfully operated more than twelve thousand miles with but little or no evidence of "titting" or "pitting."

The chief object of this invention is to provide a practical and successful solution to the basic problem and not incorporate in such solution any of the disadvantages of the proposed corrective, as set forth hereinbefore.

The chief feature of the invention consists in providing a practical solution, automatic in character which solves said problem, such solution including a current reversing arrangement in the low tension side of the ignition circuit operable as by the key operable "ignition switch."

Such arrangement may take various forms, such as directly operable by switch movement, key insertion into the ignition switch lock, or remote operation by initial ignition circuit energization conditioning the reversing switch for subsequent reversal upon deenergization of the ignition circuit.

What is believed to be one of the simplest form of said invention has been selected for illustration herein, but this is by way of example only.

Other objects and features of the invention will be set forth more fully hereinafter.

The full nature of the invention will be understood from the accompanying drawing and the following description and claims:

In the drawing Fig. 1 is a diagrammatic plan of a conventional ignition system with the invention included therein. Fig. 2 is a perspective, exploded view of a key operable ignition switch with the automatically operable reversing switch operatively associated therewith. Fig. 3 is a sectional exploded view of a modified form of key operable reversing switch, the key operable lock portion being shown in elevation.

In Fig. 1, 10 indicates a source of energy such as a magneto or battery, the latter being illustrated, and same is grounded at 11. A line 12 leads to one terminal 13 of the "ignition switch" having movable switch member 14. The other terminal 14a is connected by line 15a to one terminal 15 of a four terminal reversing switch.

Said switch includes a terminal 16 connected by line 17 to a ground 18 or same may be directly connected to the battery 10 or source of energy. Two intermediate terminals 19 and 20a are provided. Terminal 19 is connected by line 20 to one terminal 21 of the make-and-break switch 22. The other terminal 23 is connected by line 24 to one terminal of the primary coil 25, the other terminal thereof being connected by line 26 to the remaining terminal 20a of the four terminal reversing switch. A condenser 27 is connected by lines 28 and 29 across the switch 22 or more especially across points 21 and 23 thereof.

Before describing the additional elements and operation of the primary system, the secondary system or high tension side will be described.

The secondary coil 30 is grounded at 31. The other end is connected by line 31a to the movable switch member 32 of the distributor switch which successively contacts the contacts 33, each of which is connected by a line 34 to spark plug 35 grounded at 36 in the conventional manner.

The movable contact 32 moves with member

37 controlling the operation of the "make-and-break" switch 22, the operative connection being diagrammatically indicated at 38. Thus, when the circuit is closed at 21—23 current flows in the low tension circuit and high tension current is supplied by the secondary coil through switch member 32 to the proper spark plug.

The automatic reversing switch includes an insulated base 40 having four contacts 41, 42, 43 and 44 thereon. Contacts 41 and 42 are electrically connected as at 45 and contacts 43 and 44 are similarly connected as at 46.

When the reversing switch is positioned as illustrated in Fig. 1, battery current is supplied to contact 15, contact 43, connection 46, contact 44, line 20, primary coil 25, line 26, contact 20*a*, contact 42, connection 45, contact 41 and line 17.

When the reversing switch is positioned at 90° to said Fig. 1 illustrated position, see Fig. 2, substantially the same circuit is completed except the direction of current flow is reversed in line 20, the make-and-break switch 22, line 24, primary coil 25 and line 26. Such reversal also changes current phase relation in the high tension circuit as well.

Thus, arcing, pitting, et cetera, of the make-and-break switch contacts is reduced to a minimum, as hereinafter pointed out.

In Fig. 2, 60 indicates a key, 61 a keyhole receiving same, 62 a switch structure and lock connected to lines 12 and 15*a* as shown in Fig. 1, 63 an extension pin or shaft carrying a disk 64 to which is pivoted at 65 a pawl 66, normally constrained by spring 67 into ratchet tooth 68 engagement. A spring 69 may prevent reverse rotation of the ratchet. Rigid with ratchet 68 is the reversing switch member 40 previously described.

When the key 60 is inserted in keyhole 61 and turned clockwise 90°, the ignition switch 13, 14, and 14*a* is closed. In this movement pawl 66 seated or having ratchet tooth engagement rotates ratchet 68 and reversing switch 40 an amount of 90°. Upon key 60 being turned 90° to open the ignition circuit, the pawl ratchets over ratchet teeth 68 and reengages the ratchet at 90° to the previous engagement. Spring 69 prevents reverse ratchet movement. Spring 67 insures ratchet and pawl cooperation.

Thus, each time the ignition switch is turned on and off, or vice versa, if desired, the reversing switch is rotated 90° for current direction reversal, as previously described, and for the purpose described, and such reversing switch operation is automatic, that is, does not require any other manual performance than now required in a conventional system.

Fig. 3 illustrates another form of key operable switch-reversing switch arrangement. This, however, is not as satisfactory as that previously described because it merely requires insertion and removal of the key for reversing switch operation.

Slidably mounted in lock 82 is a plunger 84 adapted for movement when key 80 is inserted in keyhole 81. Pivoted to plunger 84 at 85 is a pawl 86 normally constrained by spring 87 into engagement with ratchet 88 pivoted upon an axis transverse to that of ratchet 68 illustrated in Fig. 2. Spring 89 prevents reverse rotation of the ratchet 88. Rigid with ratchet 88 is the reversing switch member 40. Note that spring 87 also returns plunger 84 to initial position when the key 80 is removed from the lock. Each reciprocation of bar 84 rotates ratchet 88 90°.

In most forms of locks, key rotational movement is required to close the ignition circuit, in others only key movement longitudinally thereof is required, or both may be required.

Either of the above forms of key-switch-reversing switch constructions may be utilized, as required. In most instances, the direction of current flow will be reversed for each make-and-break of the ignition circuit by the key operable main switch. In other instances, the direction of current flow will be reversed only when the ignition lock key is inserted into or removed from the switch.

Since many drivers do not remove the key from the lock, as suggested by the insurance companies and police departments, the form of the invention shown in Fig. 2 is preferred because this insures a sufficient number of current reversals to accomplish the desired result which is whatever metal, et cetera, flows from contact 23 to contact 21 resulting in an attempt to pit contact 23 and tit contact 21, will upon current reversal return such transferred metal with the net result that the progressive pitting and titting action common to present ignition systems is eliminated, thus maintaining contacts 23 and 21 in substantially perfect condition at all times.

It has been ascertained that the duration of current flow in either direction is substantially equal for all kinds of driving, whether of cross-country, urban or suburban character or of mixed character.

While the invention has been illustrated and described in great detail in the foregoing description, the same is to be considered as illustrative and not restrictive in character.

The several modifications described herein, as well as others which will readily suggest themselves to persons skilled in this art, all are considered to be within the broad scope of the invention, reference being had to the appended claims.

In this connection, note that claim 5 is intended to include any reversing mechanism such as herein described which is operable automatically in brake operation, gear shift operation, or like or comparable operations having a frequency of operation other than that of the spark plugs and/or the distributor "make-and-break" switch.

The invention claimed is:

1. In combination with an ignition system of an internal combustion engine including a key controlled switch, a reversing switch included in said system for current reversal, and means operable by key movement in key switch control for actuating said reversing switch.

2. A system, as defined by claim 1, characterized by the key switch movement being of to and fro character and the reversing switch being of intermittent continuous rotation character.

3. A system, as defined by claim 1, characterized by the key switch movement being of to and fro character and the reversing switch being of intermittent continuous rotation character, the key movement being of reciprocatory type.

4. A system, as defined by claim 1, characterized by the key switch movement being of to and fro character and the reversing switch being of intermittent continuous rotation character, the key movement being of oscillatory type.

5. In an ignition system for an internal combustion engine, a high tension circuit and a low tension circuit, the former including a plurality of sparking members successively energized, and

the latter including a "make-and-break" switch operable in timed relation with each sparking member energization, and a reversing circuit arrangement including a current reversing switch operable at varying intervals independent of "make-and-break" switch operation or the energization of any sparking member.

6. In an ignition system for an internal combustion engine, a secondary circuit and a primary circuit, the former including a plurality of sparking members successively energized, and the latter including a "make-and-break" switch operable in timed relation with each sparking member energization, and a reversing circuit arrangement including a current reversing switch operable at varying intervals independent of "make-and-break" switch operation or the energization of any sparking member.

7. A device, as defined by claim 5, characterized by the reversing switch reversing current flow direction in the primary circuit.

8. In an ignition circuit a polarity or current flow direction changer including four stationary contacts arranged at 90° apart, a rotatable member having similarly spaced and cooperating contacts, same being connected together electrically in adjacent pairs, a ratchet movable with the rotatable member, a to and fro movable pawl means normally constrained to ratchet engagement for quadrant movement of the rotatable member, and means normally preventing reverse rotation of the rotatable member.

9. In combination with a source of energy, an ignition system including a distributor for an internal combustion engine and a main switch for said system, of means automatically operable in the main switch actuation for reversing the direction of current flow in the ignition system to reduce and substantially prevent distributor point pitting.

10. In combination with an ignition system of an internal combustion engine including a key controlled switch, a primary circuit and a secondary circuit, the latter including a plurality of sparking members successively energized, the former including a make and break switch operable in timed relation with each sparking member energization, a current reversing circuit arrangement for the primary circuit including a current reversing switch operable at varying intervals independent of make and break switch operation or the energization of any sparking member, and means operable by key movement in key switch control for actuating said reversing switch.

11. A system, as defined by claim 10, characterized by the key switch movement being of to and fro character and the reversing switch movement being of intermittent continuous rotation character.

VERN A. CARPENTER.

April 2, 1940. V. A. CARPENTER 2,195,612

POLARITY COMPENSATING IGNITION SYSTEM FOR AUTOMOBILES

Filed Oct. 26, 1939

FIG. 1

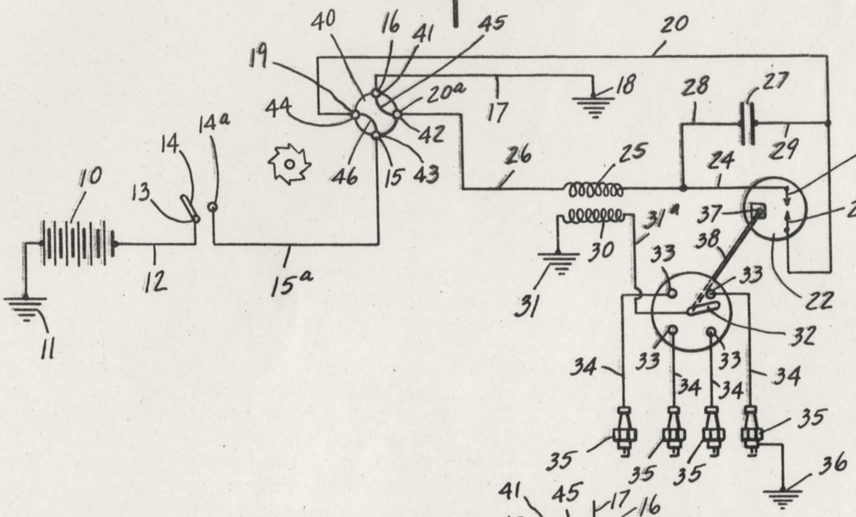


FIG. 2

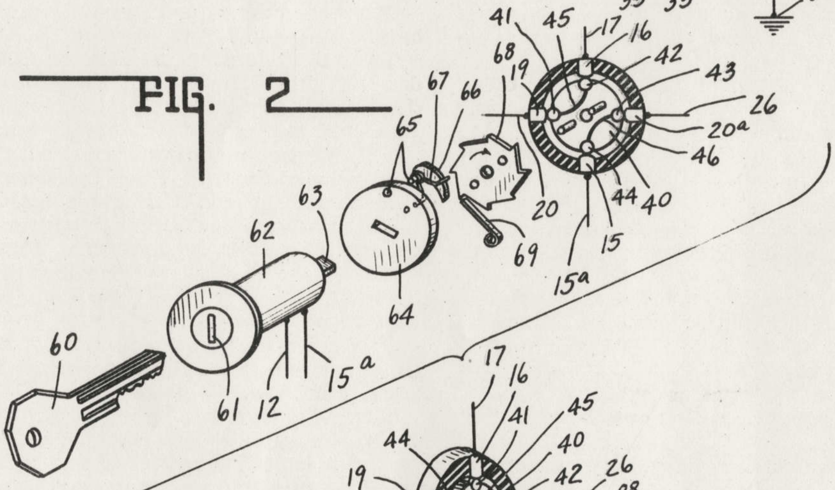
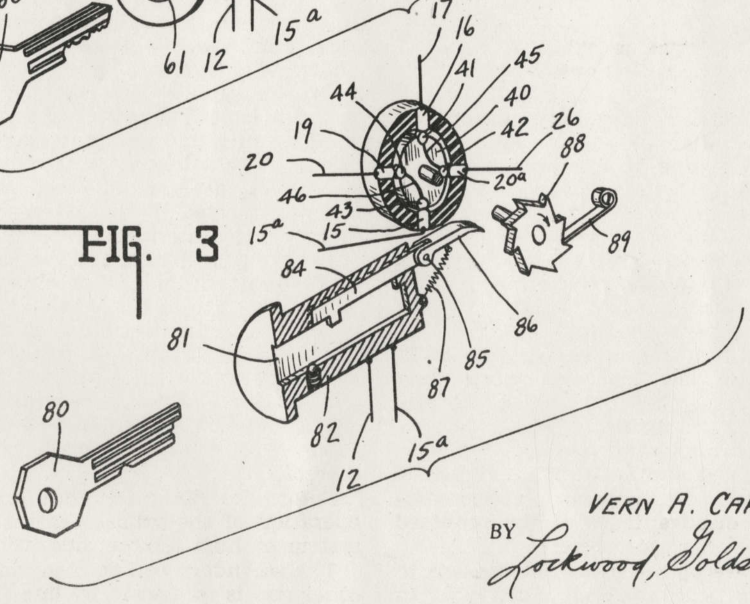


FIG. 3



INVENTOR.
VERN A. CARPENTER
BY Lockwood, Goldsmith & Galt.
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,195,612

POLARITY COMPENSATING IGNITION SYSTEM FOR AUTOMOBILES

Vern A. Carpenter, Indianapolis, Ind.

Application October 26, 1939, Serial No. 301,363

11 Claims. (Cl. 123—146.5)

This invention relates to ignition systems for internal combustion engines.

Ignition systems of this character include a source of energy such as a storage battery, carried by the vehicle and charged by the engine in its operation, a key operable master switch, a coil arrangement, a condenser, a make-and-break switch, engine operable, and a distributor for selective energization of the firing spark plugs.

Such systems, after about four thousand miles and in specially designed systems at about six thousand miles of vehicle travel, produce a "tit" on one contact member of the make-and-break switch and a pit corresponding thereto on the other contact member of said switch.

Such formation is universal and materially affects engine performance and efficiency. Such formation is the result of ionization and arcing incident in uni-directional flow of current in the low tension portion of the ignition system of conventional character.

Such formation can be delayed, as suggested, by utilizing arc-resisting contact points, et cetera, but the problem cannot be solved permanently by such expedient since all known, satisfactory contact material is subject to metal transfer incident to ionization and arcing.

It has been proposed to reverse the current flow after each current impulse but such reversal results in the disadvantage that the switch is of constant reversing character, that is, it must be operative at all times for engine operation and has a limited life due to its repetitions, or constant operation, to wit: millions of reversals per day of usual driving.

The present invention solves both problems and one installation upon a vehicle which normally requires contact replacement or repair, as by dresing, etc.), at five thousand miles of vehicle travel, has successfully operated more than twelve thousand miles with but little or no evidence of "titting" or "pitting."

The chief object of this invention is to provide a practical and successful solution to the basic problem and not incorporate in such solution any of the disadvantages of the proposed corrective, as set forth hereinbefore.

The chief feature of the invention consists in providing a practical solution, automatic in character which solves said problem, such solution including a current reversing arrangement in the low tension side of the ignition circuit operable as by the key operable "ignition switch."

Such arrangement may take various forms, such as directly operable by switch movement, key insertion into the ignition switch lock, or remote operation by initial ignition circuit energization conditioning the reversing switch for subsequent reversal upon deenergization of the ignition circuit.

What is believed to be one of the simplest form of said invention has been selected for illustration herein, but this is by way of example only.

Other objects and features of the invention will be set forth more fully hereinafter.

The full nature of the invention will be understood from the accompanying drawing and the following description and claims:

In the drawing Fig. 1 is a diagrammatic plan of a conventional ignition system with the invention included therein. Fig. 2 is a perspective, exploded view of a key operable ignition switch with the automatically operable reversing switch operatively associated therewith. Fig. 3 is a sectional exploded view of a modified form of key operable reversing switch, the key operable lock portion being shown in elevation.

In Fig. 1, 10 indicates a source of energy such as a magneto or battery, the latter being illustrated, and same is grounded at 11. A line 12 leads to one terminal 13 of the "ignition switch" having movable switch member 14. The other terminal 14a is connected by line 15a to one terminal 15 of a four terminal reversing switch.

Said switch includes a terminal 16 connected by line 17 to a ground 18 or same may be directly connected to the battery 10 or source of energy. Two intermediate terminals 19 and 20a are provided. Terminal 19 is connected by line 20 to one terminal 21 of the make-and-break switch 22. The other terminal 23 is connected by line 24 to one terminal of the primary coil 25, the other terminal thereof being connected by line 26 to the remaining terminal 20a of the four terminal reversing switch. A condenser 27 is connected by lines 28 and 29 across the switch 22 or more especially across points 21 and 23 thereof.

Before describing the additional elements and operation of the primary system, the secondary system or high tension side will be described.

The secondary coil 30 is grounded at 31. The other end is connected by line 31a to the movable switch member 32 of the distributor switch which successively contacts the contacts 33, each of which is connected by a line 34 to spark plug 35 grounded at 36 in the conventional manner.

The movable contact 32 moves with member

37 controlling the operation of the "make-and-break" switch 22, the operative connection being diagrammatically indicated at 38. Thus, when the circuit is closed at 21—23 current flows in the low tension circuit and high tension current is supplied by the secondary coil through switch member 32 to the proper spark plug.

The automatic reversing switch includes an insulated base 40 having four contacts 41, 42, 43 and 44 thereon. Contacts 41 and 42 are electrically connected as at 45 and contacts 43 and 44 are similarly connected as at 46.

When the reversing switch is positioned as illustrated in Fig. 1, battery current is supplied to contact 15, contact 43, connection 46, contact 44, line 20, primary coil 25, line 26, contact 20a, contact 42, connection 45, contact 41 and line 17.

When the reversing switch is positioned at 90° to said Fig. 1 illustrated position, see Fig. 2, substantially the same circuit is completed except the direction of current flow is reversed in line 20, the make-and-break switch 22, line 24, primary coil 25 and line 26. Such reversal also changes current phase relation in the high tension circuit as well.

Thus, arcing, pitting, et cetera, of the make-and-break switch contacts is reduced to a minimum, as hereinafter pointed out.

In Fig. 2, 60 indicates a key, 61 a keyhole receiving same, 62 a switch structure and lock connected to lines 12 and 15a as shown in Fig. 1, 63 an extension pin or shaft carrying a disk 64 to which is pivoted at 65 a pawl 66, normally constrained by spring 67 into ratchet tooth 68 engagement. A spring 69 may prevent reverse rotation of the ratchet. Rigid with ratchet 68 is the reversing switch member 40 previously described.

When the key 60 is inserted in keyhole 61 and turned clockwise 90°, the ignition switch 13, 14, and 14a is closed. In this movement pawl 66 seated or having ratchet tooth engagement rotates ratchet 68 and reversing switch 40 an amount of 90°. Upon key 60 being turned 90° to open the ignition circuit, the pawl ratchets over ratchet teeth 68 and reengages the ratchet at 90° to the previous engagement. Spring 69 prevents reverse ratchet movement. Spring 67 insures ratchet and pawl cooperation.

Thus, each time the ignition switch is turned on and off, or vice versa, if desired, the reversing switch is rotated 90° for current direction reversal, as previously described, and for the purpose described, and such reversing switch operation is automatic, that is, does not require any other manual performance than now required in a conventional system.

Fig. 3 illustrates another form of key operable switch-reversing switch arrangement. This, however, is not as satisfactory as that previously described because it merely requires insertion and removal of the key for reversing switch operation.

Slidably mounted in lock 82 is a plunger 84 adapted for movement when key 80 is inserted in keyhole 81. Pivoted to plunger 84 at 85 is a pawl 86 normally constrained by spring 87 into engagement with ratchet 88 pivoted upon an axis transverse to that of ratchet 68 illustrated in Fig. 2. Spring 89 prevents reverse rotation of the ratchet 88. Rigid with ratchet 88 is the reversing switch member 40. Note that spring 87 also returns plunger 84 to initial position when the key 80 is removed from the lock. Each reciprocation of bar 84 rotates ratchet 88 90°.

In most forms of locks, key rotational movement is required to close the ignition circuit, in others only key movement longitudinally thereof is required, or both may be required.

Either of the above forms of key-switch-reversing switch constructions may be utilized, as required. In most instances, the direction of current flow will be reversed for each make-and-break of the ignition circuit by the key operable main switch. In other instances, the direction of current flow will be reversed only when the ignition lock key is inserted into or removed from the switch.

Since many drivers do not remove the key from the lock, as suggested by the insurance companies and police departments, the form of the invention shown in Fig. 2 is preferred because this insures a sufficient number of current reversals to accomplish the desired result which is whatever metal, et cetera, flows from contact 23 to contact 21 resulting in an attempt to pit contact 23 and tit contact 21, will upon current reversal return such transferred metal with the net result that the progressive pitting and titting action common to present ignition systems is eliminated, thus maintaining contacts 23 and 21 in substantially perfect condition at all times.

It has been ascertained that the duration of current flow in either direction is substantially equal for all kinds of driving, whether of cross-country, urban or suburban character or of mixed character.

While the invention has been illustrated and described in great detail in the foregoing description, the same is to be considered as illustrative and not restrictive in character.

The several modifications described herein, as well as others which will readily suggest themselves to persons skilled in this art, all are considered to be within the broad scope of the invention, reference being had to the appended claims.

In this connection, note that claim 5 is intended to include any reversing mechanism such as herein described which is operable automatically in brake operation, gear shift operation, or like or comparable operations having a frequency of operation other than that of the spark plugs and/or the distributor "make-and-break" switch.

The invention claimed is:

1. In combination with an ignition system of an internal combustion engine including a key controlled switch, a reversing switch included in said system for current reversal, and means operable by key movement in key switch control for actuating said reversing switch.

2. A system, as defined by claim 1, characterized by the key switch movement being of to and fro character and the reversing switch being of intermittent continuous rotation character.

3. A system, as defined by claim 1, characterized by the key switch movement being of to and fro character and the reversing switch being of intermittent continuous rotation character, the key movement being of reciprocatory type.

4. A system, as defined by claim 1, characterized by the key switch movement being of to and fro character and the reversing switch being of intermittent continuous rotation character, the key movement being of oscillatory type.

5. In an ignition system for an internal combustion engine, a high tension circuit and a low tension circuit, the former including a plurality of sparking members successively energized, and

the latter including a "make-and-break" switch operable in timed relation with each sparking member energization, and a reversing circuit arrangement including a current reversing switch operable at varying intervals independent of "make-and-break" switch operation or the energization of any sparking member.

6. In an ignition system for an internal combustion engine, a secondary circuit and a primary circuit, the former including a plurality of sparking members successively energized, and the latter including a "make-and-break" switch operable in timed relation with each sparking member energization, and a reversing circuit arrangement including a current reversing switch operable at varying intervals independent of "make-and-break" switch operation or the energization of any sparking member.

7. A device, as defined by claim 5, characterized by the reversing switch reversing current flow direction in the primary circuit.

8. In an ignition circuit a polarity or current flow direction changer including four stationary contacts arranged at 90° apart, a rotatable member having similarly spaced and cooperating contacts, same being connected together electrically in adjacent pairs, a ratchet movable with the rotatable member, a to and fro movable pawl means normally constrained to ratchet engagement for quadrant movement of the rotatable member, and means normally preventing reverse rotation of the rotatable member.

9. In combination with a source of energy, an ignition system including a distributor for an internal combustion engine and a main switch for said system, of means automatically operable in the main switch actuation for reversing the direction of current flow in the ignition system to reduce and substantially prevent distributor point pitting.

10. In combination with an ignition system of an internal combustion engine including a key controlled switch, a primary circuit and a secondary circuit, the latter including a plurality of sparking members successively energized, the former including a make and break switch operable in timed relation with each sparking member energization, a current reversing circuit arrangement for the primary circuit including a current reversing switch operable at varying intervals independent of make and break switch operation or the energization of any sparking member, and means operable by key movement in key switch control for actuating said reversing switch.

11. A system, as defined by claim 10, characterized by the key switch movement being of to and fro character and the reversing switch movement being of intermittent continuous rotation character.

VERN A. CARPENTER.

Feb. 17, 1942. N. M. McCULLOUGH 2,273,365

VEHICLE CONTROL AND SPEED INDICATING SYSTEM

Filed Dec. 18, 1937 2 Sheets-Sheet 1

FIG. 1

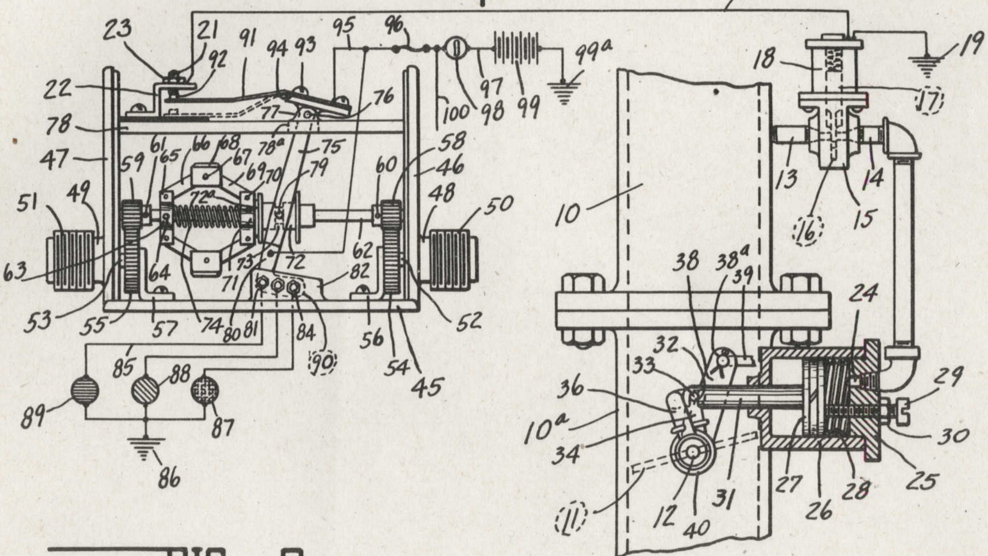


FIG. 2

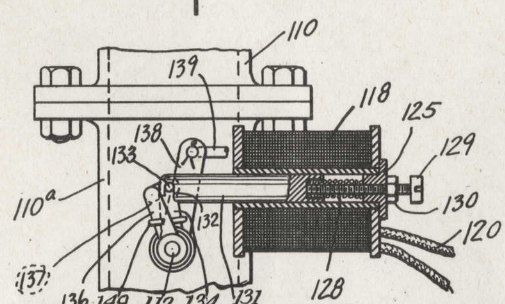


FIG. 3

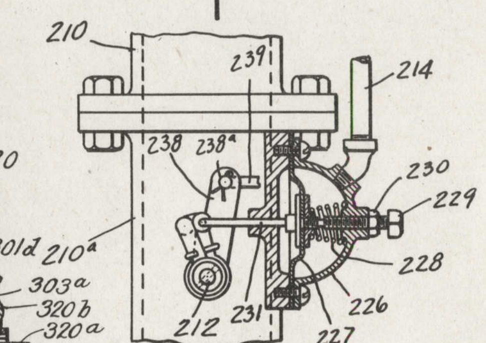


FIG. 5A.

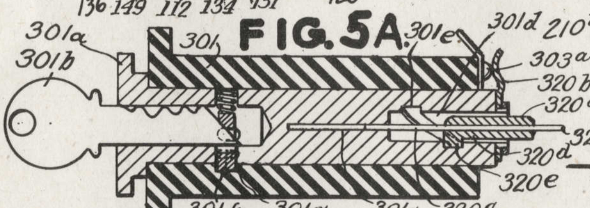


FIG. 4

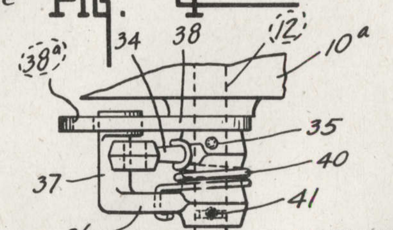
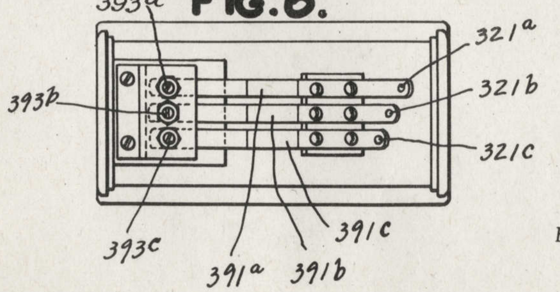


FIG. 6.



INVENTORS.
NEEL M. McCULLOUGH.

BY Lockwood, Goldsmith & Galt
ATTORNEYS.

Feb. 17, 1942. N. M. McCULLOUGH 2,273,365

VEHICLE CONTROL AND SPEED INDICATING SYSTEM

Filed Dec. 18, 1937 2 Sheets-Sheet 2

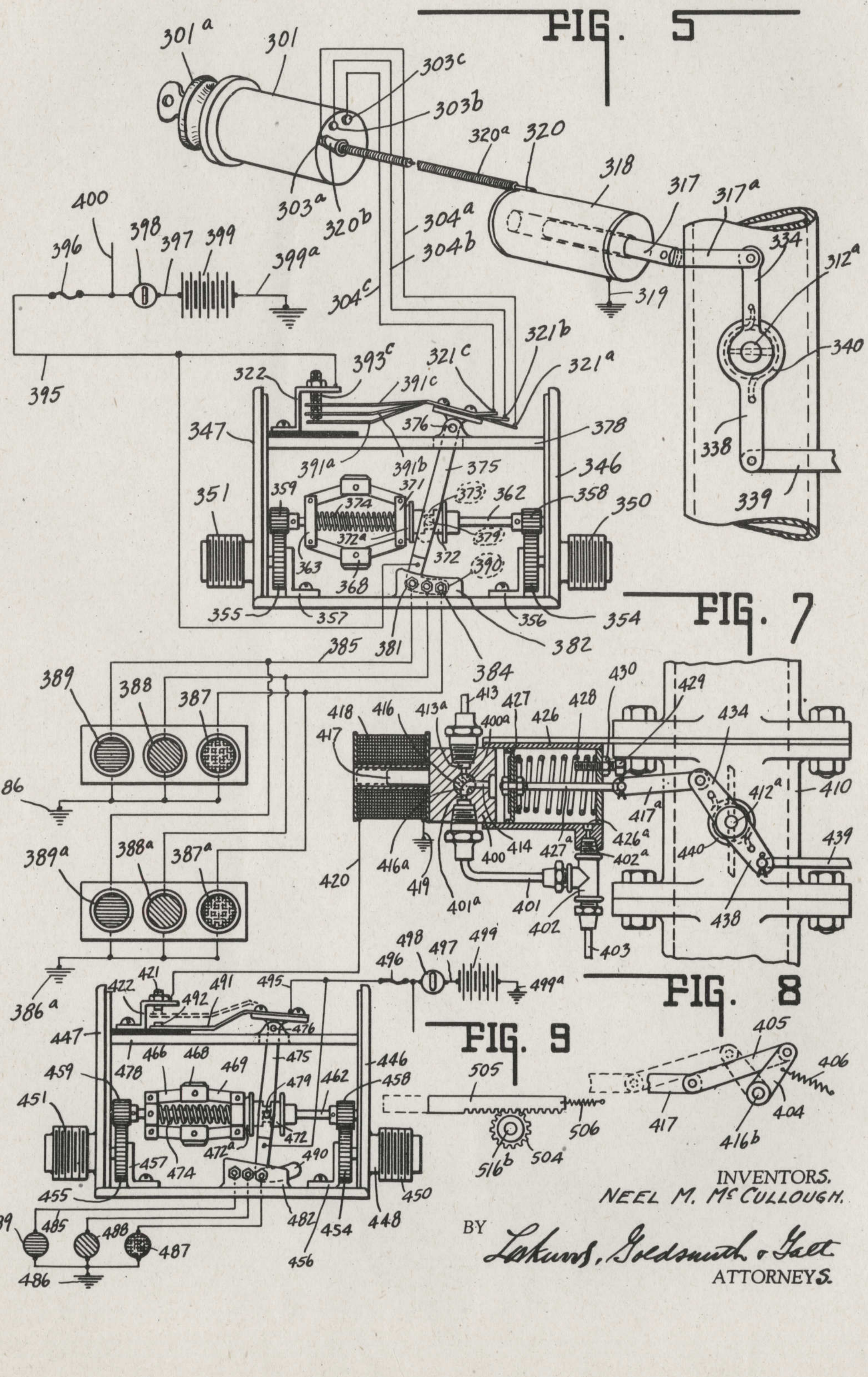


FIG. 5

FIG. 7

FIG. 8

FIG. 9

INVENTORS.
NEEL M. McCULLOUGH.

BY Lakuns, Goldsmith & Gatt

ATTORNEYS.

UNITED STATES PATENT OFFICE

2,273,365

VEHICLE CONTROL AND SPEED INDICATING SYSTEM

Neel M. McCullough, Anderson, Ind., assignor to Pierce Governor Company, Anderson, Ind., a corporation

Application December 18, 1937, Serial No. 180,497

2 Claims. (Cl. 180—82.1)

This invention relates to a control system for self-propelled vehicles having a speedometer drive and an engine provided with a fuel passage and a fuel controlling valve therein.

One chief object of the invention is to provide an automatic control which will not only indicate visually and internally and/or externally of the vehicle the speed thereof, but is at the same time automatically arranged to control the fuel supply upon the vehicle attaining a predetermined speed.

Another chief object of the invention is to provide a manual arrangement whereby the fuel control may be of multiple character that is responsive to different speeds and the manual selection of the predetermined speed can be imposed upon the control system for the automatic operation thereof, as previously described.

Another object of the invention is to associate with the manual control a lock arrangement whereby the owner of the vehicle may select the desired maximum vehicle speed for the vehicle and impose the selection upon the control system to prevent speeding of the vehicle beyond the selected vehicle speed.

The chief feature of the invention consists in the construction and arrangement of a control system whereby the several objects are accomplished.

Other features and objects of the invention will be more fully set forth hereinafter.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

In the drawings,

Fig. 1 is an elevational view in semi-diagrammatic form of a speedometer operable control, the signal means associated therewith and one form of engine control means automatically operable by the system upon attainment of the predetermined speed.

Fig. 2 is a view similar to the right hand portion of Fig. 1 and illustrates a simpler and modified form of the invention.

Fig. 3 is a similar view of still a further modified form of the invention.

Fig. 4 is a top plan view of a portion of a lever system associated with the fuel controlling valve.

Fig. 5 is a view similar to Fig. 1 and of another embodiment of the invention of more complicated form and the preferred form of the invention.

Fig. 5—A is an enlarged sectional view of a lock controlled speed selecting switch.

Fig. 6 is a top plan view of the switch mechanism illustrated in Fig. 5.

Fig. 7 is a view similar to Fig. 1 and of a pressure type system, the pressure portion being shown in section.

Fig. 8 is a plan view of the solenoid control portion of the system shown in Fig. 7.

Fig. 9 is an elevational view similar to Fig. 8 of a modified form of control.

In Figs. 1 and 4 of the drawings 10 indicates the fuel intake portion of an internal combustion engine supply and the same includes a valve 11 carried by a shaft 12 which projects outwardly from the conduit or fuel supply passage portion *10a*. Portion *10a* may be of the adaptor insert type, as is well known in the internal combustion art, being interposed between the end of the engine intake manifold and the carburetor.

In the form of the invention shown in Fig. 1, a conduit 13 communicates with the conduit 14 through a valve body 15 controlled by a valve member 16, the stem 17 of which constitutes the core of a solenoid 18. One terminal of the solenoid is grounded as at 19. The other terminal is connected by the line 20 to a switch terminal or contact 21 adjustably supported by a threaded connection in the supporting bracket 22 and locked therein by the nut 23.

The conduit 14 communicates with a port 24 in a cylinder head 25 detachably supported by a cylinder 26 in which is mounted a piston 27 normally constrained toward the left by spring 28. A stop member 29 in the form of a bolt has threaded connection with the head 25 and extends therethrough and is adapted for engagement by the piston at such time as the valve 16 is opened through energization of solenoid 18 so that the vacuum in the intake passage is effective upon the piston 27, to move the same to the right and compress spring 28, such movement continuing until the piston engages the exposed inner end of the stop 29, the position of which is locked in adjusted position by the nut 30.

The piston 27 carries a piston rod 31 which at its free end includes a notch 32 that seats a pin 33 carried by lever arm 34 which is pinned to the shaft 12 as at 35. Another lever arm 36 has an angular portion 37 which lies behind—see Fig. 4—the lever 34 and projects into the plane of the lever 38, the latter being apertured as at *38a* for connection to a manually operable member 39 connected to a hand and/or foot throttle arrangement.

A spring 40 is concentric with the shaft and has its opposite ends associated with the two adjacent lever arms 34 and 36 so that within the range of the spring the arms may be independently operated and at other times they are simultaneously operated. A set-screw 41, or the like, prevents axial displacement of the lever arm 36 relative to the shaft 12 but permits the lever arm to have rotation relative to the shaft.

The position of the parts described is illustrated in Fig. 1, as where the vacuum of the intake has operated the rod 31 to move the valve in the intake into substantially closed position.

In the left hand portion of Fig. 1, 45 indicates a base and 46 and 47 indicates two sides of a frame structure which include projecting bosses 48 and 49, respectively, threaded as at 50 and 51, respectively. These bosses are tubular and the speedometer drive protecting sheating has threaded connection with one of the threaded portions and the sheathing of that portion of the drive leading to the speedometer has threaded connection with the other threaded portion.

The shaft portion of the drive has the usual tongue and groove connection within this threaded portion and with the shaft that extends into the housing defined by the frame members last mentioned.

Herein two shafts 52 and 53 are illustrated which have secured thereto the gears 54 and 55, respectively, the latter being supported by the brackets 56 and 57, respectively, and said gears mesh with the pinions 58 and 59, respectively, secured as at 60 and 61, respectively, to the shaft 62.

A sleeve 63 is suitably secured to the shaft 62 as at 64 and includes a plurality of outwardly extending ears 65 which are pivotally connected to link means 66, in turn pivotally connected as at 67 to weights 68. Also pivotally connected at 67 to the weights 68 are oppositely arranged link means 69, in turn pivotally connected at 70 to a sliding collar 71 rigid with which is the grooved collar portion 72 having the groove 73 therein. A spring 74 is concentric with the shaft 62 between the two collars 71 and 63 and normally tends to maintain the respective pairs of links 66 and 69 in aligned position.

A pair of lever members 75 is pivotally supported at 76 in ears 77 carried by the upper base member 78 of the frame, said lever extending through the aperture 78*a* beneath the ears and between the same. Extending inwardly toward each other from each of the arms is a pin 79 that rides in the groove 73.

As the power portion of the speedometer drive is rotated in response to the vehicle speed, the shaft 62 is rotated in proportion thereto and the weights 67 and links 66 and 69 are subjected to centrifugal force. The tendency of these parts to move outwardly away from the shaft at the weight connections is resisted by the spring 74 at the predetermined speed for which the spring tension is adjusted, which adjustment may be provided between the portion 72*a* and the collar 71 or at any other portion of the device, since the aforesaid constitutes a centrifugal governor commonly known as the phonograph governor mechanism. When the speed is that for which the centrifugal force will in opposition to the spring load, howsoever adjusted, move the weights outwardly away from the shaft, the collar 72 will be moved to the left on the shaft 62 and thus automatically tilt the lever arrangement to the left in clockwise relation relative to the pivot 76.

One arm of the lever is extended as at 80 beyond the yoke connection to the sleeve 72 and terminates in a contact portion 81. A bracket 82 supports in insulated relation terminal studs 84 which are arranged arcuately, the radius of the arc corresponding to the radial length of the lever arm 75 including the contact portion 80.

Thus, as the lever is caused to move through the governor structure, the successive terminal contacts 84 are engaged to complete a circuit to respective electric conductors 85, each of which is connected to a light bulb of a signal arrangement, the bulbs in turn being grounded as at 86. Herein signal 87 is the low speed signal. It may be amber or yellow. Signal 88 is the medium speed signal and it may be green. Signal 89 is the high speed signal and it may be blue. The device may be arranged, for example, so that the light bulb in signal 87 will be energized when the vehicle speed of approximately 30 M. P. H. is attained. Upon the vehicle speed reaching, for example, 32 M. P. H. to 45 M. P. H., signal 88 will be energized and after the vehicle exceeds 45 M. P. H., the high speed visual signal will be energized.

Light contacts may be so positioned that the first light will be energized when the ignition is closed or a separate light in series with the main supply to the control may be provided and this would be a pilot light indicating operation condition of the control circuit.

Should regulations be such that the use of different colored signals is prohibited, there is provided an arcuate arm 90. In this event, the lower speed arrangement signal 87 will be energized. When the vehicle attains a speed known as an intermediate speed, then both signals 87 and 88 will be first energized and when the vehicle attains a high speed, all three signals will be energized. Any other range of speeds and numbers of signals may be provided as will be quite apparent from the foregoing disclosure.

These signals may be arranged in multiple as will be hereinafter more fully illustrated and described with reference to the form of the invention shown in Fig. 5. In the present form of the invention, these signals are positioned externally of the vehicle so as to be visible from both the front and rear thereof so that at all times these signals will indicate the range of speed at which the vehicle is travelling. The signals simultaneously viewable from front and rear of the vehicle may be mounted for example, on the left front fender and may be arranged for observation by the driver as well.

If, for example, it is desired that the vehicle be permitted to travel at a speed not exceeding 50 M. P. H., then the valve operating mechanism does not become operative until 50 M. P. H. vehicle speed is attained, whereupon it becomes automatically operable. Of course, when the vehicle has attained this speed in the first instance, only signal 89 will be energized and in the second instance, all three signals 87—88—89 will be energized.

The means for energization of the valve operating valve mechanism is shown in the upper portion of Fig. 1 and includes a flexible finger 91 which carries a contact 92. Finger 91 is suitably secured as at 93 to a lateral flange portion 94 suitably secured to the two lever arm members 75, so that the finger 91 is tiltable in a clockwise direction with and by the tilting of the arm structure 75. A conductor 95 is in electrical connection with the finger 91 and the contact portion 80 of the arm 75. It is connected through a fuse structure 96 to line 97 controlled by the ignition lock switch 98, the latter also controlling the ignition line 100, the energization being derived from a suitable source diagrammatically illustrated herein as by a battery 99, it being grounded as at 99a.

When the predetermined speed for which the governor structure is adjusted and the contact 21 is adjusted is attained, contact 92 engages contact 21 to complete the circuit through the solenoid 18 and through the ground 19 and 99a to the battery providing the ignition switch 98 is in condition for vehicle operation, which must be so conditioned in order to secure internal combustion engine operation to secure vehicle movement under normal conditions.

In Fig. 2 there is illustrated a modified form of the invention and in this figure numerals of the one hundred series indicate like or equivalent parts, the departures being as follows: The operating rod 131 in this instance instead of comprising a piston rod constitutes the core of the solenoid 118, the supply line 120 of which is adapted to supply current to the solenoid when the switch mechanism indicated in the upper portion of the left hand portion of Fig. 1 is in closed position. This figure illustrates the rod or plunger 131 in the fuel controlling position. By reference to Fig. 4 the several levers and the interconnections therebetween and the valve operating rod will be understood.

A stop member 129 has threaded engagement with the support 125 and is locked in the adjusted position by the nut 130. Concentric with the stop member 129 within the bore of the solenoid is the spring 128 which normally constrains the core or stem or rod 131 toward the left—see Fig. 2. The operation of the device illustrated in Fig. 2 is substantially the same as that illustrated in Fig. 1, with this exception, that instead of utilizing a variation of pressure for operation of the stem, the operation of the stem is directly controlled by the solenoid instead of indirectly controlled thereby, as shown in the right hand portion of Fig. 1.

A further modified form of the invention is illustrated in Fig. 3 and this is similar to the lower half of the right hand portion of the invention illustrated in Fig. 1 and briefly may be said to comprise a diaphragm type of power in place of the piston type of power shown in Fig. 1. Numerals of the two hundred series indicate like or equivalent parts. Thus the conduit 214, it will be understood, is controlled by a valve such as illustrated in Fig. 1 and indicated by the numeral 15. The diaphragm housing is indicated by the numeral 226 and threadedly supports the stop member 229 locked as at 230 and concentric with which is a coil spring 228 which normally constrains the diaphragm 227 toward the left. The diaphragm carries a stem 231 which is operatively associated with the shaft 212 in substantially the same manner as illustrated in Figs. 1, 2 and 4.

Upon actuation of the solenoid 18 of the valve 15 in Fig. 1, and if the valve control the conduit 214 connected to the intake 210 in the same manner that conduit 14 is connected to the conduit 10 in Fig. 1, vacuum will be imposed upon the diaphragm 227 and cause the same to move to the right until it engages the inner end of the stop 229 in opposition to the spring 228 and in this position the fuel valve which may be termed the throttle valve of the engine, is in substantially closed position.

Certain engines will more readily lend themselves to the use of one of these forms of valve control while others will more readily lend themselves to another form. However, all the forms are considered to be within the scope of the invention broadly disclosed in Fig. 1.

Reference will now be had to Figs. 5 and 6, wherein numerals of the three hundred series indicate like or equivalent parts. One series of visual signals is indicated by numerals 387, 388 and 389, colored if desired in the same manner as signals 87, 88 and 89. A second set of signals may be provided and these are in multiple with the first set and bear similar numerals but with the subscript a. One set may be mounted interiorly of the vehicle and the other set may be visible from two opposite directions and exteriorly mounted. Herein the valve controlling solenoid is indicated by the numeral 318, and the core is indicated by the numeral 317. It may be connected by a link 317a to an arm 334 associated with the shaft 312a. This shaft carries the fuel controlling valve. Also associated with the shaft is the manual control arm 338 actuable by the rod 339 in turn actuated by the foot or hand throttle. The spring 340 is operatively interposed between the arms 338 and 334.

The governor mechanism is substantially the same as that illustrated in Fig. 1 and the switch for actuating the signals is substantially the same as disclosed therein. The present form of the invention, however, contemplates derivation of power from the battery 399 grounded as at 399a and the supply line 397 of which leads to the ignition system supply line 400 and a branch 395 includes the fuse 396 therein, both the ignition and the control supply lines being controlled by the car ignition lock switch 398.

There is also provided on the dash in the present instance, a speed selection and fuel control switch structure 301 which includes a lock releasable oscillatable interior element that includes three contacts 303a, 303b and 303c. Line 320 from the solenoid, enclosed by tube 320a, may terminate in a contact 320b and this rotatable member is arranged for selective connection between the line 320 and one of the three contacts 303a, 303b or 303c. When the proper selection has been made for anyone of the predetermined speed conditions, the key may be withdrawn and the adjusting member then will be locked in the adjusted position.

Since the three lines 304a, 304b and 304c at one end connect to the terminals 303 having corresponding subscripts and terminate at the opposite end at the terminals 321 having corresponding subscripts and associated with each of the latter terminals are spring finger constructions 391 having corresponding subscripts, all of which are not only flexible but are simultaneously tiltable in the same manner that spring finger 91—see Fig. 1—is tiltable, it will be quite apparent that if the arrangement 301 is adjusted for the high speed control, then engagement of finger 391 for low speed with its associated adjustable contact 393 and/or second or intermediate speed contact finger 391 engages its corresponding contact 393 and no current will flow from the line 395.

It is only when high speed contact finger 391 engages its contact 393 that the current is supplied to the appropriate line 304 and through the same to the line 320 to actuate the solenoid 318 and operate the fuel valve for fuel valve actuation and automatic fuel control.

In a similar manner, if the manual speed selection switch structure 301 is adjusted to the intermediate speed there will be no actuation of the solenoid 318 when the low speed switch arrangement 391—393 is closed through governor actuation but the solenoid will be energized and the fuel valve actuated only when the intermediate speed switch arrangement is closed. When extreme low speed is to be imposed upon the vehicle, it will be quite apparent that immediately upon the low speed spring finger 391 being in electrical connection with its adjustable contact 393, the current will be supplied to the solenoid 318 for actuating the fuel valve thus preventing the vehicle from overspeeding.

It is to be further understood that in the rotation of portion 301*a* for speed selection, the structural arrangement is such that although arm 320*b* is rotated, the tubular member 320*a* is moved longitudinally in a corresponding manner.

In this manner since core 317 is relatively stationary until the switch is actuated, the travel thereof upon switch actuation to a position of solenoid registration, is only proportional to solenoid position adjustment. For low speed, the core moves the greatest distance insuring greatest closing of the valve. For highest speed, the core moves the least distance so that full registration of core and solenoid only secures fuel valve closing to a very slight degree relatively. This permits the engine when thus controlled to operate up to the predetermined high vehicle speed without fuel control and thereafter the fuel control is imposed upon the engine. The fuel control valve is controlled by arm 334 in turn rocked by link 317*a* connected to core 317. Solenoid 318 slides on this core when 320*a* is moved longitudinally in the rotation of 301*a*.

Now when the proper contact 303 corresponding to the lock determined speed selected is engaged by arm 320*b* and the actual speed switch 321 therefore, is closed, the solenoid 318 is energized. If there is a slow speed setup, the solenoid and core are but slightly telescoped. If maximum speed control is set up, maximum initial telescopic relation exists. If intermediate speed control is set up, the telescoping is of intermediate amount.

All this is regardless of solenoid energization or deenergization. Now when energized, at any selected speed, the core registers with solenoid or seeks the fully telescoped position. In so doing, the core has greatest movement at low speed, least at high speed, and an intermediate amount at an intermediate speed. Hence, fuel valve carried by shaft 312*a* is almost fully closed upon slow speed attainment, slightly closed at high speed attainment and partly closed therebetween at intermediate speed attainment.

The solenoid 318 is suitably supported in brackets carried by the intake, engine or carburetor and said brackets permit longitudinal movement of the solenoid but prevent rotational movement thereof as by a tongue and groove connection. Such a bracket mounting is not illustrated since same is quite conventional and would merely complicate Fig. 5.

The shell 301 of necessity is of insulation material and mounts the three circuit contact members 303*a*, 303*b* and 303*c* in insulated relation and to same are connected the selective circuit wires 304*a*, 304*b* and 304*c*, respectively. Since the actual speed switch controls these wires, member 301*a* controlled by key 301*b*—see Figs. 5 and 5A—may be of metal and arm 320*b* carried thereby thus is in electrical connection with conductor 320 preferably but not necessarily insulated at 320*a*. Such connection is recess 301*c* that slidably receives end 320*c* of wire 320. This recess is enlarged as at 301*d* and is provided with a spiral groove 301*e* therein. The recess enlargement 301*d* receives the inner end 320*d* having the lateral tongue 320*e* seated in the spiral groove.

The stationary sleeve 301 is the cylinder and part 301*a* is the barrel that slidably mounts a locking plunger 301*f* normally constrained to seat in one of the seats 301*g* corresponding to the contacts 303*a*, et cetera, so that upon key removal the speed selected is locked up.

Whenever it is desired to change the speed selection, key 301*b* is inserted which retracts plunger 301*f* from its recess or seat 301*g* and the barrel is rotated which not only rotates arm 320*b* but also due to the spiral groove 301*e* and end 320*e* causes the solenoid 318 to move longitudinally in its bracket support before mentioned, but not illustrated. 320*a* if of insulated character prevents accidental short circuiting of conductor 320. When the new speed selection is made, the key is removed and the plunger 301*f* seats in its new recess 301*g*.

It is to be understood that Fig. 5 is a conventional semi-diagrammatic representation of the preferred form of the invention. Likewise, it is to be understood the fuel control is but conventionally illustrated herein, although solenoid operable directly or indirectly and furthermore, each form of the invention contemplates manual control of the fuel valve, as desired within the range of speed control imposed on said valve, either automatically or both.

In Figs. 7 and 8 a pressure type embodiment of the form of the invention is shown similar to that in Fig. 1. In said figures numerals of the four hundred series designate like or equivalent parts.

In this form of the invention, the immediate fuel control portion of the invention is similar to that illustrated in Fig. 5 and parts are similarly numbered but of the four hundred series.

In said Figs. 7 and 8 there is illustrated a cylinder 426 in which is mounted piston 427 normally constrained by spring 428 toward non-controlling position. Piston rod 427*a* is connected by link 417*a* to lever 434 connected to throttle valve shaft 412*a* and associated with spring 440, also associated with lever 438 manually operable by rod 439 in a manner previously described with reference to corresponding parts illustrated in Fig. 5. An adjustable stop structure 429—430 may be employed, if desired

Cylinder head 400 includes a bore 400*a* in which is mounted valve 416 having the angular passage 416*a*. Line 413 communicates with the bore by passage 413*a*. Passage 414 communicates with the cylinder at one end and the bore at the opposite end.

Another passage 401*a* communicates at one end with the bore and at the opposite end with discharge line 401. Cylinder 426 includes a port 426*a* which communicates with waste line 401 by a T connection 402 and nipple 402*a*.

The pressure supply line 413, when valve 416 is positioned with passage 416*a* in dotted line position, supplies oil under pressure from the oil pressure supply system of the vehicle to the cylinder to move the piston as far to the right as it can travel. Air to the right thereof escapes through port 426*a*.

When the valve **416** is positioned as shown by the full lines, the piston is returned by spring **428** to the full line position and the oil discharges through passage **401***a*, conduit **401**, T **502** and return **403** to the crankcase of the engine.

The solenoid **418**, when energized, attracts core **417** which through link **405**, see Fig. 8, actuates arm **404** carried by the valve stem **416***b*. When the solenoid is deenergized, the spring **406** returns the parts to the full line position—see Fig. 8.

In Fig. 9 is illustrated a modified form of valve and core operating connection. In this figure, **516***b* indicates the valve stem, **504** a pinion rigid therewith, **506** and **505** a rack portion of the solenoid core **517**. These parts may be substituted for parts **417**, **404**, **405** and **406** illustrated in Figs. 7 and 8 without departing from the scope of the invention.

While throughout the term "solenoid" has been employed, the same is intended to include an electromagnet with suitable linkage as well as a solenoid as such term is used in a specific sense.

This application is a continuation-in-part of the following copending applications, Serial No. 91,213 filed July 17, 1936, now Patent No. 2,169,267, dated August 15, 1939; Serial No. 93,800, filed August 1, 1936, now Patent No. 2,142,403, dated January 3, 1939; and Serial No. 100,650, filed September 14, 1936, now Patent No. 2,169,268, dated August 15, 1939.

While the invention has been described in great detail in the foregoing description, the same is to be considered as illustrative and not restrictive in character. The various modifications herein before described as well as others which will readily suggest themselves to persons skilled in this art, are all considered to be within the broad scope of this invention, reference being had to the appended claims.

The invention claimed is:

1. A selective speed control system for self-propelled vehicles having a device proportionally operable to vehicle speed, and an engine with a fuel supply passage with a valve in said passage, electrically operable means for said valve, a connection between said means and valve, a plurality of parallel circuits for the electrical operable means, a multiple switch structure for said circuits and operable by the device for energizing the electrically operable means at predetermined vehicle speeds, a second multiple switch structure for said parallel circuits, and manually operable means for selectively connecting the electrically operable means to the second multiple switch structure and simultaneously adjusting the connection between the electrically operable means and valve, the amount of adjustment being inverse to the selected speed for selective speed conditioning purposes whereby valve control is proportional to selected speed condition in that valve movement is least at highest selected speed and most at lowest selected speed.

2. A device as defined by claim 2, characterized by the addition of a locking arrangement for locking the manually operable means in any selected speed condition position.

NEEL M. McCULLOUGH.

July 28, 1942. C. H. BUCK **2,291,145**

METHOD OF FLEXIBLE HEATING IN INTERMITTENTLY OPERABLE SYSTEMS

Filed April 13, 1940

FIG. 1

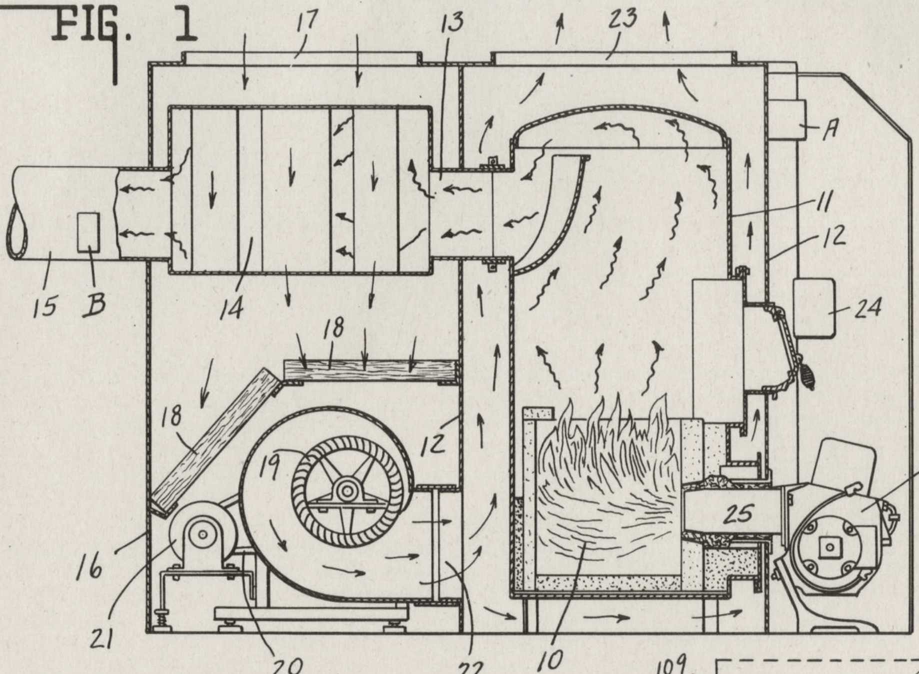


FIG. 2

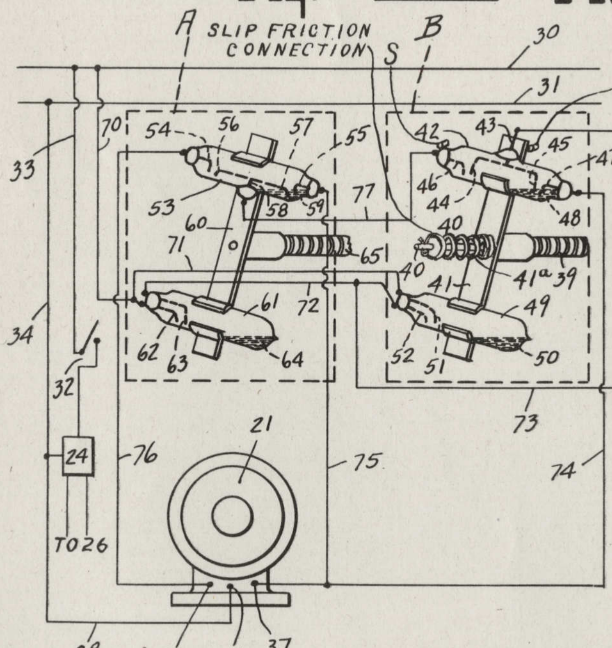


FIG. 3

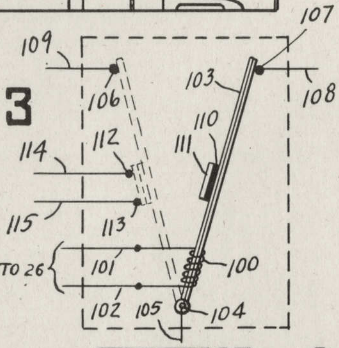
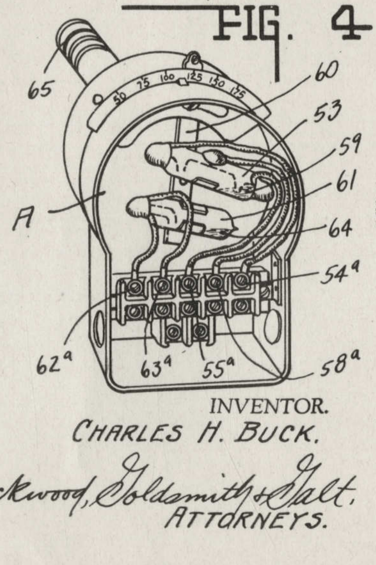


FIG. 4



INVENTOR.
CHARLES H. BUCK.

BY Lockwood, Goldsmith & Galt,
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,291,145

METHOD OF FLEXIBLE HEATING IN INTERMITTENTLY OPERABLE SYSTEMS

Charles H. Buck, Indianapolis, Ind.

Application April 13, 1940, Serial No. 329,433

1 Claim. (Cl. 236—9)

This invention relates to means for and a method of obtaining what is generally known as flexible firing effect from an intermittently operable combustion source.

The chief object of this invention is as suggested above, to-wit; to provide means for an intermittently operable combustion source and to so control the operation of said combustion source and the heat transferring medium and means that a flexible firing effect is obtained from an installation of the intermittent type.

The chief feature of the invention consists in operating such an intermittent combustion source and controlling the medium and means associated therewith so that when heat is desired for household or like heating purposes, as soon as the combustion source produces an initial amount of heat, the heat transferring medium is initially circulated and at a lower rate than at the rate which is utilized when the combustion source is operating at maximum capacity and the transfer of heat is being rapidly effected, coupled with the further provision that when heat is no longer demanded for such household heating, the heat stored in a portion of the heat transferring mechanism is slowly dissipated into the heat transferring medium as distinguished from the present and prior practice of rapidly transferring the same with the result that the effect of flexible firing is obtained and with the further result that "high over-run" operation is either very materially reduced or substantially eliminated.

For a complete understanding of the invention, it should be noted that for household heating there is generally provided one or more "room" thermostats in the desired location or locations, each of which is adapted to control the combustion source. This combustion source may be a gas fired furnace, an oil fired furnace, or a stoker fed furnace, as applied to hot air heating. If applied to hot water or steam heating, the same type of fuel may be utilized. Since the problems sought to be solved by this invention and solved thereby are more particularly acute in hot air heating installations, the following description and the drawing describe and illustrate, respectively, a hot air embodiment of the invention.

In hot air heating, the same may be of two types; the gravity type or the forced warm air type. In connection with the gravity type, it is well known that when the intermittently operable combustion source supplies heat that the air in contact with the bonnet and the like and included as a part of the circulating system for the air medium, immediately becomes heated and to a corresponding proportional degree and immediately starts to circulate and as the source of heat supplies additional heat to the bonnet, the rate of the circulation increases.

Then when the thermostat opens the circuit controlling the heat source, the heat previously stored in the bonnet and the like continues to dissipate or transfer to the circulating air in a decreasing amount of heat following cessation of heat supplied to the bonnet, until the heat is exhausted from the bonnet, whereupon the circulating medium, the air, ceases circulation.

It has been ascertained that the public is demanding clean heating equipment with the result that the circulation of air as aforesaid requires cleaning of the air which may be of two characters, either by washing or by filtering. Washing of the air is needlessly expensive. Filtering of the air is relatively inexpensive and practically all hot air installations, at the present time, are of the forced warm air character for the reason that the filter arrangement, when introduced into the gravity type system, practically prohibits gravity flow. Consequently, the necessity for filtering being paramount, there is provided a means for positively circulating the air in the system. In almost all instances, the cold air return discharges to a filter arrangement and a fan or blower draws the cold air through the filters which are replaceable and then forces the filtered air around and over the bonnet and other heating surfaces of the combustion source, and thence into the several pipes leading into the rooms to be heated.

The present invention is applied to the last mentioned type of system, although modifications thereof may be applied to other types of systems previously mentioned, with but slight change.

The present invention contemplates the utilization of a multi-speed motor for operating a fan or blower and, preferably, the motor has two speeds—the high and the low speed. The household "room" thermostat is the master control. When heat is required, it, through appropriate control means, insures the initiation of heat supply to the bonnet by automatically opening the gas valve in a gas fired furnace, etc.

The types of fuel are solid, liquid or vapor, to-wit: coal or coke, oil or gas. Usually there is no forced supply of air for a gas unit. There is a forced supply of air for oil and solid fuel consuming units. Generally, this forced supply of air is operated simultaneously with fuel supply. The fuel supply proper, as well as the air supply, is customarily provided with a safety arrangement which, in the event that combustion cannot take place or does not occur, the fuel and air supply, while initiated, immediately ceases to function. This is the safety or protective factor which is standard in all intermittently operable combustion sources, more especially in gas and oil fired arrangements, but is also included in solid fuel fired arrangements in that unless the solid fuel initially supplied does not immediately continue to burn and to the desired amount, a thermally responsive element immediately cuts off continued fuel and air supply so that such solid fuel arrangement does not continue operation without combustion occurring simultaneously therewith. Since these types of controls and safety elements are standard equipment, as stated, no further detailed description nor any specific illustration thereof is believed necessary.

Also, old and well known is the operation which follows: When the room thermostat no longer calls for heat, the respective motors or controls are deenergized or rendered inoperative and further fuel and air supply is discontinued.

In such operation, it will be noted that for some interval following initial combustion the heat produced initially must heat all of the adjacent and surrounding parts in the combustion chamber, bonnet, etc. Thus, these types of heat sources differ from the more flexible type wherein there is resident as in a hand fired furnace a relatively large body of fuel, that is relatively slowly burning at all times. The latter type of construction is what is generally considered a flexible supply.

Returning to the intermittent type, following the initial heating of the parts in the combustion chamber which sometimes, particularly in gas and oil fired furnaces, includes heat absorbing refractories are employed to radiate heat combustion and such refractories have a heat absorbing capacity the aforesaid must be satisfied before the bonnet is in condition to supply heat to the air adjacent thereto.

Following satisfaction of this condition, additional heat then must be supplied to raise the bonnet temperature until such time as the heat therein is sufficient to heat the air in contact with the bonnet and the like, so that when the air is sufficiently heated it can be circulated for heating purposes. It is customary in installations of this character to provide a bonnet thermostat which, when the bonnet attains a certain temperature, say for example 125° to 165°, a circuit is closed by that thermostat and through the fan motor which insures positive circulation of the heated air.

It will thus be noted that from the time the combustion source starts to supply heat until the time that heat is adequately supplied to the circulating air, there is an appreciable time lag. Then, it is evident that as long as the room thermostat calls for heat, the combustion source will supply heat. When the room thermostat is thermally actuated to open the control circuit to the combustion source, no further heat is supplied by that combustion source, or more particularly, the primary supply.

However, there is a large amount of heat stored in the bonnet and refractories which, upon cessation of combustion, still is in condition to discharge and transfer heat so that long after the room thermostat shuts off, the bonnet thermostat still holds the circulating fan motor circuit closed until such time as the bonnet thermostat opens that circuit incident to the cooling of the bonnet by reason of the forced circulation of the cooler air from the several rooms to and over the bonnet and back to said rooms.

The resulting condition is this. If the thermostat is set, for example, to supply heat at a predetermined temperature and is adjusted to cut off heat supply at several degrees thereabove, this so-called intermittent heating results in what is known as a "high over-run" and this is because the bonnet thermostat continues fan operation. The resulting action in the rooms to be heated is that there is at each cycle a relatively wide fluctuation between the actual room temperature when heat is supplied in response to room thermostat demand for heat and the final room temperature effected, long after the room thermostat has been satisfied. These are always considerably below and above the temperatures for which the room thermostat demands or causes a cessation of operation at the primary source.

Insofar as forced feed hot air heating is concerned, therefore, the problem is emphasized many times when such heating system is associated with an intermittently operable source of heat.

The present invention contemplates the employment of a multi-speed motor for the air circulating fan or blower and having the former so controlled that when the primary heat source is conditioned to supply heat and is not otherwise inoperable, the fan motor shortly after such conditioning, operates at low speed and then when the bonnet temperature increases to the proper amount the low speed motor operation is discontinued and high speed motor operation of the fan is effected which is continued so long as the room thermostat calls for heat.

Immediately upon the room thermostat shutting off, the air circulating fan motor, or rather shortly thereafter, ceases to operate at high speed, but is then operated at low speed and this low speed operation is continued until the bonnet temperature has sufficiently decreased whereupon cessation of all forced feeding of air is effected.

From the foregoing, therefore, it will be understood that during the fire build-up period and during the fire dying period, corresponding to a hand-fired furnace, the air circulating fan motor operates at slow speed while during the maximum or full draft period of a comparable hand fired furnace, the air circulating fan motor operates at high speed. Thus, there is obtained with this invention that condition comparable to a flexible firing effect by utilizing as a primary source of heat, an intermittently operable combustion source.

The objective result is that the so-called high over-run heretofore inherent in intermittently operable combustion source systems, together with other inherent difficulties or objections are eliminated.

One of the latter is the elimination of so-called air stratification common to such intermittently operable systems and not generally present, unless there is an air locking or binding, in a gravity system. It may be noted, also, that when the latter condition occurs in a gravity system, practically the only solution to that problem is to apply a forced circulating arrangement by installing a fan or blower to positively insure proper circulation.

The basic invention, therefore, it will be appreciated from the foregoing, relates primarily to the cycle of control for obtaining flexible firing effect from an intermittently operable combustion source. Certain phases of the invention are equally advantageously applicable to certain other types of combustion sources, such as those known as high-low firing systems and those known as flexible flame firing systems, although specific mention hereof of the same is not to be construed as excluding others to which the present invention might also be applied with the same advantages attendant upon such application.

The problems inherent in heating system constructions are well known and attempts have been made to solve the same by utilizing time controls which have definite time factor applications, regardless of the temperature difference between the interior of the house to be heated and the exterior, so that such time controls, while seeking to accomplish substantially the same objective, to-wit: the solution of these problems fail to accomplish the same over a wide range of conditions because the adjustments must be so made that they only apply to the average temperature difference condition.

The present invention, therefore is universally flexible since, as will be hereinafter pointed out more fully, it operates solely upon temperature difference and, therefore, regardless of the temperature difference between the interior of the house to be heated and the exterior or outside air, the system always properly functions and the problems previously inherent in intermittently operated combustion sources, time lag responsive control systems are not present.

Having thus described the cycle of operations, the problem and the solution effected by such cycling reference will now be had more particularly to apparatus capable of effecting such cycling.

It is to be understood, however, that while the several parts of this apparatus are illustrated as of mercury switch character they may be of snap switch character or of relay switch type. Mercury switches are notoriously effective and safe, the circuit being made and broken within a sealed chamber, thereby reducing fire hazard to a minimum hence the preferred form of the apparatus invention is illustrated and described as including mercury switches.

The full nature of the invention will be understood from the accompanying drawing, the following description and claim:

In the drawing, Fig. 1 is a diagrammatic sectional view through a forced air heating system including the invention applied thereto, the latter being more or less illustrated diagrammatically.

Fig. 2 is a wiring diagram of connections showing mercury switch applications throughout.

Fig. 3 is a diagram of a warp switch modification of a portion of the switching arrangement shown in Fig. 2.

Fig. 4 is a perspective view of a temperature responsive switch arrangement.

In Fig. 1 of the drawing, there is indicated a combustion chamber **10** surrounding a bonnet **11**, in turn surrounded by the furnace casing **12**, the air space therebetween being included in the hot air heating circulatory system. The combustion chamber is herein shown discharging as at **13** to a super-heater **14** in turn discharging to a smoke pipe **15** leading to a chimney or stack. The letter B designates the so-called stack switch arrangement to which reference will be had more fully hereinafter and to its equivalent warp switch construction, see Fig. 4.

A casing **16** has one or more cold air inlets **17**, the other ends of which are connected to registers and the like by cold air ducts. These registers are positioned, usually, in the floor of one or more rooms in the lower floor of a multi-floor building. The relatively cool air entering the intake **17** passes through the super-heater and is initially heated. It then passes through the filter structures **18** being drawn therethrough by a fan structure **19** herein shown belt-driven as by the belt **20** from the fan motor **21** which, preferably, is of multi-speed character. This arrangement, however, can be direct drive or can be two motors with slip clutches, if desired. The fan discharges as at **22** to the chamber between the outer part of the furnace and the dome and bonnet arrangement.

The hot air discharges from the furnace by one or more outlets **23** which, through suitable conduits, discharge to the several rooms. These conduits usually are valve controlled.

Associated with the bonnet and dome is what might be termed the bonnet switch, herein designated by the letter A. Also carried externally of the furnace proper is another motor controller arrangement **24** to which reference will be had hereinafter.

The present form of the invention illustrated includes a tubular structure **25** adapted to supply both air and oil to the combustion chamber **10** and this air and oil is supplied by a combination unit including a motor and fan arrangement, together with all the customary safety devices, valves and pipe, and the same is designated generally by the numeral **26** in Fig. 1.

Reference will now be had to Fig. 2. Herein is illustrated the power supply mains **30** and **31**. In the event the room thermostat **32** is of 110 volt character, it is included in series for direct control and operation of the controller arrangement **24** which, as before stated, controls the air and fuel supply motor combination **26**. As long as this thermostat **32** is closed, air and fuel will be supplied for combustion purposes, providing the controller **24** is properly conditioned.

Usually the controller **24** includes a safety device which prevents the supply of fuel if the device is not conditioned for proper operation.

Herein line **33** includes a supply line to the controller **24** and line **34** includes the return. It, of course, is obvious that the thermostat switch may be of a remote control character, that is, close a switch that in turn controls the supply of energy that is supplied to the controller mechanism included in the controller **24**.

Furthermore, it is quite apparent that the room thermostat in the latter instance also may be of low voltage type and then would derive its voltage supply from a small transformer. All of these are conventional variations and are well known in standard practice.

In Fig. 2, the motor **21** is provided with terminals **35**, **36** and **37**. The terminal **36** is connected by line **38** to one of the mains, which is the ground main. The motor is so arranged that when current is supplied to terminal **35**, the motor operates at high speed, and when current is supplied to terminal **37** the motor operates at low speed. Thus, the fan operates at high or low speed, respectively, depending upon to which motor terminal current is supplied.

Included in the dotted lines indicated by the letter A in Fig. 2, is the bonnet switch and included within the dotted lines B in Fig. 2, is the stack switch.

Since certain of the parts hereinafter to be described, are conventional and well known constructions, only brief reference will be had thereto. For example, incorporated as a part of the stack switch is a bi-metallic helix 39, which upon being sufficiently heated has one end arranged to cause rotational movement. This rotating end is indicated by the numeral 40 and carries a support 41 that is tiltable clockwise and anticlockwise to certain stops which limit the extent of the movement, regardless of the changes of temperature.

Carried by the member 41 is a single pole double throw mercury tube switch indicated generally by the numeral 42 and included therein is a central terminal 43 and two oppositely directed contact terminals 44 and 45. Extending into each end of the tube is a contact member such as 46 and 47. The mercury 48 is adapted to bridge alternately the switch contacts 45 and 47 and 44 and 46, depending upon the position of the member 41.

The member 41 also mounts another mercury switch indicated generally by the numeral 49 and including mercury 50 therein and having two terminals 51 and 52 at one end. As shown in Fig. 2, which represents the dormant condition, the mercury 50 in switch 49 does not close the circuit across the contacts 51 and 52 and the mercury 48 in the other switch 42 does not close the circuit across the contacts 44 and 46, but does close the circuit across the contacts 45 and 47.

When there is an increase in temperature in the stack incident to initial combustion and long prior to any appreciable rise in temperature to which the bonnet switch arrangement A is susceptible, the helix 39 is affected and the member 41 is tilted, counter-clockwise so as to close the circuit across contacts 51 and 52 in switch 49 and across 44 and 46 in switch 42, and simultaneously open the circuit across 45 and 47 in the last mentioned switch.

These are the two positions assumed by this switch arrangement. The last mentioned is what might be termed, active combustion position, and the former, as shown in the drawing, is the so-called "dormant position." It is to be understood that the helix 39 is operatively connected to the member 40 such that there is a slip engagement connection effected so that member 41 is operated by metal helix 39 on a change in temperature of a predetermined amount, regardless of the starting or stopping points of the structure.

Since this helix and its slip connection to a switch carrier is well known in the heating and ventilating control art, no specific description is believed necessary.

The bonnet switch structure A, see Figs. 2 and 4, includes a mercury switch 53 which at opposite ends includes a contact 54 and 55. Adjacent each contact is a contact 56 and 57, respectively the two latter being connected together and having a common terminal connection 58. The mercury 59 in the tube is adapted to close the circuit across the contacts 57 and 55 when the bonnet switch structure is in the inactive or fire build-up position. The tiltable member 60 supports said switch 53. It also supports another mercury switch 61 which at one end has two terminals 62 and 63. The mercury 64 in said mercury switch is adapted, during the active combustion period or after the fire has been built up sufficiently to close the circuit across contacts 62 and 63. An element similar to element 39 and indicated by the numeral 65 is exposed or responsive to bonnet temperatures. This switch arrangement A is of the slow acting type as compared to the switch B. This switch arrangement A is not of the slip character whereas switch arrangement B is of that character so that as the bonnet temperature gradually rises, the member 60 will gradually rotate counter-clockwise so that the circuit will be closed across contacts 54 and 56 and across contacts 62 and 63 and will be opened across contacts 55 and 57.

This tilted position of the bonnet switch in the counter-clockwise direction is maintained from the time that the switch becomes operative, that is, responds to an increase in bonnet temperature sufficient to cause the switches to be tilted, until such time as the temperature of the bonnet drops. This, as previously set forth, occurs a considerable period after the fuel supply has been rendered inoperative by the room thermostat due to the storage of heat as before set forth.

A line 70 connects the main 30 to the switch contact 62. The line 71 connects that same switch contact to the switch contact 51. The line 72 connects switch contact 52 to switch contact 63 and the line 72 is also connected by line 73 to the common switch terminal 43 of the switch 42. The switch contact 47 is connected by line 74 to the terminal 37 or low speed terminal of the motor 21. The line 75 also connects thereto and to the switch contact 55 in the switch 53. The switch contact 54 in the switch 53 is connected by line 76 to the terminal 35 or the high speed terminal of the motor 21. The terminal 46 of switch 42 is connected by line 77 to the common terminal 58 of the mercury switch 53. In Fig. 2 stops S limit the actual throw of the switch carrier 40. However, the spring 41*a* permits the bi-metallic helix 39 to coil and uncoil as required by temperature conditions and there is thus insured proper switch carrier movement in the ranges permitted by said stops S.

Having thus described the various connections, the circuits will be set forth briefly as follows:

When the room thermostat 32 calls for heat, the control 24 is suitably energized as before described. After a very slight interval, it will be obvious that the products of combustion escape through the smoke pipe and in so doing the temperature in the smoke pipe increases. When a predetermined amount of temperature difference has been obtained, member 39 responsive to such temperature, responds thereto which tilts the mercury switches 42 and 49 counter-clockwise. In so doing, it will be noted that current then is supplied to low speed motor terminal 37 as follows:

Current from the main 30 is supplied by line 70 to line 71 to the terminal 51 through the mercury 50 to the terminal 52 and thence by way of lines 72 and 73 to the common terminal 43, thence by contact 44 through the mercury 48 of switch 42 to the terminal 46, thence by line 77 to the common terminal 58 of the switch 53 through the contact 57 and mercury 59 to contact 55 and thence by line 75 and 74 to the low speed terminal 37.

Thus, until the stack switch structure B has responded to a predetermined temperature in the stack, the fan motor 21 is not energized even after the cycle has been initiated by the room thermostat 32, but upon attainment of that predetermined temperature difference the low speed portion of the motor 21 is energized for low speed fan operation, thereby insuring relatively slow speed forced air operation. This is during the fire build-up period and before the bonnet has attained a sufficiently high temperature to cause rapid circulation of the air.

When the bonnet has been sufficiently heated the bi-metallic helix 65 of switch A becomes operative to rotate member 60 counter-clockwise so as to tilt the mercury switches 61 and 53. When this occurs, the circuit is as follows:

The current is again supplied from line 30 by means of line 70 to terminal 62. The mercury 64 in switch 61 then bridges the contacts 62 and 63 so that if current is supplied to line 72 and by mercury 50 to contact 51 and thence to line 71 it is carried back to the contact 62. It will be noted that this in effect has no circuit effect, but this false circuit condition is pointed out so that the real circuit condition arrangement will be understood.

Current from line 70, as stated, through the mercury 64 passes from terminal 62 to terminal 63 of switch 61 and thence by lines 72 and 73, it passes to the common terminal 43 of switch 42 and the mercury 48 therein bridges contacts 44 and 46 completing the circuit to line 77 connected to the common terminal 58. The mercury 59 in the switch 53 now completes the circuit across the contacts 54 and 56 so that the line 76 is in series with the line 70 so that current is supplied to motor 21 through the high speed terminal 35 for high speed operation of the motor. Therefore, high speed operation of the fan 19 insures rapid circulation of the heated air between the bonnet and dome and the furnace casting wall. This condition or circuit arrangement is maintained as long as the control 24 is energized combustion continues in the firebowl.

It is to be noted that if, for any reason, the control 24 fails to function due to mechanical or other failure when the room thermostat calls for heat, the switch arrangement B does not function. Therefore no operation of the fan motor occurs upon combustion source failure.

When the room thermostat responds to the heated condition caused by the operation of the heating system being activated, it opens the circuit to the control 24 and combustion ceases. Within a relatively short time following such cessation of combustion, the bi-metallic helix 39 again becomes operative but in a reverse direction and upon the predetermined temperature drop the switches 42 and 49 are tilted clockwise from their previous counter-clockwise tilted position. In so doing, the circuits are conditioned through these two switches as shown in Fig. 2.

It is, however, to be noted that due to the residual heat in the bonnet, firebowl, refractories, etc., the switch structure A is not positioned as shown in Fig. 2 but remains positioned in the tilted position as last described. The circuits then are as follows: Current is supplied by line 30 to line 70 to contact switch 62 of switch 61 and since the mercury 50 is now remote from the two switch points 51 and 52 of switch 49, no circuit is completed through the switch 49 by line 71. The circuit, however, is completed by the mercury 64 across contact 62 and 63 and thence by lines 72 and 73 to the common switch terminal 43 of the switch 42.

The mercury 48 now bridges the two contacts 45 and 47 so that current is supplied by line 74 from contact 47 to the low speed terminal 37 and thus substantially upon cessation of combustion or following the same, at a very short interval, air circulating fan high speed motor operation ceases and low speed motor operation thereof occurs. This continues until the bonnet temperature has dropped sufficiently so that bi-metallic helix 65 again becomes operative in the opposite direction in an amount sufficient to tilt the switches 61 and 53 clockwise to the position shown in Fig. 2. Thereupon, since both switches 61 and 49 are in the clockwise tilted or dormant position, as shown in Fig. 2, no current is supplied to either the high or low speed terminals 35 or 37 of the motor.

Reference will now be had to Fig. 3. In said figure there is indicated a heating device 100 supplied by lines 101 and 102 and these lines are connected to the electrical power supply and are responsive to the operative condition of the controller 24 and associated mechanisms. In other words, if proper combustion cannot be effected when the thermostat 32 calls for heat, this heating element 100 will not be energized for heating purposes or heated, at least if there be a safety control incorporated in the controller 24, to such degree as to effect thermally a thermally responsive element, to-wit: a warp switch controller. This warp switch controller is diagrammatically indicated in Fig. 3 as a bi-metallic warp switch 103 mounted at 104 connected to a line 105 which, in effect, is the line 73 in Fig. 2.

The bi-metallic warp switch member 103 is positioned between the contacts 106 and 107 which are comparable respectively to switch contacts 46 and 47 respectively of switch 42. A line from contact 107 indicated by numeral 108 is the same as the line 74 of Fig. 2 and leads to the low speed terminal 37. A line 109 from contact 106 is the same as line 77 of Fig. 2 to common terminal 58 of switch 53.

As shown in Fig. 3, member 103 contacts the contact 107 and this is the dormant position. Upon the predetermined temperature difference occurring incident to the operation of the heating means 100 as beforementioned, member 103 moves counter-clockwise and contacts the contact 106. The bi-metallic strip 103 supports in insulated relation as at 110, a bridging contact member 111 adapted to contact two contacts 112 and 113 to which is connected lines 114 and 115. The contacts 112 and 113 correspond to the switch points 51 and 52 of switch 49 in Fig. 2 and the lines 114 and 115 thereto and therefrom correspond to the lines 71 and 72 respectively, of Fig. 2.

The operation of this switch structure shown in Fig. 3 is functionally identical to that illustrated in Fig. 2 and represented therein and designated as the stack switch B.

In this connection, it should be noted that the switch arrangement shown in Fig. 3 does not require that the switch arrangement be subjected to stack temperature differences or the like. In other words the basic invention comprehends a switch arrangement which is responsive to combustion per se, that is, switch B or the switch arrangement shown in Fig. 3, tilts counter-clockwise when combustion starts or shortly thereafter and when combustion stops or shortly thereafter this switch arrangement is tilted in the reverse direction.

Other electrically operable means may be utilized in lieu of either of the two specific switch arrangements disclosed herein.

While the invention has been illustrated and described in great detail in the foregoing description, the same is to be considered as illustrative and not restrictive in character.

The several modifications described herein, as well as others which will readily suggest themselves, to persons skilled in this art, are all considered to be within the broad scope of the invention, reference being had to the appended claim.

The invention claimed is:

A method of obtaining flexible firing effect in a heating system having a conventional source of heat intermittently operable in response to room thermostat demand, a fan and motor operable at selective speeds for forcing the flow of the heating medium of the system, and a pair of thermally responsive controls for the motor arranged for subjection to two different thermal conditions, one thermal responsive control being directly responsive to predetermined change in the active temperature of the heat source and the other being responsive to a predetermined temperature of the heating medium when subjected to the heat effect of the heat source, said method including automatically forcing the flow of the heating medium at a relatively slow rate and in response to the first mentioned thermal control immediately or comparatively shortly after room thermostat calls for heat, continuing that forced flow during the heat build up period of the system until terminated by the second thermal control, then forcing the flow of the heating medium at a much greater rate when the second mentioned control becomes effective incident to heating medium increased temperature to the predetermined temperature, continuing the second mentioned flow until the room thermostat no longer calls for heat, and then continuing the forced flow of the heating medium at the slower rate from immediately or comparatively shortly after room thermostat demand is satisfied and until the source of heat has sufficiently cooled as determined by the first mentioned control becoming ineffective for fan operation.

CHARLES H. BUCK.

May 23, 1944. G. HODGES 2,349,625

SIGNAL DISCRIMINATING SYSTEM

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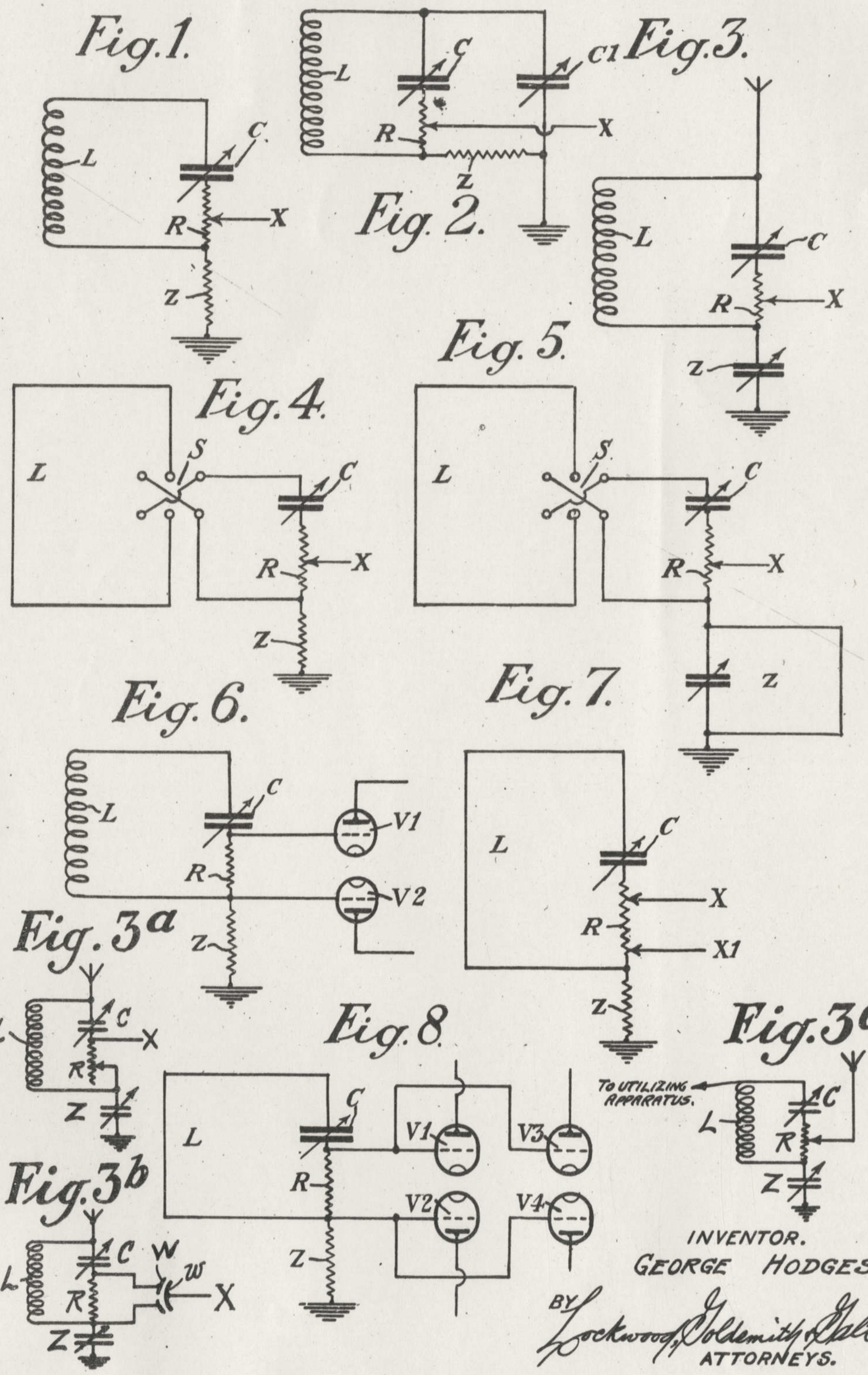

INVENTOR.
GEORGE HODGES.

BY Lockwood, Goldsmith & Galt.
ATTORNEYS.

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SIGNAL DISCRIMINATING SYSTEM

George Hodges, Meadow Way, Rickmansworth, England

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1 Claim. (Cl. 250—20)

This invention relates to wireless signalling apparatus or other apparatus employing radio frequency methods and more particularly to the circuit arrangement of a wireless receiving apparatus.

The object of the invention is to produce a circuit arrangement for use with wireless receiving apparatus which will effect discrimination between wanted and unwanted signals, or between radio waves arriving by more than one path from a transmitter, or between a carrier wave and its sidebands.

The application of the invention may be considered as falling principally into four categories:

1. As a means to effect the elimination or reduction of unwanted signals or interference in a wireless receiver.

2. As a means to effect a reduction of fading effects of received signals.

3. As a tuning circuit which provides a resonance curve which is flat over a band of frequencies or which may rise on each side of a carrier frequency.

According to the present invention I provide in a wireless signalling apparatus or other apparatus employing radio frequency methods, means for applying incoming signal potentials to an oscillatory circuit comprising an inductance, a resistance and a condenser in series, the said circuit being associated with an impedance, one side of the impedance being connected to the junction of the inductance and the resistance and the other side of the impedance being connected to earth, the circuit arrangement being such that by the phase and amplitude matching adjustments provided, unwanted signal potentials developed across the resistance and the impedance may be balanced out so that they do not reach an output circuit, associated with the said oscillatory circuit and impedance, at the same time permitting the wanted signal potentials to reach the said output circuit.

In order that the said invention may be clearly understood and readily carried into effect the same will now be described by way of example with reference to the accompanying drawing, in which:

Figure 1 is a circuit diagram showing the basic principles of the invention.

Figure 2 is a circuit diagram showing a modification of the circuit shown in Figure 1.

Figure 3 is a circuit diagram showing a practical application of the circuit shown in Figure 1.

Fig. 3*a* is a circuit diagram of a circuit similar to that illustrated in Fig. 3 but wherein the resistance is variable.

Fig. 3*b* is a circuit diagram of a circuit similar to that illustrated in Fig. 3 but wherein a variable condenser is applied in multiple to the resistance.

Fig. 3*c* is a circuit diagram of a circuit similar to that illustrated in Fig. 3 but where the input and output connections are illustrated in reversed relationship.

Figure 4 is a circuit diagram showing a modification of the invention in which the inductance is in the form of a loop aerial.

Fig. 5 is a circuit diagram similar to Fig. 4 but of a modification wherein the impedance is in a loop circuit.

Figure 6 is a circuit diagram showing a modification of the invention in which amplitude matching is achieved by thermionic valves and

Figure 7 is a circuit diagram showing a modification of the invention in which the signal potentials are fed to two amplifiers.

Figure 8 is a circuit diagram showing a further modification of the invention in which amplitude matching is achieved by thermionic valves feeding the signal potentials to two amplifiers.

Figures 1 and 2 illustrate the basic principles of the circuit arrangements. In Figure 1 an oscillatory circuit comprising an inductance L and a condenser C has connected in series a resistance R, the circuit being earthed through an impedance Z. It is necessary that the resistance should be connected in the condenser side of the oscillatory circuit, that is to say between the condenser and the impedance, the inductance being connected at one end to the junction between the resistance and the impedance and at the other end to the side of the condenser opposite to the side connected to the resistance. The impedance may be in the form of a resistance or a capacity or an inductance or other suitable combination of resistance, capacity and inductance which produces an impedance of the required value between the oscillatory circuit and earth. The output potential with respect to earth is taken from a tapping on the resistance and is delivered at the point X to the succeeding circuits of a wireless receiver. For the theoretically ideal operation of the circuit, the resistance R should be non-inductive and free from capacity effects since such effects will upset the phasing conditions to be described later. In practice the output connections necessarily introduce a certain amount of capacity or other impedance in parallel with the resistance and in cases where the parallel impedance cannot otherwise be made of high value relative to the resistance it is advantageous to include a fixed condenser between the point X and the succeeding apparatus, the capacity of this condenser being kept as small as possible consistent with the requirement of conveying an adequate proportion of the wanted signal potentials to the succeeding apparatus.

In the basic circuit shown in Figure 1 the input arrangements are omitted for simplicity. Signal potentials may reach the oscillatory circuit by the normal arrangements of coupling or connection to an aerial, with or without intermediate valve amplifying stages, or alternatively the inductance of the oscillatory circuit may be arranged as a loop aerial. On the output side the potential developed across the resistance may be arranged to oppose the potential developed across the impedance and provided the potentials are suitably matched in phase and amplitude unwanted signal potentials will not appear between the point X and earth.

Phasing is accomplished by tuning the oscillatory circuit so that the potentials, developed across the resistance and the impedance, are in phase or phase opposition, the necessary condition depending upon the form of amplitude matching adopted. Tuning of the oscillatory circuit is performed in the normal manner by adjusting the inductance or capacity or both. The correct setting of the tuning controls to achieve phase matching across the resistance and the impedance is not necessarily exactly the same as that required for resonance, though in operation the circuit is first tuned roughly to the frequency of the signals to be dealt with, a fine adjustment on either side of the resonant frequency then being made if necessary to achieve accurate phase matching. The values of the inductance and capacity of the oscillatory circuit may be chosen so that tuning is accomplished either at the fundamental frequency of the circuit or a harmonic frequency.

Aerials are of many kinds including a loop, a vertical conductor, a horizontal conductor and an umbrella. The theory of the phasing operation may be explained by first considering a case where the inductance of the oscillatory circuit is arranged as a loop aerial. Signal potentials are developed across the resistance R due to the loop aerial effect. Signal potentials are developed across the impedance Z due to the vertical aerial effect of an earthed loop. But it must be recognized that some potential due to vertical aerial effect will also be developed across the resistance R. The important point to be observed, therefore, is that whilst the potential across Z is largely due to vertical aerial effect, the potential across R is a mixture of vertical and loop effects. It is known that the voltage in a vertical aerial is in phase with the flux in space and that in a loop circuit the voltage is 90 degrees out of phase with the flux in space and that this phase angle is independent of the direction of the incoming waves relative to the loop.

The aforesaid terms loop and vertical effects are used to designate the effects obtained from a loop aerial and a vertical aerial, even though a portion of the former serves as the latter, as herein illustrated. Portions of the circuit including same are termed loop aerial and vertical aerial.

I take as an example a case in which a potential of a certain amplitude is set up across R by the loop effect and a potential of the same amplitude is also set up across R by the vertical effect, the two potentials being out of phase as indicated in the preceding paragraph. Since they are of equal amplitude, the resulting potential will be a mixture of the two phases, i. e. the phase will be half way between the actual loop and vertical phases. But this new phase angle will apply only as long as the amplitudes are equal. If the loop aerial, without being rotated, picks up signals from a different direction, the relative amplitudes of the loop and vertical effects across R are changed for this second signal due to the directional effect. Although the potentials have the same phase difference as before, the fact that they have different amplitudes means that for this second signal the resulting phase of the potential across R is not half way between the loop and vertical phases, but will shift towards one or the other. Changes in the relative amplitudes of the loop and vertical effects may be brought about not only by changes in the direction of incoming signals. Any alteration of the tuning of the loop circuit will cause a similar variation of the amplitude of the loop effect across R, which, mixed with the vertical effect across R, causes a phase shift with respect to the potential across A. Amplitude and phase changes across the impedance Z should also be considered. Whilst the potential developed across Z is largely due to vertical aerial effect, the loop and vertical aerial circuits cannot be regarded as being independent of each other due to the fact that the impedance is connected at a point which does not earth the loop symmetrically and, accordingly, the amplitude and phase across Z is also modified by variations in the loop circuit. The total effect of all these possible phase changes is sufficient to enable the tuning control to bring the potentials across R and Z into phase.

A second example may be considered in which the inductance is not a loop aerial, but the tuning coil of the circuit LCR, input potentials from a separate aerial or other source being applied between a point on the inductance, remote from earth, and earth. It is convenient to approach the theory of this form of the circuit by analogy with the earth loop previously described. Potentials developed in the circuit LCR will be referred to as being due to the closed circuit effect, potentials developed across the impedance Z being referred to as due to the vertical effect. It should be noted that the potential developed across R will be partly due to the closed circuit effect and partly to the vertical effect. Phase difference between the potentials in the closed circuit and the vertical circuit exists and as the tuning of the circuit is varied there is a variation in the mixture of the closed circuit and vertical effects across R, the two potentials of different amplitude and phase producing a new resulting phase as in the example previously described. The effects are closely analogous to those of the loop form of the apparatus, provided it is recognized that in this second example there is no question of variations due to directional effect, the tuning operation being employed to compensate for phase changes due to differences of signal frequency.

An important effect should be noted in connection with this second example. When the tuning of the circuit LCR is adjusted for phase matching the potential across R is in phase opposition to the potential across Z, enabling amplitude balance to be obtained at the output point X when suitable values are chosen for R and Z. The effect also exists in the loop form of the apparatus and although it contributes to the phase changes it is masked by the large variations which occur in the relative amplitudes of the loop and vertical effects. Accordingly, it will be shown later that a switching arrangement is necessary with the loop form of the apparatus when phase opposition across R and Z is desired.

A third example may be considered in which the inductance is the tuning coil of the circuit LCR, signals being applied to the circuit by inductive coupling with an aerial or other source. It is recognized that if the coupling were purely inductive the theoretical conditions for phase matching would not be fulfilled. In practice, however, a stray capacity between the aerial circuit and circuit LCR exists and it may be encouraged by design to the extent required. The analogy with the earthed loop may be used again. Inductive coupling provides the closed circuit effect and capacitative coupling provides the vertical effect, there being a phase difference between the two potentials.

In a modification of the circuit illustrated in Figure 2, the impedance is arranged so as to form part of the oscillatory circuit. The circuit, as before, comprises an inductance L and condenser C, which may be the main tuning condenser. This condenser is connected in series with the inductance through an impedance Z, the side of the condenser connected to the impedance being earthed. Shunted across the inductance of the circuit is a further condenser C*l* which may be of fixed or variable value. This condenser is arranged in series with a resistance R. The circuit of Figure 2 is similar to that shown in Figure 1 except for the fact that an additional condenser is connected between the end of the inductance, remote from earth, and earth. The two circuits described operate on the same principle and for simplicity the following description will relate to the first mentioned circuit and its developments, it being understood that the modification illustrated in Figure 2 may be applied to various forms of the circuit.

A practical application of the circuit is illustrated in Figure 3 in which a receiving aerial is connected to the tuning coil in normal manner. Figure 3 also illustrates the use of a variable condenser as the form of impedance Z. To operate the circuit, the unwanted signal potentials developed across R and Z are brought into phase opposition by adjusting the tuning of the oscillatory circuit as previously described. To match the amplitude of the two potentials thus opposed, a proportion of the potential developed across R is tapped off by the sliding contact shown. The impedance Z is adjusted to a pre-set value so that at some point on the resistance R the signal potential between the tapping point and the impedance is exactly equal to the signal potential across the impedance and consequently the unwanted signal potentials will not be passed on to a receiver connected between the point X and earth.

In this form of the circuit discrimination between wanted and unwanted signals depends upon the difference in their frequencies since any difference in frequency will upset the phase and amplitude of the potentials developed across the resistance and the impedance. If the circuit is adjusted for balance at the frequency of the unwanted signals, some proportion of the wanted signal potentials at another frequency will be passed through to the receiver. When the unwanted potentials are due to atmospherics or other electrical disturbances having an indefinite frequency characteristic, the oscillatory circuit may be tuned to a frequency considerably different from that of the wanted signals. Some degree of balance may be achieved for the interference whilst the wanted signals force themselves through to the output point.

In choosing suitable values for the resistance and the impedance, consideration must be given to the particular form of the circuit used and the waveband over which it is designed to operate. In the circuit shown in Figure 3 a value of 100 or 200 ohms for the resistance is satisfactory when the circuit is operating on the medium wave broadcasting band, and the value of the impedance is then chosen so that the potential developed across the impedance can be made equal to the potential developed across the resistance. Higher or lower values for the resistance and the impedance may be adopted provided their relative values are such as to give amplitude balance as indicated. In the case of short wave signals it is preferable to use lower values so that the resistance shall not damp the circuit unduly.

In Figure 3 amplitude matching is provided by varying the value of the impedance Z and by adjusting a sliding contact on the resistance R. Alternatively or additionally the resistance R may be made variable in which case the connection with the point X may conveniently be made at the junction of the resistance R and condenser C, see Fig. 3*a*. Alternatively, see Fig. 3*b*, a differential condenser may be connected across the resistance R, the fixed vanes V^x being connected one to each end of the resistance R and the moving vanes W to the output point X. The value of the differential condenser should be as small as practicable to avoid undue capacity in parallel with R. Alternative input arrangements may be adopted. Instead of the direct aerial connection shown, signal potentials from an aerial or other source such as a valve amplifier may be applied to the circuit by normal direct connection or inductive or capacitive coupling arrangements. The input and output connections of the circuit are reversible. Signals from an aerial or other source may be applied between the point X and earth, and the output, see Fig. 3*c*, may be taken from the end of the inductance L, remote from earth, and earth. Balance is achieved by matching the phase and amplitude of the potentials due to coupling by the resistance R and the impedance Z, the basic principles of the operation remaining the same as previously described.

In Figure 4 the inductance L takes the form of a loop aerial (with or without a loading inductance for tuning purposes) and with this loop aerial arrangement the input connections previously referred to are unnecessary. Under these conditions the potentials developed across the resistance R and the impedance Z may either assist or oppose each other, depending upon the direction from which the signals reach the loop aerial. The possible variability in the sign of the potentials may be allowed for by reversing the connections to the loop inductance by means of a suitable switch S. Unwanted signals may be balanced out by fulfilling the previously described requirements for matching the phase and amplitude of the potentials developed across R and Z. It is not necessary to provide means for rotating the loop aerial in order to balance out signals from any particular direction since the circuit is capable of balancing out signals from any direction by the phase and amplitude adjustments described. Consequently the loop aerial may be either of the conventional type or may be a single wire loop disposed irregularly around the walls of a building or other support.

When a loop aerial is employed in this way, discrimination between wanted and unwanted signals is afforded not only by any difference in their frequencies but also to a much greater extent by any difference in the direction from which signals reach the loop. It has been shown that there is a possible phase variability amounting to phase reversal between the potentials set up across the resistance R and impedance Z and there is also much variability in amplitude when signals reach the aerial from different directions since the loop is strongly directional. The conditions of matched phase and amplitude required for balance will accordingly be upset to a great extent by differences in the direction from which signals reach the aerial and the discrimination afforded by frequency difference becomes of secondary importance. A loop aerial circuit employed in this way discriminates not only between signals of different frequencies but also between signals of the same frequency provided they reach the aerial from different directions. Differences of polarization of the waves have an effect similar to differences of direction. In cases where a small rotatable loop is employed instead of the fixed loop referred to above, the normal operation of turning the loop to pick up minimum interference may be employed as an additional or alternative adjustment, since turning the loop will vary the phase and amplitude of the potentials set up across R and Z.

The impedance in the circuits described may alternatively, see Fig. 5, comprise an oscillatory circuit tuned to the frequency of the unwanted signals, the inductance of this second oscillatory circuit being arranged as a loop aerial or coupled or directly connected to a separate open aerial with or without intermediate valve amplifying stages. The second loop or open aerial is spaced from the loop or open aerial providing the input to the oscillatory circuit first described as including a resistance and being earthed through an impedance. Where two aerials are thus employed, discrimination may be effected when the ratio of wanted to unwanted signals is greater at one aerial location than at the other. Unwanted signals may be balanced out at the tapping point on the resistance by fulfilling the previously described requirements for matching the phase and amplitude of the potentials developed across the resistance and the impedance (in this case the second oscillatory circuit). It is recognised that exact phase matching is not always possible with inputs from two aerials but some degree of discrimination between wanted and unwanted signals or interference may nevertheless be achieved.

Other specific embodiments of the invention relate to alternative arrangements for matching the amplitude of the potentials to be opposed in order that unwanted signals or interference may be balanced out at the output point connected to the subsequent utilization circuit. These arrangements apply either to a loop circuit or to a circuit having separate input connections.

In a modified arrangement of the output circuit illustrated in Figure 6, the values of the resistance R and impedance Z respectively are such as to provide only partial matching of amplitude, final balance being achieved in a circuit fed by valves. The grid of the valve V1 is connected to one end of the resistance and the grid of the valve V2 to the other end of the resistance. The value of the resistance R is made small compared with the value of the impedance Z so that the potential existing across the resistance is always smaller than that across the impedance. On the anode side of the valves various known methods may be adopted for opposing the two output potentials and for reducing the output of one or other of the valves for exact amplitude matching. The use of valves of variable amplification factor offers a ready means of achieving balance in the anode circuit. The valves may amplify at signal frequency or may be arranged as frequency changers in a superheterodyne receiver. The circuit shown in Figure 6 will normally include in the grid connections the usual grid condensers, grid leaks and cathode connections to the ground which are merely omitted for simple illustration.

In cases where the amplitude balance is effected by valves as previously described, the arrangement has several advantages over the first described circuits. The values of the resistance and the impedance may be permanently fixed without reference to individual signal conditions. The capacity in parallel with the resistance due to the output connections is reduced to a minimum by reason of the direct connection to the grids of the valves. The value of the resistance may be low so that the oscillatory circuit is not unduly damped, a particular advantage when the circuit has to deal with short wave signals. Furthermore, the arrangement simplifies the phasing operation when a loop aerial is employed since balance may be achieved when the potentials across the resistance and the impedance are either in phase or phase opposition. When they are in phase the potential at the end of the resistance, where it is connected to the condenser, will be somewhat greater than the potential at the other end of the resistance at its point of connection with the impedance, the potentials being of the same sign; when they are in phase opposition the potential at the condenser end of the resistance will be somewhat less than at the other end of the resistance at the point of connection with the impedance, though still of the same sign. Consequently the switch, previously referred to, for changing over the connections to the loop may be dispensed with when the valve means for amplitude matching is employed. The only phasing adjustment necessary is effected by tuning the loop circuit.

Figure 6 also serves to illustrate a modified operating condition of the circuit in which unwanted signals may be balanced out by making the phasing adjustment only and dispensing with the necessity for variable amplitude matching. For this purpose the valves V1 and V2 are arranged as limiters so that their anode outputs are constant for any amplitude input above a fixed value. The limited outputs are matched in amplitude and opposed as previously described. The potentials across R and Z due to unwanted signals are brought into phase by the tuning adjustment of the oscillatory circuit and no signals are accordingly passed on from the opposed anode circuits of the valves. The wanted signals which require a different phase setting of the oscillatory circuit tuning will not be balanced out in the opposed anode circuits of the valves since they are out of phase and the wanted signals are accordingly passed on to the subsequent receiving circuits. In practice it may be desirable for the valves V1 and V2 to be the first stages of two separate amplifier channels, the opposed limiter valves being arranged at a subsequent stage. Known limiter arrangements other than valves are also applicable to this form of the invention, which is particularly applicable to telegraphic or other code signals.

The application of the invention to the reduction of fading effects of wireless signals lies in the fact that fading is often caused by waves reaching the receiving aerial by different paths, sometimes assisting and sometimes opposing each other. A loop aerial is employed as previously described to discriminate between waves arriving at different angles, one or other of the waves being treated as an unwanted signal and accordingly suppressed. In certain conditions improved reception is obtained by balancing out the ground wave and utilizing the wave reflected from the upper atmosphere or vice versa. In most cases, however, it is found that the reflected wave is too variable in direction for effective suppression as an unwanted signal and also too variable in strength for use as a wanted signal. Furthermore, in the case of short wave reception, the ground wave may be absent altogether, the only available signal being provided by two or more reflected waves.

An arrangement of the circuit for use in these conditions is shown in Figure 7 which comprises a loop aerial circuit as previously described, the only modification being the provision of two sliding contacts on the resistance R which feed the signal potentials to two separate amplifiers at X and X1. The potentials developed across the resistance and the impedance are approximately matched in amplitude and phase (if necessary by including a change-over switch, see Fig. 4, for the loop aerial inductance) and the positions of the sliders are adjusted so that each of them balances out waves from one direction whilst permitting waves from another direction to deliver a potential to its succeeding amplifier. Such balance can be only approximate because the one phase setting of the tuning control has to serve for both directions and the amplitude matching involves an average position for the sliders to meet conditions liable to continuous variation. Nevertheless, since balance at one position involves unbalance at the other position, the combined effect of a number of waves is not the same in both channels at the same instant. By the application of known electrical or mechanical methods the final output of the system may be selected from whichever of the two receiver channels offers the better signal or the outputs of the two channels may be combined to assist each other. As an alternative to the use of a simple loop aerial, the input arrangement involving two spaced aerials as previously described is particularly suited to the anti-fading form of the invention.

The alternative output arrangement in which amplitude matching is achieved by means of valves may also be adapted to the anti-fading form of the device. In this case the valves are duplicated. one pair of opposed valves feeding one amplifier channel and the other pair feeding the other amplifier channel. One pair of valves may balance out waves from one direction and the other pair of valves may balance out waves from another direction, the potentials being accordingly separated into two channels as before.

The arrangement is shown in Figure 8 in which the anode outputs of valves V1 and V2 are opposed and approximately matched in amplitude, any resultant signal potential being passed on to an amplifier. The anode outputs of valves V3 and V4 are similarly opposed and approximately matched in amplitude, the resultant signal from this pair of valves being passed on to a second amplifier. The circuit shown in Figure 8 will normally include in the grid connections the usual grid condensers and grid leaks which are merely omitted for simple illustration. Where the valves employed are of the variable amplification type, a convenient method of achieving the required average setting for amplitude matching is to apply to a valve in one pair a bias potential which is slightly different from that applied to the valve occupying the equivalent position in the other pair. With this arrangement there remains one valve in each pair which may carry the same bias and if desired economy can be effected by replacing these two valves by one valve whose anode output is shared between the two channels.

The application of the invention to produce a circuit with a resonance curve which is flat over a band of frequencies or which may rise on each side of a carrier frequency may be illustrated by the basic arrangement shown in Figure 1. The input potentials are applied to the oscillatory circuit comprising the inductance L and condenser C and the potentials developed across the resistance R and impedance Z are matched for phase and amplitude as before so that they may be balanced out at the point X if desired. In this application of the invention, however, complete balance will not normally be required. A carrier frequency may be partly balanced out and due to the fact that the sidebands are represented by different frequencies they will not balance out to the same extent. The output may therefore have a rising response curve as the frequency of the sidebands departs from the carrier frequency, or this rising response may be used to offset an opposite effect elsewhere in the system to produce an overall response curve which is substantially flat over a band of frequencies. The alternative input and output arrangements relating to the suppression of signals by frequency discrimination may also be applied to this application of the invention. The operations are essentially the same and differ only in degree since in the present case partial suppression only is required.

In the claim the tuning circuit and the impedance connection, for convenience, are defined as follows, to-wit, a closed circuit and a vertical circuit, respectively. It will be noted that the impedance, per se, is not a circuit but is a part of a circuit, which is termed vertical and which shares a common path with the tuning circuit.

The terminology, therefore, of closed and vertical circuits appears most appropriate to indicate one complete side of the entire system whether of input or output type; since in most instances, the disclosed portion of the entire system is interchangeable.

What I claim is:

A selective signal system including a closed tunable circuit and a second circuit, said circuits being mutually coupled, said closed circuit comprising an inductance, a condenser and a substantially pure resistance sequentially connected in series, the remote ends of the resistance and inductance having a junction connection to form the closed circuit, and wherein the phase of the potential developed is 90° out of phase to the flux in space of an incoming wave signal, said second circuit comprising an impedance having at one end a ground connection and its sole other end connected to the junction connection above, at least an appreciable portion of said pure resistance and said entire impedance being included in the second circuit, the developed potential of which is in phase with the flux in space of the incoming wave signal, the impedance by reason of its connection to the junction earthing unsymmetrically the first named closed circuit, and means connected to both circuits for potential delivery, the phases and amplitudes of the specified potentials effecting cancellation of unwanted potentials at the point of delivery of wanted potentials, all points of wanted potential delivery being remote from the inductance-condenser connection in said closed circuit, said system discriminating between wanted and unwanted potentials.

GEORGE HODGES.

Aug. 8, 1944.

J. A. BENNETT

2,355,047

NONLINEAR MODULATING SYSTEM

Filed Feb. 24, 1942

2 Sheets-Sheet 1

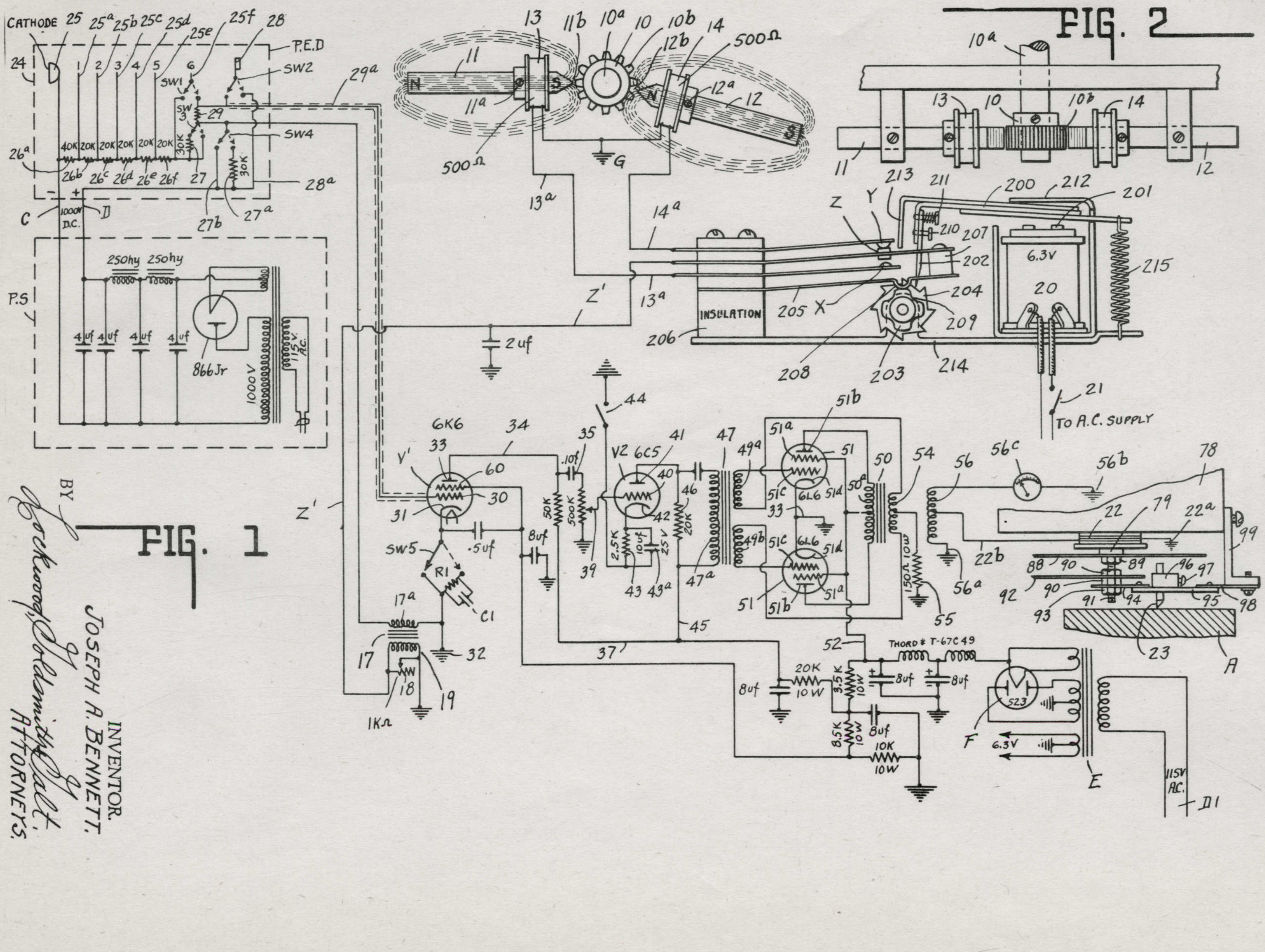


FIG. 1

FIG. 2

INVENTOR.
JOSEPH A. BENNETT.
BY
Lockwood, Goldsmith & Galt.
ATTORNEYS.

Aug. 8, 1944. J. A. BENNETT 2,355,047

NONLINEAR MODULATING SYSTEM

Filed Feb. 24, 1942 2 Sheets-Sheet 2

FIG. 3

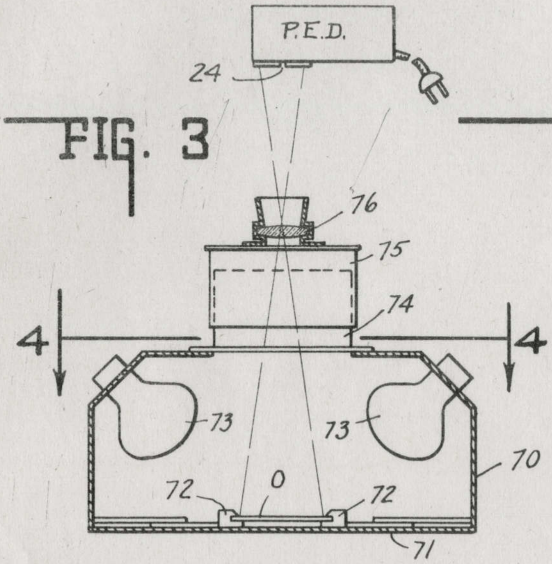


FIG. 5

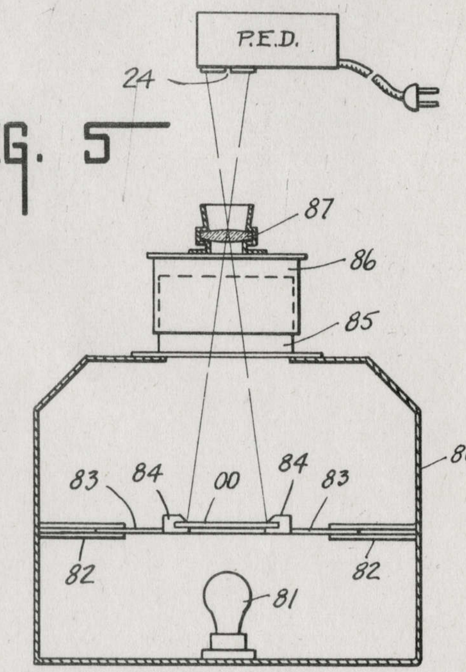


FIG. 4

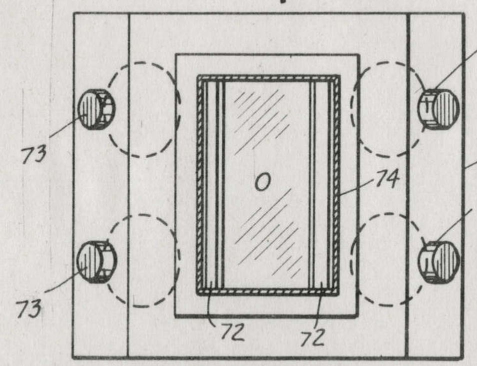


FIG. 6

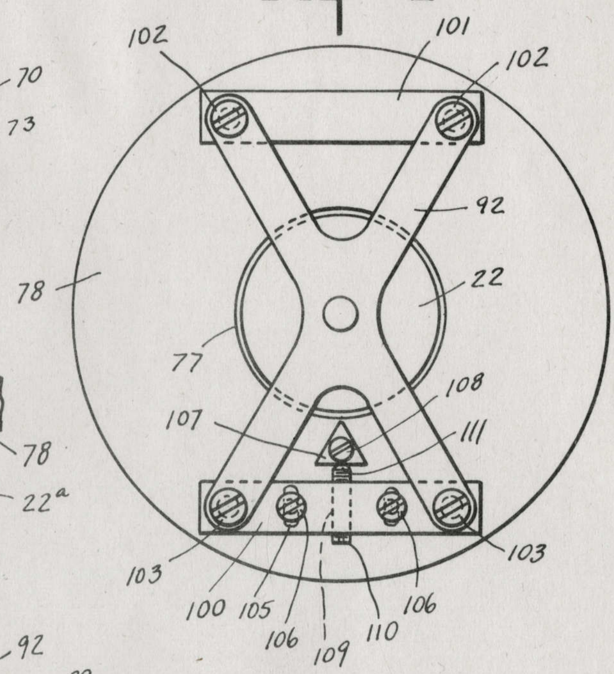


FIG. 7

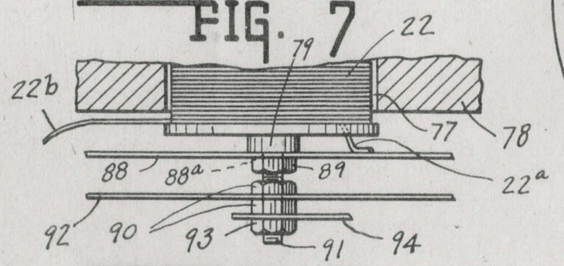
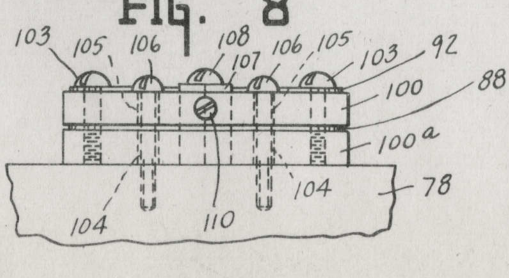


FIG. 8



INVENTOR.
JOSEPH A. BENNETT.

BY Lockwood, Goldsmith & Galt.
ATTORNEYS.

Patented Aug. 8, 1944 2,355,047

UNITED STATES PATENT OFFICE

2,355,047

NONLINEAR MODULATING SYSTEM

Joseph A. Bennett, Anderson, Ind., assignor to Lynch Corporation, Anderson, Ind., a corporation

Application February 24, 1942, Serial No. 432,284

23 Claims. (Cl. 178—6.6)

This invention relates to apparatus for producing printing plates from negatives and positive copy by scanning same when suitably illuminated, the transparent or translucent copy illumination being passed through the copy while the opaque copy illumination is reflected therefrom upon a light reception and tool control energizing arrangement.

Reference is had to the prior Patent No. 2,209,183 dated July 23, 1940, by way of example, illustrating a general organization suitable for the aforesaid operation.

The present invention, therefore, is directed to improvements upon certain portions of the organization illustrated therein. As recited therein, the printing plate to be formed may move relative to the forming tool or the reverse may occur. Similarly the copy or the scanning device may move relative to the other.

Since the aforesaid and said patent summarizes in sufficient detail the general type of apparatus in which the present invention may be included, further reference will be had hereinafter to the specific improvements in question. By the foregoing, however, it is not intended .o exclude use of said improvements in similar devices.

Primarily, this invention relates to a system of translating light intensity from copy to a reproducing element and more particularly involves the element of a non-linear modulator.

One chief object of the invention is to provide a method and means for amplifying the effects of low values of light intensities and at the same time mixing with these amplified effects of said intensities a timing signal or carrier current so that the output of the amplifying mechanism will record on a proper medium the values corresponding to the copy and in relation to the timing signal.

One chief feature of the invention is that it includes a photo emissive cell with an aperture to permit light to fall on the cathode of the cell, an impulse generator to provide the aforesaid timing signal, a transformer to introduce the timing signal to the grid circuit, a modulating tube to amplify the modulated timed signal and an audio-type, transformer-coupled amplifier to carry the modulated signal to a reproducing device, whereby the modulated signal may be recorded on the medium for reproduction, in this particular instance, a printing plate.

In applications where it is expedient to mix an alternating current signal with the current from a phototube it is found that to operate the vacuum tube at its proper characteristic a separate source of negative bias is necessary. This always proves difficult to maintain and critical to adjust. In the case of a separate bias supply a great deal of filtering is necessary to provide a ripple free direct current voltage supply. Batteries may be used but their life is limited and a reduced voltage would change the operating characteristics of the vacuum tube. This would, of course, either distort the signal or cause a change in the amplification of the tube. Cathode bias is used in some cases but is found to be unsatisfactory due to high plate voltages and voltage drop across certain tubes. Another deficiency is found in that variable cathode resistors, capable of carrying high plate-cathode currents, are not adapted to the particular usages found necessary.

By use of the non-linear modulator arrangement, therefore, it has been found that tonal values of a subject, say a photographic positive print, might be translated on to the proper medium in conjunction with a timing signal so that halftone reproductions may be made.

Another chief object of this invention is to provide a timing signal of controlled repetitious character operative throughout one translation of the moving element of the device and operatively ineffective upon return movement thereof and which upon lateral indexing is operatively effective in like manner but displaced 180° in phase relation for the formation of the printing surface in accordance with the tonal values of the copy and between the previous surface formations although offset therefrom by said indexing.

The chief feature of the invention corresponding to this object is the specific form of timing signal and controls therefor, which signal is supplied as a carrier current to the reproducing device for its normal effective operation as hereinafter pointed out.

Another chief object of this invention is to provide a signal responsive tool support that can be so adjusted to resonance that but slight power is required for its operation.

The chief feature of the invention corresponding thereto is the provision of a support suitably tensioned for the purpose set forth.

Another object of this invention is to provide an arrangement for receiving copy and so associating same with the scanning portions of the apparatus that reductions, enlargements or reproductions of such copy may readily be effected simultaneously in the scanning.

Other objects and features of this invention will be set forth more fully hereinafter.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

In the drawings

Fig. 1 is a wiring diagram of the circuits involved, a portion of the phase displacing arrangement being shown in elevation and a portion of the operating tool and its immediate control mechanism as well as the printing plate operated upon being shown in elevation.

Fig. 2 is a plan view of the timing signal producing mechanism.

Fig. 3 is a diagrammatic side elevation of a reflected light embodiment of the invention.

Fig. 4 is a view taken on line 4—4 of Fig. 3 and in the direction of the arrows.

Fig. 5 is a view similar to Fig. 4 and of a transmitted light embodiment of the invention.

Fig. 6 is a bottom plan view of the magnet field, the image coil, the tensioned tool support and the tensioning adjustment arrangement.

Fig. 7 is a central sectional view through the same.

Fig. 8 is an end elevation thereof, this view being shown in inverted relation for clearness.

In Fig. 3 of the drawings, there is illustrated more or less diagrammatically, an illumination source for the device. Herein the photo-emission device is indicated by the designation PED, having the light transmitting aperture 24. This device moves linearly if the object is stationary and also is indexed or translated transversely at the completion of each longitudinal traverse, all as generally pointed out in the before mentioned patent.

Positioned beneath the photo-emissive device is a housing 70 having a base 71 that is opaque and which slidably supports a pair of object carriers 72, the object being designated by the letter O. It is a photographic positive print.

Four lamps 73 direct their illumination upon the face of the object O. This light is reflected therefrom and upwardly through an adjustable bellows structure herein shown in the form of two telescopic tubes 74 and 75, one being rigid with the housing 70 and the other mounting a lens structure designated by 76. It is quite apparent that the light reflected from the object O is passed through the lens and forms in the plane of the aperture 24 an image corresponding to that of the object, and having the variable tonal values of the object.

As the photo-emissive device is moved, the effect is one of scanning and the illumination received by the aperture at each position is that which is transmitted to the working tool to form the printing surface in accordance with, first, the image in the plane of the aperture and secondly, in accordance with the object O. When the plane of the image is equidistant from the lens 76, as the latter is from the object, the image will be the same as the object so far as size is concerned and the printing plate will be of corresponding size. When the lens is moved toward the photo-emissive device or away from the same, the image in the plane of the aperture naturally will vary in accordance with the well known laws and will be in proportion.

Reference now will be had to Fig. 5. In this form of the invention there is illustrated the same photo-emissive device PED having the aperture 24. The housing 80 herein mounts a suitable source of illumination 81 in direct alignment with the central axis of the structure. Thereabove is a plate support 82 and adjustably carried thereby as at 83 are the copy supports 84. The copy in this case is designated by OO. This housing 80 carries one portion 85 of a bellows structure herein in the form of two telescopic tubes, the other tube being designated by 86 and mounting the lens structure 87. Light from lamp 81 passes through the copy, such as a photographic negative, and then passes through the lens and forms in the plane of the aperture 24 the corresponding image of the desired size and tonal values.

It will be observed that the variation in size of this image for scanning purposes, as it were, may be varied by moving the lens toward and away from the copy in the well known manner. The printing plate formed as a result of light passing through the aperture 24 and from the copy and incident to the longitudinal traverse of said aperture and the lateral offsetting and subsequent traverse, et cetera, all as broadly described in the before mentioned patent, results in the formation of a printing plate conforming to this image and consequently to the original copy as to tonal values and required size.

Before proceeding to a detailed description and discussion of the system embodied within this invention it appears appropriate that reference now be had to the working tool and its support and control since, as it is actuated, said tool forms the desired printing face. Reference, therefore, will be had to the right hand portion of Fig. 1 and to Figs. 6 to 8, inclusive.

In these figures the numeral 78 indicates a permanent magnet. This is of field character. It may, however, be an electro magnetic field of constant character. It has a circular bore 77 and in it is mounted the image coil 22. This image coil has extending therefrom a post or stud arrangement 79 and the same provides a bearing for a cross shaped spring member or spider 88, the latter being apertured at 88*a*. A threaded post extends from portion 79 through said aperture 88*a* and mounts a nut 89. Hence, the central bearing portion of the cross shaped flexible element 88 is rigidly connected to the image coil 22.

A pair of lock nuts 90 on the stud 91 mounts in spaced and parallel relation a similarly cross shaped flexible element or spider 92. There also is mounted on this stud by the nuts 93 a flat spring member 94 and the same is connected to the elongated member 95 that carries the socket 96 which by means of which member 97 holds the tool 23 in the adjusted position. A spring member 98 is carried by the bracket 99 in turn carried by the permanent magnet structure 78. All of the aforesaid appears in Fig. 1.

Referring to Figs. 6 to 8, inclusive, it will be noted that two ends of the cross shaped members are spaced apart by the bars 100 and 101. They are in turn spaced from the face of the supporting field arrangement 78 by other bars designated by subscript *a*, and similarly numbered. Screws 102 pass through two of the arm ends of each cross member and the two bars 101 and 101*a* and rigidly anchor said cross members to the permanent field. The other two arm ends of the cross members are rigidly secured to the member 100 by screws, or the like, 103. The bar 100*a* is apertured as at 104 and the bar 100 is transversely slotted as at 105. Screws 106 anchor the bar 100 in adjusted relation and the bar 100*a* to the permanent field 78.

Suitably secured to the underface permanent field 78 is the bearing member 107 secured by cap screw 108. The bar 100 intermediate its ends and intermediate its top and bottom planes is transversely apertured as at 109 and threaded, and a headless set screw 110 having the bearing portion 111 is mounted therein and projects toward the abutment or stop 107. The adjustment is effected for tensioning of the two cross members before mentioned by screw 110.

Since it has been found that when these members are in proper tension, a comparative low current value will be sufficient to secure the desired movement of the tool. If these members are not under proper tension, enormous current values must be utilized to effect such operation. Proper tension (tuned to resonance) is imparted to these two parallel cross members by moving the bearing point 111 inwardly which forces the block or bar 100 outwardly, relatively speaking, and when the proper adjustment of tension is obtained, the screw 106 rigidly clamp this adjustable end of the cross members to the permanent field, and the structure is in resonance.

It is to be understood that when a variable current, such as one of sine wave formation, is impressed upon image coil 22, the tool 23 reciprocates vertically or longitudinally in a direction parallel to the axis of the image coil which floats in the bore of the permanent field. This periodic movement of the tool is quite slight but is periodic in accordance with the signal. When, however, the signal is varied by the amplification, incident to the impressing of other current thereon in addition to the so-called carrier normal operating current, the image coil appropriately reacts with the permanent field and in response to such reaction the working tool is reciprocated the desired amplitude or stroke. Thus as the current supplied to the image coil varies the working tool digs into the surface of the plate A the desired depth.

It is to be understood in this form of the invention, the working tool is relatively stationary while the plate moves back and forth, traverses laterally with and in accordance with permanent field movement which is in accordance with movement of the photo-emissive device. It has been found preferably to have the copy stationary, relatively speaking, and the working tool stationary, and the other two parts move relative thereto, although the reverse relationship, as previously described, may be utilized with equal facility. The physical connection is termed the carriage.

Reference now will be had to the top part of Fig. 1 and Fig. 2, wherein there is illustrated the impulse generator for the device that provides the timing signal hereinafter referred to more particularly. This impulse generator is associated with a phase displacement arrangement so that on one stroke of the carriage in the working direction the timing signal is applied to the amplifying means, et cetera, in one phase and on the next working stroke the same signal of identical value is applied but the phase relationship is 180° to that previously imposed and these two, 180° displaced phase signals are alternatively imposed on successive working strokes. The mechanism for such action is as follows:

The rotor 10 is mounted on shaft 10a. This is connected to or formed as an extension of the longitudinal feed screw of the complete mechanism which, for example, only may be represented as that illustrated in the aforementioned patent. Accordingly, as the feed screw revolves, for carriage movement, the shaft 10a and the rotor 10 are turned at a speed proportional to or at the same speed of the feed screw, respectively. The rotor 10 is provided with teeth or segments 10b. Adjacent thereto are mounted two permanent magnets 11 and 12. The difference in the mounting or rather the position thereof, will be set forth hereinafter.

Upon each is adjustably mounted a coil. On permanent magnet 11 coil 13 is adjustably mounted at 11a while on permanent magnet 12 coil 14 is adjustably mounted at 12a. These permanent magnets are suitably mounted but magnetically insulated from the frame of the machine and the shaft 10a also passes through the frame of the machine, all as shown diagrammatically in Fig. 2, the magnets being aligned so that the polarity is NS—NS, and the coils being connected in series.

As the rotor 10 rotates, there is generated in each of the coils a current which flows providing the respective coil circuit is closed. The two coils are grounded as at G. The two coils are respectively connected by lines 13a and 14a to the poles X and Y, respectively, of a phase selector switch having the movable switch contact Z, connected in turn by line Z' to the primary winding 19 of the transformer 17.

It will be quite apparent that as the coils are adjusted longitudinally on the permanent magnets, the electromotive force generated will vary accordingly. Also, as the air gap or clearance between the rotor and magnet is decreased, more electromotive force will be generated in the coil and as the air gap is increased, less electromotive force will be generated in the coil. It has been found, for example, that a .006" air gap between the permanent magnet and the outer tip of each tooth or segment 10b will provide sufficient electromotive force for signal purposes.

It will be quite apparent that as the rotor passes the tip of the respective magnet, the electromotive force generated is of sine wave character and as each tooth or rotor segment passes, this wave form is repeated in the coil circuit. Naturally, if the switch controlling the closed circuit condition for the coil is not closed, no current will flow in that coil circuit, despite the generation of voltage therein.

From Farrady's law it can be readily calculated how many turns have to be provided and what resistance is necessary for each of the coils. They are identical. They are, however, displaced axially with reference to their angularity. For convenience, they are positioned in what might be termed general opposed relation as shown, but this is not necessary.

It will be observed from Fig. 1 that permanent magnet 11 at any one instant for rotor position, by way of example, is immediately opposite the center line of tooth 10b or segment of the rotor while at the same instant, the tip of the permanent magnet 12 is in alignment with the center line of a tooth space. When the magnet is positioned as last mentioned, no voltage is generated. When the magnet is positioned as first mentioned, maximum voltage is generated and as stated, this voltage increases and decreases and the resulting wave form is of sine character and the current is of alternating current type.

The switch member Z is normally biased to close a circuit to switch contact X. During the interval this circuit is closed, the coil 13 only supplies the signal to the remainder of the device and this current as stated, is of a definite voltage, is alternating in character and is passed on to the transformer 17.

Again referring by way of example to the patent, it will be recalled the reciprocating carriage of the machine disclosed therein completes a working stroke or traverse and then returns to initial position and is indexed following the completion of the stroke and the time cycle of reciprocation is repeated. All of this is automatic.

Phase selector and ratchet relay operation

To select the proper phase so that on adjacent strokes of the carriage the cutting tool will space the pits in plate A formed in proper staggered relation, the following operation is carried out: When trip switch **21**, which is in series with a proper voltage supply and coil **20**, is closed momentarily by action of the carriage on the return stroke, the coil **20** is energized and attracts armature **200** to pole **201**. Attached to armature **200** is pawl **202**. This engages ratchet **204** and indexes it one step or tooth. Attached to ratchet **204** is cam **203**. Riding on cam **203** is a leaf spring **205**, one end of which is attached to an insulated fibre stack **206**. Riding in sliding contact on the other end of spring **205** is an insulator **207** which forces leaf spring **205** carrying contact Z into contact with contact Y. This completes the coil **14** circuit and voltage from the impulse generator previously described flows from contact Y through contact Z to line Z′.

On the next return stroke of the carriage the trip switch **21** is again closed momentarily. The armature **200** is again attracted to the pole **201** and the pawl **202** again engages the ratchet **204** and indexes it another step or tooth. At this time leaf spring **205** has its extension **208** drop down into the depression **209** in the cam **203**. Contact Z then engages contact X. The voltage now flows from coil **13** through contact X to Z and thence to Z′. This permits the pits formed in plate A to be positioned in staggered relation with the previous row of pits depending on which contact is used.

The pawl **202** is so fastened to the armature **200**, as indicated at **210** and **211**, so that on its upward movement when urged by spring **211**, it slips over the ratchet tooth and aligns itself for the next indexing. The upward movement of the armature **200** is limted by stop bar **212** while stop bar **213** keeps the ratchet **202** from overthrowing. The leaf spring **205** to which is attached insulator **207** is spring tensioned so that it is urged toward base **214**. The ratchet **204** is steel and cam **203** is fibre. The leaf springs carrying contacts X, Y, and Z, supported in stack **206**, are phosphor bronze. Spring **215** urges armature **200** away from pole **201** and **212** is the stop.

Upon completion of the initial stroke, the carriage of the machine, therefore, mechanically closes switch **21** momentarily. This closes the ratchet relay circuit which indexes the ratchet and cam one ratchet tooth or increment. Such indexing causes the switch contact Z to engage the switch point Y in the circuit of the coil **14** which closes the circuit through this coil to the line Z′ before mentioned, and simultaneously opens the circuit through the switch point X, including the coil **13**. This coil circuit including coil **14**, however, is maintained closed throughout the next working stroke by the indexable cam **203**. Upon completion of that working stroke, the ratchet relay **20** is again energized and the circuit through coil **13** is established. This cycle is repeated as long as the carriage is reciprocated. Therefore, on every new stroke of the carriage, there will be introduced into the transformer **17** a signal from the coil **14** which signal is displaced 180° in phase from the signal produced in coil **13**, and utilized in the preceding stroke of the carriage.

The effect is as follows: If we assume that a table is attached to the feed screw of the machine which revolves rotor **10** through shaft **10***a* and if we assume the pitch of this feed screw is such that one complete revolution of rotor **10** advances said table carrying the proper recording medium forward ¼″, the rotor in this instance having twelve segments, there would be produced in either coil twelve surges of voltage per rotation of rotor **10**, which surges would be translated by the amplifier arrangement to the cutting tool **23**. This results in twelve pits being formed on the recording medium, the plate A. The centers of these pits would then be spaced 1/48″ apart. This spacing and pitting is continued throughout a definite length of the stroke of the carriage.

The carriage, as will be apparent, is then indexed or traversed laterally the proper distance so that another longitudinal line of pits may be effected on the plate A by the working tool **23**. However, this second stroke has resulted in current now being supplied by the coil **14** which is at 180° to the previous current, wherefore, the resulting pits formed throughout the forward stroke of the carriage in the second traverse of the tool **23** relative to the plate A will result in pits being formed that are displaced half the distance between the previous or adjacent row of pits, although the spacing in this second row of pits is the same as that in the preceding row.

The spacing between adjacent rows of pits is determinable solely by the amount of indexing. The offsetting or staggering of the pits in adjacent rows is determined by the phase displacement. The result is that the working tool **23** forms in the plate a pitted surface, the depth and areas of the pits being governed by the control of the cutting tool **23**, as hereinafter described, and as also broadly recited in the before mentioned patent by way of example, so that the surface of plate A has a true half tone formation.

It is, therefore, observed, that in regard to the foregoing that the switch point Z maintains contact with the point Y during the entire second working stroke of the tool and that upon completion of that stroke the circuit arrangement is reconditioned through the ratchet relay and cam so that on the third working stroke the timing signal is supplied to the amplifying device, et cetera, by the coil **13**, and this alternation is repeated for successive working strokes.

Initially hereinbefore, it has been stated that the copy can remain stationary and that the printing plate material can also remain stationary and that the carriage, as that term is used, can carry the working tool and the means for picking up the light signal from the copy. It has also been stated this relationship might be reversed. As stated immediately preceding, the machine may be so arranged that the copy will remain stationary, the light signal pick-up device may move in accordance with carriage movement, the tool support may remain stationary and the printing plate may move in accordance with and by carriage movement. The reverse of this may be utilized, as will be quite evident from an understanding of the before mentioned patent, and the preceding description herein.

Since the preceding patent is quite comprehensive in its disclosure of pit formation and the results effected thereby, it is believed no further description is necessary for the understanding of this invention. Also, it will be quite apparent that the specific description herein relating to Fig. 2, et cetera, relates to improvements capable of inclusion in a machine of the general character set forth in the before mentioned patent.

Reference now will be had more particularly to the electrical system included between the aperture **24** of the light signal pick-up arrangement, the timing signal generator, and the image coil **22** effective upon the working tool, and this is all diagrammatically disclosed in Fig. 1.

The general periodicity of the reciprocation or working stroke of the tool **23** is determined by the frequency of the impulse generator provided timing signal as aforesaid, and the length of that stroke is determined by the light intensity of the object being scanned. The sine wave form signal of predetermined voltage is one that can be modified or controlled by rheostat **18**. Accordingly, the proper and required voltage can be introduced into the primary **19** of the modulating transformer **17**.

The light intensity may be derived from a light reflected upon an opaque object including a photograph or may be passed through a translucent or semi-transparent object, such as a film or negative, all as previously described. In any event it is preferable that the light utilized be of beam type and such a light beam is provided through a proper focusing arrangement, etc.

Transmitted or reflected light is supplied to the aperture **24** in a photo-emissive device PED. This device has impressed across its negative and positive terminals C and D, respectively, 1000 volts of direct current, the source of which is indicated in the apparatus indicated by PS which includes a source of alternating current, a rectifier type tube, suitable chokes and condensers to provide a well filtered direct current voltage.

The photo-emissive device PED is an evacuated construction of the multiplier type, having the cathode **25** connected to the negative terminal C. The successive cathodes **25**—A–**25**—F inclusive, respectively, are each connected to resistances **26**—A to **26**—F, respectively, with a single pole double throw switch *Sw*—**1** interposed between **25**—F and **26**—F. These resistances are connected in series and at one end to the negative terminal C and ultimately to the positive terminal D, forming a voltage divider that places each successive cathode at a higher electrical potential from the previous one from negative to positive. Another resistance **27** is connected to the resistance **26**—F and to the positive terminal D of the voltage divider. Resistance **27** is in series with a single pole double throw switch *Sw*—**3** connected to the resistance **29**, which in turn is in series with collector **28** through a single pole double throw switch *Sw*—**2**. This collector means **28** also is in series with the other pole of switch *Sw*—**2** and positive terminal D by line **28***a*. Resistance **29** also is connected to the positive terminal D of the device by a single pole double throw switch *Sw*—**4** and line **27***b*. In series with terminal D and switch *Sw*—**3** is resistance **27** through switch *Sw*—**4** and line **27***b*. Resistance **27***a* is in series with terminal D and the other poles of switch *Sw*—**4**.

In the operation of this modulator two systems are necessary as follows: In using reflected light as from a photographic copy when the maximum light enters the aperture **24**, the image coil **22** has maximum amplitude. When using transparent copy, such as a photographic negative the image coil **22** has maximum amplitude when a minimum of light enters the aperture **24**. The system using positive copy will be described, first, as follows:

In this operation, if it is assumed that a light ray of low light intensity enters the aperture **24**, it will cause cathode **25** to emit a few electrons, which in turn multiply their effect through the successive cathodes **25**—A to **25**—F inclusive, in logarithmic proportion so that energy which is collected on collector **28** in the form of electrical current, is what might be termed a comparatively large number of electrons, whereas the light intensity impressed on the aperture **24** only frees a few electrons at the cathode **25**. This occurs because of the well known law of secondary emission, and an example of amplification of low light intensity will be set forth hereinafter.

This collected current is always in direct proportion to intensity of the light impressed at the aperture **24**. It will be apparent that low light intensities can be utilized; hence, finer tonal values can be recorded on plate A, dependent upon size of aperture **24**.

This collected energy at **28** is then impressed on the subsequent circuit together with the timing signal before mentioned, supplied by line Z'. A connection **29***a* magnetically and electrostatically shielded, connects collector **28** to the signal grid **30** of a vacuum tube V—**1**. The cathode **31** of this tube is in series with a single pole, double throw switch *Sw*—**5**, which has a common ground with the transformer secondary **17***a* of the transformer **17** at **32**. The other terminal of this transformer is connected to the positive terminal D of the emissive device PED, as shown.

It will be observed that due to the arrangement of the switches indicated by *Sw*—**1**, *Sw*—**2**, *Sw*—**3** and *Sw*—**4** that the collector **28** is connected to the signal grid **30** of the tube V—**1**. It will also be observed that the sign of this current is positive in polarity and that it becomes more positive in polarity as more light is admitted to the aperture **24**.

For positive copy operation, the switches above mentioned are indicated to be thrown to the left as shown by the solid lines in the drawings, Fig. 1. The subsequent action of the modulator tube V—**1** is as follows:

In the vacuum tube V—**1** there is provided said signal grid **30**, a screen grid **60**, a plate **33**, and a cathode **31**. The plate **33** and the screen grid **60** are provided with a source of direct current voltage to maintain them at the proper positive potential. The grid **30** is in series with the collector **28**, the grid resistance **29**, together with the direct current voltage of the photo-emissive device PED and the secondary **17***a* of transformer **17**. This is also in series with cathode **31**, providing the grid return circuit.

Impressed on the secondary **17***a* of transformer **17** is the alternating current voltage supplied by the induced current in either coil **13** or coil **14**, depending upon which voltage has been selected by the phase selector **203**. This voltage is capable of regulation as by adjustable resistance **18**. Accordingly, as this alternating current voltage is introduced into the grid circuit as before mentioned and as the PED current at collector **28** changes, due to more or less light entering aperture **24**, the changing bias on grid

30 changes and permits more or less of the alternating current signal to appear in the plate 33 circuit. As less light is admitted to aperture 24, less of the signal appears in the circuit of plate 33 and as more light is admitted to aperture 24 more of the signal appears in the plate 33 circuit, and this signal is proportional to the amount of light that falls on initial cathode 25.

In the negative copy system, using transmitted light and a photographic negative as copy, it is necessary to change the sign of the current that is impressed on the grid 30 of tube V—1 to negative polarity. This is accomplished by throwing switches *Sw*—1, *Sw*—2, *Sw*—3 and *Sw*—4 to the right, as shown by the dotted lines in Fig. 1, which places the connection 29*a* at one end at 25—F and the other end at grid 30 of tube V—1, and establishes the correct electrical circuit for the other components generally indicated by the drawing in Fig. 1.

At the same time the other single pole double throw switch *Sw*—5 is thrown to the right, as shown by dotted lines in Fig. 1. All switches may be arranged for singular simultaneous operation. This switch *Sw*—5 is in series with cathode 31 of tube V—1 and also with a cathode bias resistor R—1 of the proper value and a cathode bias filter C—1. This resistor R—1 places the correct negative bias voltage on signal grid 30 of tube V—1 to permit the alternating current signal induced in the transformer secondary 17*a* to enter the plate 33 circuit of tube V—1. When the light entering aperture 24 is of minimum value, the bias voltage on grid 30 of tube V—1 supplied by negative bias resistor R—1, will permit the maximum amplitude of the signal to appear in the plate 33 circuit. As the maximum value of light entering aperture 24 causes cathode 25—F to impress the maximum amount of voltage on grid 30 this will cause the negative bias voltage to be greater and will cause less of the timing signal to appear in the plate circuit. Hence, the minimum amount of light will cause the greatest amount of amplitude of the signal and the maximum amount of light will cause the minimum of amplitude in the negative copy system.

The subsequent action of the timing signal is as follows: The plate 33 of the vacuum tube V—1 is connected by line 34 to a blocking condenser 35. It is also connected to a resistor 36, which is connected by line 37 to the direct current power supply as shown at D—1. In series with the blocking condenser 35 is a gain control 38 and adjustably tapped thereto as at 39 is a grid connection of vacuum tube V—2, having the grid 40, plate 41 and cathode 42. The cathode 42 of the tube V—2 is connected to a cathode resistor 43 and a cathode bias filter 43*a* to ground through a normally closed switch 44.

In the desired working stroke of the carriage this cathode 44 is at the same positive potential as the plate 41, but the inclusion of cathode resistor 43 places grid 40 at the correct negative bias to permit the plate circuit including plate 41 to draw current in proportion to the signal impressed on grid 40 of tube V—2. The cathode bias filter 43*a* filters out the alternating current component in the plate-cathode circuit and provides a ripple free negative bias voltage for grid 40.

On the non-working or return stroke of the carriage the switch 44 is opened automatically incident to carriage movement and held open throughout that return stroke so there is no negative bias on the grid 40. This causes the tube V—2 to become operative over a range which is represented by the non-linear portion of its operating characteristic curve, and hence, only static plate current flows in tube V—2 under this circumstance and hence tube V—2, insofar as the remainder of the system and copy reproduction is concerned, is ineffective or inoperative. It is to be observed that the blocking condenser 35 only passes to the tube V—2 or rather the grid 40 thereof only an alternating component of the current supplied by plate 33 of the tube V—1.

The plate 41 of tube V—2 is connected to a point of positive voltage as at 45 on the line 37 before mentioned, through a series resistor 46. This series resistor is included across the terminals of the primary 47*a* of a transformer 47 with a series condenser 48. This transformer 47 has two secondaries 49*a* and 49*b*, the purpose of which is to provide inverse feedback from the transformer 50 to provide a wave form correction inherent in transformers of this type.

For this purpose also there is included two tubes 51 in push-pull relation and connected as shown. The screen grids 51*a* of these tubes are connected by line 52 to a source of positive direct current voltage. The plates 51*b* of these tubes are connected to the primary 50*a* of transformer 50 before mentioned, and the midpoint of transformer primary 50*a* is also connected to line 52. The signal grids 51*c* of these tubes 51 are connected to the transformer secondaries 49*a* and 49*b*. The cathodes 51*d* of these tubes are connected to ground as at 53. The tertiary winding 54 of transformer 50 is connected at opposite ends to the adjacent ends of the secondaries 49*a* and 49*b* of the transformer 47. The midpoint of this winding 54 is grounded through a resistor 55 to provide correct negative bias voltage on grids 51*c* of the tubes 51.

The transformer secondary winding 56 of the transformer 50 is connected to the image coil 22, the other terminal of this coil being grounded as at 22*a*. This secondary winding 56 is of dual character, the connection to the image coil being to a tap to match the impedance of the image coil 22, one winding end being grounded at 56*a*, the other at 56*b* in series with an alternating current voltmeter 56*c*. The grounds 22*a* and 56*a*, with the image coil 22 in series, complete the electrical circuit. This is to insure proper pulsation of the image coil 22 in response to the carrier signal and proper reciprocation of that coil in response to the changing light admitted to aperture 24, all of which originates as a result of the combined timing signals and changing bias impressed on signal grid 30 of tube V—1.

D—1 indicates a conventional source of alternating current, which is supplied to a transformer E which through the apparatus indicated, including generally the tube F, which is of rectifying character, and a filter network as illustrated in Fig. 1, supplies direct current of the proper values and at the proper voltages to lines 52, 37 and 45, as well as to the other elements of the device such as the screen grid 60 of the tube V—1.

Non-linear modulator superiority as a photo-cell amplifier

In the use of amplifiers to amplify low level light intensities, great difficulty is encountered when the source of light is so weak that a great deal of amplification is necessary. If amplification is attempted by the direct coupled method, the variations in the contact potential, et cetera, high voltage power supplies or a power supply for each stage is encountered. This is difficult to accomplish as has been proven by numerous previous attempts. Another system to get high gain amplification from photo-cell currents contemplates the use of a light chopper interposed between the light source and the photo-cell. This creates an alternating current signal that can be amplified to any desired value but the difficulty is that in the case of the present amplifier it was necessary to interpose a timing signal into the circuit so that work could be done at regularly timed intervals and this work could be modified in accordance with varying amounts of light. Previous attempts along this theory used a phototube coupled direct to a tube of the pentagrid mixer type using one grid for the photo-cell connection and the oscillator grid to introduce the timing signal into the circuit. Other types of multi-element tubes were used in try ng to achieve the same result, none proving entirely satisfactory.

In this instance, using a pentode type tube and having all the elements at their proper voltage and current values, advantage is taken of the fact that the timing signal can be introduced into the circuit and this signal modulated by the current developed in the photo-cell as the result of light values admitted to the cathode of the photo-cell. In this way, by operating the tube at its proper linear characteristic, more minute changes in light values will be reproduced in the tube and subsequently properly recorded due to the fact that this change in light value acts directly as a bias on the signal grid and controls this grid to a degree impossible to achieve in any other way so far as now known. Since the modulated signal appears in the plate circuit of the modulating tube in direct proportion to the light value admitted on the cathode of the photo-cell, it may be passed on to any number of succeeding amplifier tubes as an alternating current signal of varying amplitude. No limits are then placed on the amplifier in faithful reproduction of the input signal and no discrimination is made regarding frequencies that might be developed in the copy source. This eliminates the introduction of development of any spurious frequencies and, therefore, eliminates any possibility of any production of spurious copy on the plate A.

By way of example only, the following illustration is set forth, which has actually been utilized:

A 5 x 7 or 35 sq. in. copy has been illuminated with a 600 watt incandescent light source and this light reflected from the copy has been passed through a lens structure having a 4.5 f. aperture, and at a distance of approximately 8″ the image in the plane of the light pickup device PED or rather aperture **24** thereof may be assumed to be of the same size. In other words, in the particular example, the lens structure is positioned midway between the copy and the aperture. The aperture is .028″ in per side. From this it can be readily calculated what is the intensity of the light lumens that are picked up through this aperture and this is assuming the maximum value of such illumination, the minimum value of the lumens naturally being zero when there is, for that particular portion of the image, no light present in the plane of the aperture **24** at that particular instant.

The photo-electric multiplying device PED has been determined to operate on the formula, when the intensity is equal to ten times the square root of the voltage of any one stage divided by three, it being assumed the voltage across all stages is substantially the same, broadly speaking. This square root is taken to the *n*th power, *n* representing the number of amplification stages through which the picked-up illumination or emission is passed. Herein six stages are illustrated.

The result is that in the example given, approximately 23,600 microamperes are collected at the collector **28** per lumen of light intensity supplied to the aperture **24**. It is readily apparent, therefore, that extremely lower light intensities present at the aperture **24** will be transmitted to the subsequent electrical control system for plate reproduction and for reasons assigned, the reproduction in the plate will be a faithful copy provided the electrical reproducing system is properly controlled and of substantially the character hereinbefore disclosed.

It has been pointed out hereinbefore that this system does not have spurious frequencies created or introduced therein and this is given as but one example of the possible introduction of error. The instant invention, therefore, reproduces on the printing plate A a surface that will print a faithful half-tone reproduction with all the essential characteristics of the original copy but in addition thereto will include therein all the tonal values and gradations present in the original copy within the limitations of the plate development, it being, of course, borne in mind that the system as disclosed has been specifically illustrated as providing in the plate pits spaced a predetermined distance apart linearly and with the adjacent rows thereof spaced half that distance apart. This forms what might be termed a "screen" of about 65 lines. Plates have been made that include 85 line. If it be assumed that 8 ft. candles are distributed over 35 sq. in., that is the 5 x 7 objective, there will be approximately 4.4 ft. candle illumination per sq. in. The total foot candles impressed on the aperture, therefore, is roughly 4⅜, multiplied by the square of .028″, or roughly, .0025 ft. candles, which it will be recognized is very low light intensity at aperture **24**.

This specific example is set forth merely to indicate the range of sensitivity possible to be accommodated by this invention and is in no sense to be considered as an example of limitation.

In Fig. 1 of the drawings, certain values are assigned to certain resistances and condensers, and certain designations of commercial tubes have been applied. It is to be understood these values are given by way of example only and not by way of limitation and these tube designations are also given by way of example only and not by way of limitation.

While the invention has been illustrated and described in great detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character.

The several modifications described herein as well as others which will readily suggest themselves to persons skilled in this art, all are considered to be within the broad scope of the invention, reference being had to the appended claims.

The invention claimed is:

1. A system for obtaining phase displacement of signals including in combination a segmented rotor of magnetic type, a pair of magnets, a coil means associated with each magnet, and a signal supply circuit selectively connectable to each coil means, said magnets having a displacement at least equal to (n plus ½) the rotor segment spacing where n is the number of full segments between magnets, each coil means included in the magnetic circuit being adjustably mounted upon the associated magnet for regulation voltage derived from said coil means.

2. A system for obtaining phase displacement of signals including in combination a segmented rotor of magnetic type, a pair of magnets, a coil means associated with each magnet, and a signal supply circuit selectively connectable to each coil means, said magnets having a displacement at least equal to (n plus ½) the rotor segment spacing where n is the number of full segments between magnets, each magnet being of linear character, and means adjustably supporting each magnet for longitudinal adjustment toward and away from the segmented rotor for voltage regulation.

3. A system for obtaining phase displacement of signals including in combination a segmented rotor of magnetic type, a pair of magnets, a coil means associated with each magnet, and a signal supply circuit selectively connectable to each coil means, said magnets having a displacement at least equal to (n plus ½) the rotor segment spacing where n is the number of full segments between magnets, each coil means included in the magnetic circuit being adjustably mounted upon the associated magnet for regulation voltage derived from said coil means, each magnet being of linear character, and means adjustably supporting each magnet for longitudinal adjustment toward and away from the segmented rotor for voltage regulation.

4. In a copy reproducing system, a tool support, means for providing a magnetic field, a coil therein and responsive thereto, a control circuit for said coil, and a resonant, tension adjustable, device for said support and said coil, said device including a member resiliently connected at one end to a relatively stationary base and resiliently connected to the coil, and means of a resonating character interposed between the base and coil, said resonating means having adjustable mounting with one of the two last mentioned and relatively fixed mounting upon the other for initial tension inclusion in said resonating means.

5. In a copy reproducing system, a tool support, means for providing a magnetic field, a coil therein and responsive thereto, a control circuit for said coil, and a resonant, tension adjustable, device for said support and said coil, said device including a non-magnetic spider means centrally connected to the coil and tool support and having fixed anchorage for certain of the arms of the spider means and adjustable anchorage for other arms for spider tensioning.

6. In a copy reproducing system, a tool support, means for providing a magnetic field, a coil therein and responsive thereto, a control circuit for said coil, and a resonant, tension adjustable, device for said support and said coil, said device including a non-magnetic spider means centrally connected to the coil and tool support and having fixed anchorage for certain of the arms of the spider means and adjustable anchorage for other arms for spider tensioning, said anchorages being carried by said field providing means.

7. In a copy reproducing system, a tool support, means for providing a magnetic field, a coil therein and responsive thereto, a control circuit for said coil, and a resonant, tension adjustable, device for said support and said coil, said device including a non-magnetic spider means centrally connected to the coil and tool support and having fixed anchorage for certain of the arms of the spider means and adjustable anchorage for other arms for spider tensioning, said spider means including a plurality of parallel, spaced, substantially identical spider members in registering relation.

8. In a copy roproducing system, a tool support, means for providing a magnetic field, a coil therein and responsive thereto, a control circuit for said coil, and a resonant, tension adjustable, device for said support and said coil, said device including a non-magnetic spider means centrally connected to the coil and tool support and having fixed anchorage for certain of the arms of the spider means and adjustable anchorage for other arms for spider tensioning, said spider means being X-shaped with two arm ends fixed, means connecting the two other arms together, and adjustable means associated with the connecting means midway between the connections to the arms for effecting tension adjustment of said means, and means for anchoring the tension adjusted ends.

9. In a copy reproducing system, a tool support, means for providing a magnetic field, a coil therein and responsive thereto, a control circuit for said coil, and a resonant, tension adjustable, device for said support and said coil, said device including a non-magnetic spider means centrally connected to the coil and tool support and having fixed anchorage for certain of the arms of the spider means and adjustable anchorage for other arms for spider tensioning, said spider means including a plurality of parallel, spaced substantially identical spider members in registering relation, each spider member being X-shaped and in registering relation, two ends of each spider member having fixed connection and anchorage, means connecting the other two ends of each of said members together, adjustable means associated with said connecting means and midway between the connections to the arms and midway between the outer planes of the registering spider members for singularly effecting tension adjustment simultaneously in said spider members and to a like degree, and means for anchoring the tension adjusted ends.

10. A selector switch arrangement including a pair of spaced contact means, other contact means arranged for relative contact therewith for circuit control purpose, a momentarily operable relay, a cam operatively associated with said other contact means for such selective contact, a ratchet, and a pawl for indexing said ratchet and cam and responsive to relay operation.

11. A selector switch arrangement as defined by claim 10, characterized by the addition of means limiting pawl travel for limiting ratchet rotation incident to relay responsive travel of said pawl.

12. A selector switch arrangement as defined by claim 10, characterized by the addition of means normally constraining the pawl to predetermined position in opposition to relay opera-

tion but insufficient in amount to overcome the force of said relay when operated.

13. In a copy reproducing system the combination of a photo-emissive multiplying device for low illumination intensity effect transmission, a non-linear modulating tube including a grid having a predetermined static bias and series connected to said device for changing the bias in accordance with illumination intensity, a timing signal device inductively coupled to the signal grid circuit of said tube for alternating current signal transmission, the signal appearing in the plate circuit of said modulating tube, a gain tube operatively connected to the modulating tube to amplify the modulated alternating current from the first tube, a blocking condenser in the plate circuit of the first tube for decoupling the first tube plate voltage from the grid circuit of the second tube, and a working tool, electrically operated, control operatively connected to the second tube for tool operation in accordance with the timing signal and the illumination effect transmitted thereto.

14. A system as defined by claim 13, characterized by the addition of a normally closed switch in series with the cathode resistor of the second tube for providing grid bias for signal transmission, and automatically operable means for opening said switch for preventing signal transmission to said control.

15. A system as defined by claim 13, characterized by the addition of a normally closed switch in series with the cathode resistor of the second tube for providing grid bias for signal transmission, and automatically operable means for opening said switch for preventing signal transmission to said control, the timing signal device comprising a segmented rotor of magnetic type, a pair of magnets, a coil means associated with each magnet, and a signal supply circuit selectively connectible to each coil means, said magnets having a displacement at least equal to (n plus ½) the rotor segment spacing where n is the number of full segments between magnets.

16. A system as defined by claim 13, characterized by the inclusion between the second tube and said control of a transformer for reproducing the plate signal of the second tube, a pair of amplifying tubes inductively coupled in push-pull relation and to said transformer for duplicating and increasing of the transformer received signal.

17. A system as defined by claim 13, characterized by the inclusion between the second tube and said control of a transformer for reproducing the plate signal of the second tube, a pair of amplifying tubes inductively coupled in push-pull relation and to said transformer for duplicating and increasing of the transformer received signal, a tertiary wound transformer connected to the push-pull tubes and the first transformer for impedance matching coupling to said control.

18. In a copy reproducing system the combination of a photo-emissive multiplying device for low illumination intensity effect transmission, a non-linear modulating tube including a grid having a predetermined static bias and series connected to said device for changing the bias in accordance with illumination intensity, a timing signal device inductively coupled to the signal grid circuit of said tube for alternating current signal transmission, the signal appearing in the plate circuit of said modulating tube, a gain tube operatively connected to the modulating tube to amplify the modulated alternating current from the first tube, a blocking condenser in the plate circuit of the first tube for decoupling the first tube plate voltage from the grid circuit of the second tube, a working tool, electrically operated, control operatively connected to the second tube for tool operation in accordance with the timing signal and the illumination effect transmitted thereto, a normally closed switch in series with the cathode resistor of the second tube for providing grid bias for signal transmission, and automatically operable means for opening said switch for preventing signal transmission to said control, the timing signal device comprising a segmented rotor of magnetic type, a pair of magnets, a coil means associated with each magnet, and a signal supply circuit selectively connectible to each coil means, said magnets having a displacement at least equal to (n plus ½) the rotor segment spacing where n is the number of full segments between magnets.

19. A system as defined by claim 13, characterized by the inclusion between the second tube and said control of a transformer for reproducing the plate signal of the second tube, a pair of amplifying tubes inductively coupled in push-pull relation and to said transformer for duplicating and increasing of the transformer received signal, a normally closed switch in series with the cathode resistor of the second tube for providing grid bias for signal transmission, and automatically operable means for opening said switch for preventing signal transmission to said control.

20. A system as defined by claim 13, characterized by the inclusion between the second tube and said control of a transformer for reproducing the plate signal of the second tube, a pair of amplifying tubes inductively coupled in push-pull relation and to said transformer for duplicating and increasing of the transformer received signal, a normally closed switch in series with the cathode resistor of the second tube for providining grid bias for signal transmission, and automatically operable means for opening said switch for preventing signal transmission to said control, a tertiary wound transformer connected to the push-pull tubes and the first transformer for impedance matching coupling to said control.

21. In a copy reproducing system the combination of a photo-emissive multiplying device for low illumination intensity effect transmission, a non-linear modulating tube including a grid having a predetermined static bias and series connected to said device for changing the bias in accordance with illumination intensity, a timing signal device inductively coupled to the signal grid circuit of said tube for alternating current signal transmission, the signal appearing in the plate circuit of said modulating tube, a gain tube operatively connected to the modulating tube to amplify the modulated alternating current from the first tube, a blocking condenser in the plate circuit of the first tube for decoupling the first tube plate voltage from the grid circuit of the second tube, a working tool, electrically operated, control operatively connected to the second tube for tool operation in accordance with the timing signal and the illumination effect transmitted thereto, a transformer included between the second tube and said control for reproducing the plate signal of the second tube, a pair of amplifying tubes inductively coupled in push-pull relation and to said transformer for duplicating and increasing of the transformer received signal, said timing signal device including a segmented rotor of magnetic type, a pair of magnets, coil means associated with each mag-

net and a signal supply circuit selectively connectable to each coil means, said magnets having a displacement at least equal to (n plus ½) the rotor segment spacing where n is the number of full segments between magnets.

22. In a copy reproducing system the combination of a photo-emissive multiplying device for low illumination intensity effect transmission, a non-linear modulating tube including a grid having a predetermined static bias and series connected to said device for changing the bias in accordance with illumination intensity, a timing signal device inductively coupled to the signal grid circuit of said tube for alternating current signal transmission, the signal appearing in the plate circuit of said modulating tube, a gain tube operatively connected to the modulating tube to amplify the modulated alternating current from the first tube, a blocking condenser in the plate circuit of the first tube for decoupling the first tube plate voltage from the grid circuit of the second tube, a working tool, electrically operated, control operatively connected to the second tube for tool operation in accordance with the timing signal and the illumination effect transmitted thereto, a transformer included between the second tube and said control for reproducing the plate signal of the second tube, a pair of amplifying tubes inductively coupled in push-pull relation and to said transformer for duplicating and increasing of the transformer received signal, a tertiary wound transformer connected to the push-pull tubes and the first transformer for impedance matching coupling to said control, said timing signal device including a segmented rotor of magnetic type, a pair of magnets, coil means associated with each magnet and a signal supply circuit selectively connectable to each coil means, said magnets having a displacement at least equal to (n plus ½) the rotor segment spacing where n is the number of full segments between magnets.

23. In a copy reproducing system the combination of a photo-emissive multiplying device for low illumination intensity effect transmission, a non-linear modulating tube including a grid having a predetermined static bias and series connected to said device for changing the bias in accordance with illumination intensity, a timing signal device inductively coupled to the signal grid circuit of said tube for alternating current signal transmission, said timing signal device including a segmented rotor of magnetic type, a pair of magnets, coil means associated with each magnet, said magnets having a displacement at least equal to (n plus ½) the rotor segment spacing where n is the number of full segments between magnets, a pair of spaced contact means each in series with a coil means, other contact means arranged for selective contact therewith for circuit control purpose, a momentarily operable relay, a cam operatively associated with said other contact means for such selective contact, a ratchet, and a pawl for indexing said ratchet and cam and responsive to relay operation, said other contact means being connected to the inductive coupling, the signal appearing in the plate circuit of said modulating tube, a gain tube operatively connected to the modulating tube to amplify the modulated alternating current from the first tube, a blocking condenser in the plate circuit of the first tube for decoupling the first tube plate voltage from the grid circuit of the second tube, and a working tool, electrically operated, control operatively connected to the second tube for tool operation in accordance with the timing signal and the illumination effect transmitted thereto.

JOSEPH A. BENNETT.

April 16, 1929. G. E. LUCE 1,709,138

BRICK LIFTER

Filed Aug. 1, 1925 2 Sheets-Sheet 1

FIG. 1

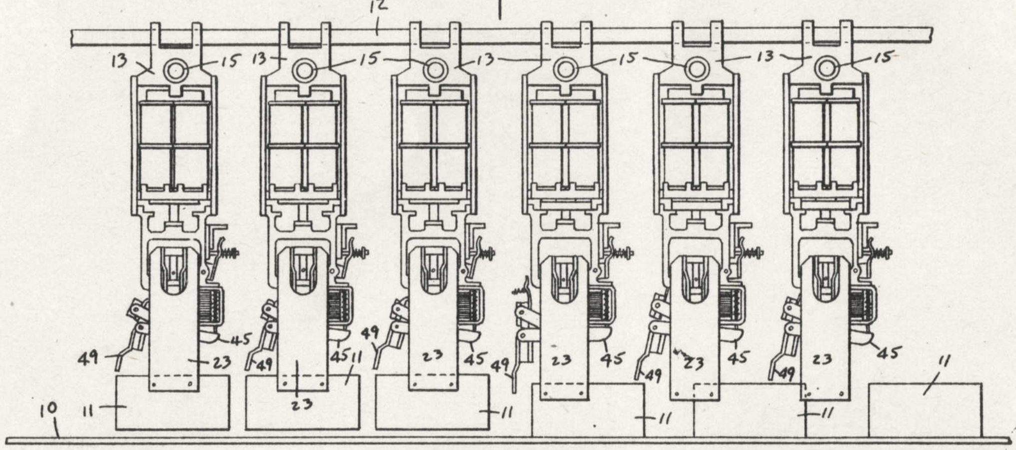


FIG. 2

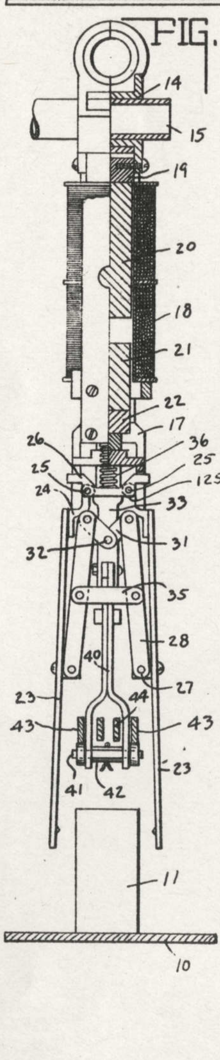


FIG. 3

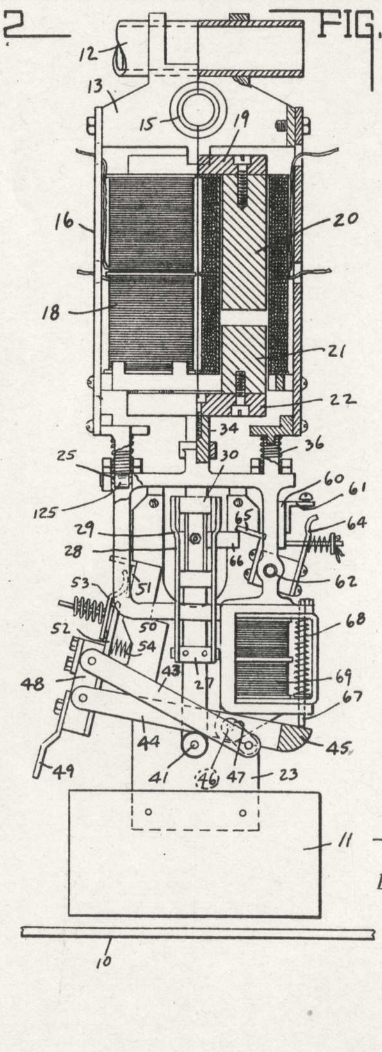
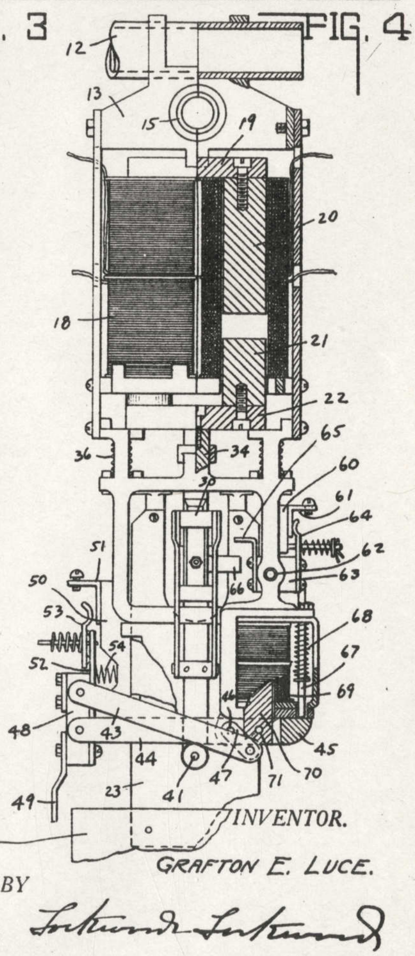


FIG. 4



INVENTOR.

GRAFTON E. LUCE.

BY

ATTORNEYS.

BRICK LIFTER

Filed Aug. 1, 1925 2 Sheets-Sheet 2

FIG. 6

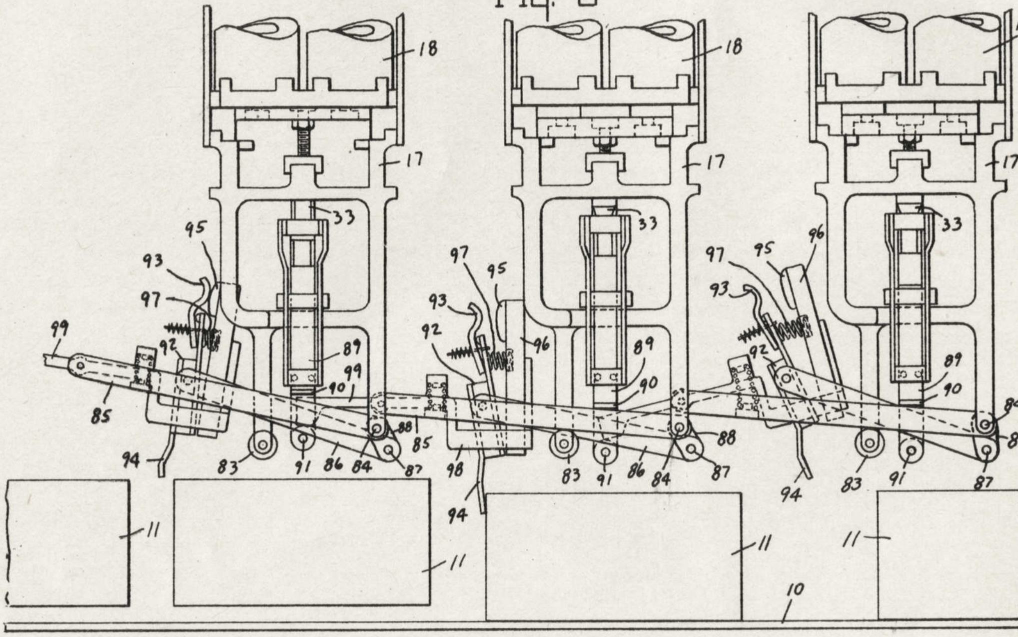


FIG. 5

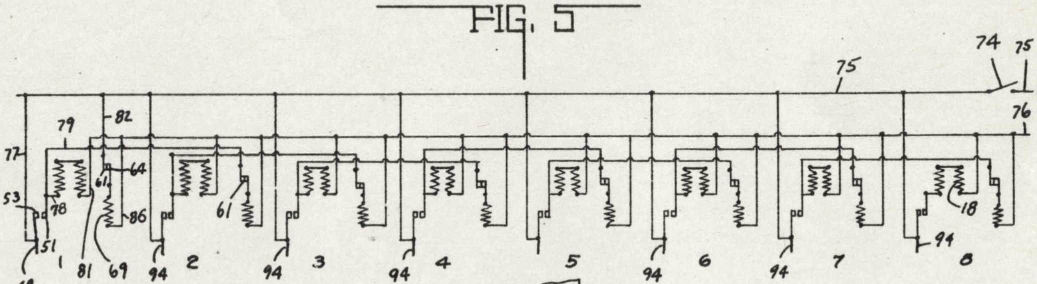


FIG. 7

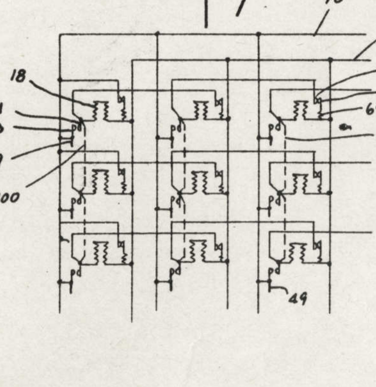
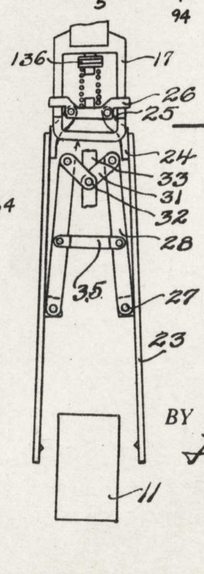


FIG. 8



INVENTOR.
GRAFTON E. LUCE.

BY Lotsund Lotsund

ATTORNEYS.

Patented Apr. 16, 1929. **1,709,138**

UNITED STATES PATENT OFFICE.

GRAFTON E. LUCE, OF CHICAGO, ILLINOIS, ASSIGNOR TO LANCASTER IRON WORKS, INC., OF LANCASTER, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

BRICK LIFTER.

Application filed August 1, 1925. Serial No. 47,515.

This invention relates to a machine for handling articles presenting opposed surfaces upon which oppositely directed forces may be applied for grasping the article and thereafter manipulating the grasped article as desired. Articles of this character may be of any desired or preferred type or form. The device is herein illustrated as applied to brick handling, although its application is to be understood as not limited thereto. Handling green brick presents the greatest problem for a machine of the foregoing character because such an article is readily deformed by excessive pressure and such an article has a relatively low compression strength. Furthermore, such an article is readily deformed by slight contact with extraneous objects or obstructions. The mechanism, therefore, is herein illustrated as adapted to handle substantially the worst class of substantially "solid" articles, to wit, a relatively plastic or green brick without materially deforming the same. The present application is a continuation of the copending application Serial No. 723,323 heretofore allowed.

The chief object of the invention is to provide a construction which will grasp an article of the character described without deforming the same and thereafter manipulate the article as desired, particularly in the release of the article from the grasping means without the preliminary supporting of the article upon another support other than the grasping means. This last mentioned action is comparable to electromagnetic operation, but in contradistinction from the aforesaid action it is to be understood that the device has no inductive connection or magnetic connection with the article to be handled.

Another object of the invention is to associate in a machine of the character described, a control for the several units thereof whereby each unit will automatically control the succeeding unit.

The chief feature of the invention is the arrangement of the parts of each unit in the machine of the character described whereby the grasping members will grasp an article such as a brick, particularly green bricks, with just sufficient force to hold the same and permit the brick to be moved from its support without movement of the support for the grasping mechanism.

Another and most important feature of the invention is the substantially "human" estimation of the force required to elevate the article and the automatic application of said estimated force to the article by the mechanism, the remainder of the force initially applied to the entire unit being expended in handling the article after the same has been grasped. Thus the device applies to the article just sufficient force to grasp it and hold it for subsequent movement, the remainder of the total force applied being expended in moving the article following the grasping action.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

In the drawings Fig. 1 is a side elevational view of a portion of the machine showing six units arranged in tandem relation and with aricles to be handled thereby in several positions and the units in corresponding positions. Fig. 2 is an end elevation of one of the units, parts being shown in half section to illustrate the same and show other parts in detail and the parts being further shown in the non-grasping position. Fig. 3 is a side elevational view with parts shown in half section to show the same and other parts in detail and with the article grasped and in an elevated position. Fig. 4 is a very similar view to Fig. 3 but illustrates the same parts in a non-grasping position preparatory to grasping. Fig. 5 is a wiring diagram of the connections. Fig. 6 is a side elevational view of several of the devices showing a modified form thereof, to wit, the mechanical inter-control, one of the units being shown in the article grasping position, one in position preparatory to grasping and the other in a position prior thereto or the non-grasping position.

Fig. 7 is a diagram of connections between a plurality of lifting devices arranged in transverse row formation and inter-connections and controls therebetween.

Fig. 8 is a view similar to Fig. 2 but with certain parts omitted or broken away to show in detail the gripping fingers and adjustment of the springs.

In the drawings 10 indicates a support for the plurality of articles 11. Herein 10 illustrates an offbearing belt carrying the brick, such as green brick or the like, beneath the brick lifting units which are associated together and carried by a common support. Herein such a support is indicated by the shaft 12. The saddle 13 is also provided with an opening 14 adapted to receive a transverse support 15. These supports 15 serve to position the several units in spaced relation while mounting of the saddles 13 on the shaft or support 12 secures the units in tandem relation. Although not a part of the present invention, it may be noted that the units are relatively movable with respect to each other and thus all of the units can be moved into close relationship on support 12 when desired, but for the purpose of the present invention the foregoing moving mechanism and control is omitted, but reference will be had to a copending application entitled "Segregator," filed July 14, 1924, having Serial No. 726,032.

Herein the saddle 13 supports two depending straps or side members 16, and supported thereby and depending therefrom is a cradle 17.

Mounted within the aforesaid framework is a fluid operable power unit. Herein said power unit is illustrated as a pair of solenoids each including an upper and lower coil, said coils being in aligned relation. The numeral 18 indicates the same. A common armature 19 is suitably secured to the framework previously described, and to the same is secured the top portion of a core 20. Thus a part of the core is stationary. The bottom part of the core 21 is movable and the two cores 21 are connected by an armature bar 22. Energization of the coils 18 therefore, will cause the cores 21 with the bar 22 to be elevated so that the core 21 may be in substantially abutting relation to core 20. This elevated position is shown in Fig. 3. Figs. 2 and 4 illustrate non-energized or lowered position of the cores.

A pair of grasping plates 23 are hingedly supported at their upper ends through a hinge member 24 at 25 upon a combination support and spring retainer 26 slidably supported in aligned relation upon the cradle 17. As shown in Figs. 3 and 4, a pair of said spring seats and guides are provided and the plates 23 include a pair of hinges 24 at their upper ends. The plates 23 intermediate the lower and grasping end and the upper and hingedly supported end support a pivot block 27 and said pivot block supports a pair of links 28, which extend upwardly and at their upper ends are offset as at 29. The upper ends of these links are connected by a spacer 30, and supported thereby is an upper toggle link 31 at each side of said spacer 30. The upper toggle link 31 together with another from the opposite clamping plate 23, is connected at 32 to a lifting or draw bar 33 which is rigidly connected as shown at 34 in Figs. 3 and 4 to the bottom armature bar 22. Thus movement of the core and bottom armature bar will raise the draw bar 33 and therefore, move the pivot 32. When this occurs, the toggle links 28 at their upper ends move outwardly and since the bottom ends of said links at 27 support the pivoted clamping plates 23, said plates move inwardly. This is because the fulcrum forming links 35 prevent separating movement of said links in the plane of the links 35, and therefore, if the upper portion of the links move outwardly or separate, the lower portion moves inwardly to compensate therefore. When this movement occurs the article or brick 11 is grasped in clamping relation while on the moving belt 10. The springs 36 are interposed between the slidably supported hinge and spring seat forming member 26 and the cradle 17, and normally tend to prevent the hinge member and gripping plates from rising. Thus the first motion of the core and draw bar operate through the toggle linkage to bring the clamping plates into contact with the article to be grasped instead of raising immediately. Further application of force results in pressure on the article without motion of any kind until enough force is applied to compress the spring, whereupon the hinge seat, clamping plate, toggle linkage and brick are all raised. It is plain that with a heavy spring the grasping force must be greater than with a light spring before the lifting can take place. By changing the size and character of the springs the grasping pressure can be varied from nothing to about 75% of the total pull of the solenoid. Washers 136 secure spring adjustment.

From the foregoing it will likewise be understood that when the coils are deenergized the springs tend to lower the clamping plates providing such opening movement is not automatically accomplished through the weight of the several parts, particularly the toggle linkages which would tend to return to their original position. Friction between parts may, however, require spring action. It will be apparent, therefore, that upon the release of the applied force, to wit, the deenergization of the coils, the articles grasped are immediately dropped from the grasping plates and therefore no support is necessary to support the articles to accomplish the release thereof from the grasping mechanism. It is to be understood, however, that wherever it is desirable to first deposit the article upon a support and then release the clamping device, such action may be utilized but the same is not necessary and in many cases is undesirable.

The foregoing is a detailed description of the essential parts of a single unit. These units, as shown in Figs. 1 and 6, may be connected together for successive operation and when such successive or continuous operation is desirable, a suitable inter-control is provided whereby one of the units controls the next successive unit and so on in turn, and herein two types of such inter-controls are illustrated, the first being of the electrical type and the second being of the mechanical type. The first is shown in detail in Figs. 2 to 5 inclusive, while the second type is shown in Fig. 6. Reference will be had first to that type of control shown in Figs. 2 to 5 inclusive, with particular reference to the first three figures for a detailed description of the structural mechanism. Carried by the lower end of the draw bar 33 is a pair of yoke forming members 40 which support a pin 41 and a bushing 42. The yoke forming members 40 straddle a pair of links 44, which links lie within a pair of links 43. The pair of links 44 at one end carry a transverse connector 45 which is a spacer block. The links 44 are pivoted at 46 to a portion of the stationary framework. The links 43 lying outside the links 44 are connected at one end to the links 44 by the connecting links 47. The opposite ends of the links 44 and 43 are connected to an insulation block 48 and said insulation block carries a projecting finger or trigger 49. This trigger is adapted to be projected downwardly into the path of the articles movable beneath the unit gripper, and thereafter be moved out of the path or reset. A relatively stationary contact support 50 is of insulation and supports a contact member 51. The insulation block 48, pivotally supported by the bar or links 44, carries a stationary contact 52 and associated therewith is a spring actuated contact finger 53. Said members 48 and 50 are maintained in separated relation by a spring 54. When the contactor is positioned as shown in Fig. 4 the trigger is projected into the path of the article and the switch members 53 and 51 are out of contact. Immediately upon the mechanical engagement of the trigger by an article the electrical circuit through these contacts 51 and 53 is closed in opposition to spring 54. This immediately energizes the solenoid 18 and causes the article to be grasped and elevated. The foregoing action is substantially instantaneous. The switch is maintained in closed circuit position by the engagement of the bar or pin 41 with links 43 to tilt the mechanism and maintain the same in closed circuit position, while the armature and core is in the elevated position. In this movement the block 48 is tilted upwardly and inwardly through the action of the toggle or scissors construction.

Stationarily supported upon the framework is an insulation base 60 having a stationary contact 61. The pivotally supported block 63 carries a trigger 65 engageable by an arm 66 carried by draw bar 33 or equivalent mechanism. Thus in the upward movement of the draw bar, arm 66 engages trigger 65 to open the switch including the members 61 and 64. The rod 67 and spring 68 press down on the spacer block 45 and hold the entire contactor out of the path of the brick when there is no power on either the main coil or the auxiliary coil. The stem of the spring on the back of the auxiliary contact is fastened to the stationary insulation block 60, and passes through 64, so that this spring closes the auxiliary contact.

A coil 69 is mounted adjacent the spacing bar 45 and links 44 and associated therewith is a core 70 pivotally associated with said links at 71. When the solenoid 69 is energized core 70 is elevated, and therefore the links 44 are tilted upon their pivots 46 to drop the trigger 49 into the path of the oncoming article.

As previously explained engagement of the article with the trigger 49 closes the circuit to the main coil or solenoid 18 which elevates the article and the arm 66, which thereupon engages the trigger 65 and opens the switch 61—64. The connection for current to coil 69 passes through switch 61—64 so that when the brick is picked up this coil is deenergized and the trigger is allowed to be pulled into the position shown in Fig. 3.

Adjacent to coil 69 is the spring stem 67 carrying the spring 68. The stem 67 presses against the spacer block 45. When the brick have been dropped the yoke 40 drops also thus opening the contact 51—53 and closing the contact 61—64. The pressure of spring 68, however, maintains the link 44 and trigger 49 in the position shown in Fig. 3, until coil 60 is again energized.

Reference will now be had to Fig. 5. In said figure there is illustrated a main line 75 and another main line 76. The main switch 74 controls the aforesaid. Herein 8 units are illustrated diagrammatically so far as their wiring connections are concerned. A line 77 connects each of the switch members or trigger actuated members 53 with the main line 75. A line 78 connects each of the relatively stationary contacts 51 with the coils 18 and a shunt connection 79 connects said contact 51 with the switch member 61 of the next adjacent or successive unit. The switch member 64 of the switch 61—64 is connected to coil 69 and a line 86 is connected as a return to line 76. Each of the coils 18 by line 81 is connected to said common return. An initiating line 82 connects the first switch member 61 to the line 75. Thus when switch 74 is energized the normally closed switch 61—64 supplied current to coil 69 which immediately picks up the armature 70 and drops the first trigger 49 into the path of the oncoming articles. It will be noted that the switches 51—53 are normally open while switches 61—64 are normally closed. Engagement of the trigger 49 by the article closes the switches 51—53 of the first unit. This immediately supplies current to coils 18 and at the same time as shown in Fig. 5 supplied current to switch member 61 of the second unit. Thus simultaneously with the energization of coils 18, coil 69 of the second unit or adjacent unit is energized so as to immediately project its trigger 49 into the path of the oncoming articles. After the coils 18 become effective the first unit engages the first initiating article to be grasped and elevated and in the continuing elevating movement, the arm 66 engages trigger 65 and opens the circuit of the coil 69 thereby deenergizing the same and permitting the links 44 to tilt, thus maintaining switches 53—51 in closed circuit position by reason of the engagement of the pin 41 with links 43. Thus energy is maintained through the return line 81 and supply lines 77 through the coils 18 for holding an article. Immediately upon the engagement of the trigger 49 of the second unit, the switch 51—53 is closed and current is supplied through its branch 77 to coils 18 and to the switch member 61 in the circuit of the coil 69 of the third unit. At the same time the second unit coils 18 are energized and maintained in that condition. Any number of units, therefore are automatically energized successively by successive individual engagement of articles with the individual triggers. When the entire battery of units is filled with articles they may be moved by moving the support 12. This can be accomplished in several ways. The switch 74 may be manually or mechanically actuated, and if desired the last switch 53 may be so arranged that it or a part of the toggle mechanism is adapted to mechanically control any desired motor motion to move the row of brick as desired. Upon opening the circuit 74 it will be apparent that all of the coils 18 are deenergized and all of the articles are released from the grasping mechanisms.

In Fig. 6 a modified form of the invention is illustrated and in this form of the invention the electrical connection between switch 51 through the shunt 79 to switch 61—64 and coil 69 and line 80, is replaced by a mechanical mechanism which in its broader aspect is the full equivalent of this electrical mechanism hereinbefore described, although, because of the ease of substitution in the event of repair and because of other operating conditions, the electrical equivalent is preferred. In Fig. 6 each of the units includes coil 18, the cradle 17, the draw bar 33 and the associated toggle linkage hereinbefore described.

The control mechanism includes the following: The cradle 17 supports a roller 83 and the cradle also provides a pivot 84 for a pair of links 85 between which are positioned another pair of links 86 which are pivotally supported at 87 by a pair of links 88 in turn pivotally supported at 84. The draw bar extension 89 carries a stop 90 and the pin 91. The pin 91 actuates the inner pair of links 86, which in reality constitute levers, to elevate the entire contactor mechanism controlling the coil 18 after said coil 18 has been energized. Pivotally supported in the opposite ends of the inner links 86 is an insulation block 92 upon which is yieldingly mounted a contactor 93. Also supported by said block is a tongue or trigger 94. Adjacent said contactor 93 is another contactor 95 supported by an insulated block 96, said contacts being maintained in open relation by a spring 97. Block 96 is supported by a U-shaped support 98 which has an extension 99 that extends beyond the ends of the levers or links 85 upon which the same is pivotally mounted.

It will be noted that the belt 10 conveys the brick or similar articles 11 beneath the mechanisms until one of the brick contacts the last trigger 94, whereupon the block 92, pivoted at the end of the links or levers 84, is tilted into closed circuit position causing contact 93 to close the circuit through contactor 95, thereby energizing coil 18 which causes the elevation of the draw bar 33 and the extension 89 thereof at the same time that the brick is clamped through the toggle linkage previously described and particularly illustrated in the preceding figures. Elevating movement of the draw bar causes the inner links 86 to be elevated and at the same time said movement elevates the outer links 85, positioning the several linkages as shown in the left hand third of Fig. 6. Simultaneously with this movement the extended end 99 of the second mechanism is caused to be tilted upon its pivot thereby moving the tongue or trigger 94 downwardly in the path of the oncoming brick, whereupon it is engaged thereby for tilting of the block, closing of the switch and energizing of the coil whereupon the cycle is repeated. After the coils 18 are deenergized the several linkages are returned to the position shown by the right hand third of Fig. 6. In this position the two pairs of levers 85 and 86 are in their lowermost position which maintains the trigger 94 in the uppermost position and the switch in the open circuit position. At the same time the trigger or extension 99 is in position to be actuated for projecting the trigger 94 into the lower or brick engageable position. Thus each successive switch actuating mechanism is adapted to be engaged by the oncoming article for energizing the lifting and clamping mechanism and simultaneously setting the trigger mechanism of the next adjacent lifting and grasping mechanism.

In Fig. 7 there is diagrammatically illustrated a plurality of individual lifting devices having the lifting and grasping coils or solenoid 18. The movably mounted switch 51—53 and the circuit thereto, said switch having the brick engageable portion or contactor 49. The solenoid 69 actuatable by brick engagement with the preceding contact for positioning the succeeding contactor for brick engagement, a switch 61—64 controlling and including in a circuit of said last mentioned solenoid and operable in the lifting movement of the grasping device. The switch 53—51 controlled thereby, however, remains in actuatable relation or closed circuit position until the lifting and grasping solenoids 18 are deenergized which automatically opens said switch 53—51 and closes the switch 61—63 as well as permitting the clamping plates to return to the lowered and opened, or non-clamping position. A cross connection 100 between all of the devices in each successive row insures that upon the first engagement of a contactor 49 by brick the positioning solenoid 69 of each of the devices of the succeeding row will be energized to position all of the contactors of said succeeding row in position for brick engagement. Thus, in the event that the brick 11 on belt 10 are supplied in a plurality of streams and there is removed from the belt, a brick in any one of the streams (usually removed by the inspector or by accident) the brick would not pile up by reason of the remaining brick in the row from which the brick has been removed, engaging the contactors and actuating the same and leave the other tandem row deenergized.

Furthermore, in the event that any contactor is coated with clay or there is an open circuit to the lifting solenoid 18 through the switches, then said solenoid 18 will pick up since it secures energy through the cross connection 100 in spite of the aforesaid failures.

The invention claimed is:

1. In combination, for lifting brick, a brick support, a plurality of brick arranged in tandem relation upon said support, a plurality of brick grasping devices similarly arranged, said brick grasping devices and said support having relative movement with respect to each other in the tandem direction, and means associated with each grasping device for actuating the same to grasp and lift the brick substantially vertically.

2. In a device for lifting brick, the combination of a brick support, a plurality of brick grasping devices arranged in tandem relation, a support for said grasping devices, said supports being movable relatively of each other in the tandem direction, and means for actuating said grasping devices for grasping and lifting the brick substantially vertically, said devices each being adapted to straddle the brick to permit passage of non-grasped brick therethrough to the preceding grasping device.

3. In a device for lifting brick, the combination of a brick support, a plurality of brick grasping devices arranged in tandem relation, a support for said grasping devices, said supports being movable relatively of each other in the tandem direction, means for actuating said grasping devices for grasping and lifting the brick substantially vertically, said devices each being adapted to straddle the brick to permit passage of non-grasped brick therethrough to the preceding grasping device, and a control associated with each grasping device whereby successive brick will be grasped on by successive devices in succession.

4. In a device of the character described, the combination of a plurality of article grasping means, electrical means for each grasping means for operating the same, and a switch associated with each of said electrical means and operable by the article to be grasped for conditioning the successive article grasping means.

5. An article handling mechanism of the character described including a pair of fingers adapted to grasp and hold an article having resisting surfaces, linkage connecting said fingers and having a predetermined limiting position, and a single power means for moving said toggle linkage for first causing said fingers to grip the article and thereafter move the linkage to the limiting position and the article from its initial position.

6. An article handling mechanism of the character described including a pair of fingers adapted to grasp and hold an article having resisting surfaces, linkage connecting said fingers and having a predetermined limiting position, a single power means for moving said linkage for first causing said fingers to grip the article and thereafter move the linkage to the limiting position and the article from its initial position, and an anti-friction support for said fingers.

7. In a mechanism for lifting brick, the combination of a brick support, and a brick grasping device, a support for said grasping device, and means for actuating said grasping device for grasping and moving the brick, said brick and brick grasping device being relatively movable with respect to each other in two transverse directions, said actuating means permitting the brick to be released from said device for deposition upon a second support without first resting the brick.

8. In a device of the character described, the combination of a plurality of article-engaging fingers, means for operating one of said fingers including a single unidirectional movable plunger, and a connection between said plunger and said operated finger which causes said fingers to engage the article until further engagement is resisted by the article and the remainder of the plunger travel is transmitted to the fingers for lifting the same and the article.

9. In a device of the character described, the combination of a plurality of article-engaging fingers, means for operating one of said fingers including a single unidirectional continuously traveling plunger, and a connection between said plunger and said operated finger which causes said fingers to engage the article until further engagement is resisted by the article and the remainder of the plunger travel is transmitted to the fingers for lifting the same and the article.

10. In a device of the character described, the combination of a plurality of article-engaging fingers, means for operating one of said fingers including an electric solenoid, a slidable core operable by said solenoid, and a connection between said core and said operated finger arranged so that the initial power application is applied to said finger for article engagement and the remainder of the power application is applied to the fingers for elevating the article.

11. In a device of the character described, the combination of a plurality of article-engaging fingers, a toggle construction for operating said fingers, and a single means for exerting a uni-directional force upon said toggle construction, whereby said fingers are adapted to first engage an article and thereafter continue to hold the article and elevate the same with the continued application of said uni-directional force.

12. In a device of the character described, the combination of a plurality of article-engaging fingers, a single linearly movable means for providing a uni-directional movement of a predetermined amount, and a connection between one of said fingers and said uni-directional means, whereby the fingers first engage an article to hold the same only with the initial portion of the movement of the uni-directional means and the remainder of the travel of the uni-directional means is utilized for elevating the article and the fingers while holding the same.

13. An apparatus of the character described including a single linearly movable reciprocable means for applying a single force acting in one direction when moved in one direction for engaging an article and thereafter raising the same while engaged and upon return movement automatically release the article.

14. An apparatus of the character described including a single linearly movable reciprocable means for applying a predetermined uni-directional force when moved in one direction for engaging an article with just sufficient force to hold the same and applying the remainder of said force to elevate the same and upon return movement automatically release the article.

15. In combination, a support, an article upon said support, a plurality of fingers for engaging said article above the support, and a single means for causing said engagement and elevating the article when thus engaged, said article-engaging means being automatically returnable upon the removal of the constraining force applied thereto to permit the article to be released without prior deposition upon a support at the time of release.

16. In a device of the character described, the combination of a plurality of article-engaging fingers, and a power operable mechanism for actuating in one movement said fingers to engage an article and elevate the same, said fingers being automatically returnable into non-engaging position upon release from the power operable mechanism and for releasing the article through the weight thereof.

17. In a device of the character described, the combination of a plurality of article-engaging fingers and a single power operable mechanism for actuating said fingers to engage an article and elevate the same in one continuous movement, said article being automatically releasable by reason of its weight when the constraining force of the power operable mechanism is released.

18. An article handling mechanism of the character described including a pair of fingers adapted to grasp and hold an article having grasping surfaces, and a single solenoid for actuating said fingers to grasp the article and elevate the same.

19. An article handling mechanism of the character described including a pair of fingers adapted to grasp and hold an article having grasping surfaces, and a single solenoid means actuable by a predetermined force for actuating one of said fingers to grasp the article with only sufficient force to hold the same and continue the application of whatever balance of force is required for moving the article thus grasped.

20. An article handling mechanism of the character described including a pair of fingers adapted to grasp and hold an article having grasping surfaces, linkage connecting said fingers, a single solenoid for operating said linkage for causing said fingers to first grasp an article and when grasped to move the same, and an anti-friction support for said fingers.

21. In a clamp construction for plastic articles, the combination of a support, a clamping mechanism movably supported thereby, and a support for said mechanism positioned beneath said first mentioned support, said clamping mechanism including a pair of horizontally fulcrumed opposed clamping plates, and pressure operable means for causing said plates to move together to engage and clamp the plastic article, said clamping plates being automatically returned to and normally maintained in non-clamping relation by gravity, said pressure operable means actuating said plates in opposition to gravity.

22. In a brick lifter, the combination of a pair of clamping plates, a support for supporting the same, a linkage connected to one of said plates, means for actuating said linkage, a support for said actuating means, and yielding means interposed between said supports for normally opposing movement of the first mentioned support with respect to the second mentioned support until the article to be clamped and raised has been grasped with sufficient force to permit of raising the same.

23. In a brick lifter, the combination of a pair of clamping plates, a support for supporting the same, linkage connected to one of said plates, means for actuating said linkage, a support for said actuating means, yielding means interposed between said supports for normally opposing movement of the first mentioned support with respect to the second mentioned support until the article to be clamped and raised has been grasped with sufficient force to permit of raising the same, and an anti-friction mounting associating said supports together.

24. In a brick lifter, the combination of a pair of clamping plates, a support for supporting the same, a linkage connected to one of said plates, power means for actuating said linkage, and yielding means associated with said support, the grasping force applied by said clamping plates being directly proportional to the strength of said yielding means.

25. In a brick lifter, the combination of a pair of clamping plates, a support for supporting the same, a linkage connected to one of said plates, power means for actuating said linkage, and adjustable yielding means associated with said support, the grasping force applied by said clamping plates being directly proportional to the adjusted strength of said yielding means.

26. In a device for lifting brick, the combination of a brick support adapted to support a plurality of brick, a plurality of rows of brick grasping devices arranged in tandem, and including a plurality of tandem arrangements, means connecting each device in the tandem arrangement for conditioning the same by the operation of the preceding device, and means connecting the devices in each row for insuring conditioning of all of the tandem arranged in the succeeding row.

27. In a device for lifting brick, the combination of a brick support adapted to support a plurality of brick, a plurality of rows of brick grasping devices arranged in tandem and including a plurality of tandem arrangements, means connecting each device in the tandem arrangement for conditioning the same by the operation of the preceding device, and means connecting the devices in each row for securing operation of all of the tandem arranged devices in said preceding row upon operation of any one of said devices in said preceding row.

28. In a device for lifting brick, the combination of a brick support adapted to support a plurality of brick, a plurality of rows of brick grasping devices, arranged in tandem and including a plurality of tandem arrangements, means connecting each device in the tandem arrangement for conditioning the same by the operation of the preceding device, and means connecting the device in each row for insuring conditioning of the tandem arranged devices in the succeeding row and for securing operation of all of the devices in said preceding row upon operation of any one of said devices in said preceding row.

29. In combination, a plurality of brick clamping means, actuating means for each of said grasping means, a brick engageable member associated with each of said brick grasping means, a plurality of brick, and means connecting each of said brick grasping means for positioning the brick engageable member for brick engagement upon brick engagement of the preceding brick engageable member with a brick, the engagement of brick with the brick engageable member initiating said actuating means and positioning said brick in predetermined position with respect to the grasping means for grasping.

30. In a brick lifting device, the combination of a grasping solenoid, a movably mounted switch controlling the same engageable by a brick to be grasped for actuating said solenoid, and means for moving said switch into position for brick engagement and solenoid actuation.

31. In a brick lifting device, the combination of a plurality of brick grasping devices each including a solenoid, a movably mounted switch controlling the same engageable by a brick to be grasped for actuating said solenoid, and means automatically actuatable by brick engagement of the preceding switch for moving said succeeding switch into position for brick engagement and solenoid actuation.

32. In a brick lifting device, the combination of a grasping solenoid, a movably mounted switch for actuating the same, a solenoid for moving said switch into position for brick engagement, and means for actuating said second mentioned solenoid.

33. In a brick lifting device, the combination of a grasping solenoid, a movably mounted switch for actuating the same, a solenoid for moving said switch into position for brick engagement, means for actuating said second mentioned solenoid, and means associated with the solenoid and switch for automatically returning the switch to non-engageable position upon actuation of the first mentioned solenoid.

34. In a brick lifting device, the combination of a grasping solenoid, a movably mounted switch for actuating the same, a solenoid for moving said switch into position for brick engagement, means for actuating said second mentioned solenoid, and means associated with the first mentioned solenoid and switch for automatically maintaining said solenoid and switch in brick grasping relation and automatically returning said switch to non-engageable position upon actuation of the first mentioned solenoid.

35. In a brick lifting device, the combina-

tion of a grasping solenoid, a movably mounted switch controlling the same engageable by a brick to be grasped for actuating said solenoid, and means associated with said solenoid and switch for automatically positioning said switch in position for brick engagement and solenoid actuation and automatically returning said switch to non-engageable position upon actuation of the solenoid.

36. In a brick lifting device, the combination of a grasping solenoid, a movably mounted switch controlling the same engageable by a brick to be grasped for actuating said solenoid, and means associated with said solenoid and switch for automatically maintaining said solenoid and switch in brick grasping relation and automatically returning said switch to non-engageable position upon actuation of said solenoid.

37. In a device for lifting brick, the combination of a brick support adapted to support a plurality of brick, a plurality of rows of brick grasping devices arranged in tandem and including a plurality of tandem arrangements, means connecting each row to the succeeding row for conditioning by a preceding device operation, the device in the successive row for operation, and means connecting the devices in each row for insuring conditioning of all of the preceding row of devices by any one of the devices in the preceding row.

38. In a device for lifting brick, the combination of a brick support adapted to support a plurality of brick, a plurality of rows of brick grasping devices arranged in tandem and including a plurality of tandem arrangements, means connecting each row to the succeeding row for conditioning by a preceding device operation the devices in the succeeding row for operation, and means connecting the devices in each row for securing operation of all of the devices in said preceding row upon operation of any one of the devices therein.

39. In a device for lifting brick, the combination of a brick support adapted to support a plurality of brick, a plurality of rows of brick grasping devices arranged in tandem and including a plurality of tandem arrangements, means connecting each row to each succeeding row for conditioning by a preceding device operation the devices in the succeeding row for operation, and means connecting the devices in each row for insuring conditioning of all of the succeeding rows of devices by any one of the devices in the preceding row and for securing operation of all of the devices in said preceding row upon operation of any of the devices therein.

40. In a device for lifting brick, the combination of a brick support adapted to support a plurality of brick, a plurality of rows of brick grasping devices arranged in tandem and including a plurality of tandem arrangements, and means connecting said devices whereby all of the devices in a row are conditioned for operation upon operation of any devices in the preceding row.

41. In a device for lifting brick, the combination of a brick support adapted to support a plurality of brick, a plurality of rows of brick grasping devices arranged in tandem and including a plurality of tandem arrangements, and means connecting said devices whereby all of the devices in a row are actuated upon operation of any device in said row.

42. In a device for lifting brick, the combination of a brick support adapted to support a plurality of brick, a plurality of rows of brick grasping devices arranged in tandem and including a plurality of tandem arrangements, and means connecting said devices whereby all of the devices in a row are conditioned for operation upon the operation of any devices in the preceding row and all of said devices in said row are actuated upon the operation of any device in said row.

43. In a device of the character described, the combination of a plurality of article grasping means, a power means for each grasping means for individually operating the same, and a device associated with each of said power means and operable by an article to be grasped for conditioning the succeeding article grasping means for grasping.

44. In a device for lifting brick, the combination of a brick support, a plurality of brick grasping devices arranged in tandem relation, a support for said grasping devices, said supports being movable relatively of each other in the tandem direction, means for actuating said grasping devices for grasping and lifting the brick substantially vertically, said devices each being adapted to straddle the brick to permit of passage of non-grasped brick thereto to the preceding grasping device, and a control associated with each grasping device operable by the brick to be grasped whereby successive grasping devices are successively conditioned for grasping brick.

45. In a clamp construction for plastic articles, the combination of a support, a clamping mechanism movably supported thereby a support for said mechanism positioned beneath said first mentioned support, said clamping mechanism including a pair of similarly fulcrumed and opposed clamping plates, and pressure operable means for causing said plates to move together to engage and clamp the article, said clamping plates being automatically returnable into non-clamping position upon return of the pressure operable means to initial condition.

46. In a brick lifter device the combination of a support, a pair of clamping plates for clamping and lifting brick, power means, means for elevating said plates, a normally

open control for said power means, a contactor engageable by the brick for operating said control, a connection between said control and the means for elevating the brick clamping plates for maintaining said control in the power applying position when the brick is elevated and a yielding mounting associated with said control permitting relative movement between the parts of said control for obtaining positive predetermined positioning of said control in the power applying position.

47. In a brick lifter device the combination of a support, a pair of clamping plates for clamping and lifting brick, power means, means for elevating said plates, a normally open control for said power means, a contactor engageable by the brick for operating said control, and a connection between said control and the means for elevating the brick clamping plates for maintaining said control in the power applying position when the brick is elevated, the maintaining connection including a linkage operable by the elevating means when the clamping plates are in clamping relation.

48. In a device for lifting brick, a solenoid for actuating said device to grasp and lift the brick, a member engageable by the brick for actuating said solenoid, a second solenoid actuable to position said brick engageable member for brick engagement, and a switch controlled by said first solenoid for deenergizing said second solenoid upon actuation of said first solenoid.

49. In an article initiating lifting device, the combination of a trigger engaged by the article to be lifted prior to the lifting for initiating the same, a normally open switch closed by the trigger when engaged by the article, and links for elevating the trigger with the article when lifted.

50. A device as defined by claim 49, characterized by the trigger elevating means including a link pivotally supported at one end, another link pivotally supported upon the opposite end of the first mentioned link and connected to the trigger, and a third link connected to the trigger, said links being arranged to maintain the trigger in switch closing position when lifted.

51. In combination a pair of relatively movable switch members, links associated therewith for securing relative movement therebetween, a solenoid for causing lowering movement of the links, another solenoid for causing upward movement of the links when the switch is closed, a normally closed switch controlling the first mentioned solenoid, and means operable in the elevational movement responsive to the second-mentioned solenoid for opening said second-mentioned switch and deenergizing said first-mentioned solenoid.

52. A device as defined by claim 51, characterized by the addition of a spring for cushioning the lowering movement of the links when the second-mentioned solenoid is deenergized.

53. A device as defined by claim 51, characterized by the addition of means for normally maintaining the links in the elevated position when the second mentioned solenoid is deenergized.

54. A device as defined by claim 51, characterized by the addition of means for normally maintaining the links in the elevated position when the second mentioned solenoid is deenergized, and means operative to energize said first-mentioned solenoid to actuate said links for lowering the same in opposition to said maintaining means.

In witness whereof, I have hereunto affixed my signature.

GRAFTON E. LUCE.

May 17, 1932. R. N. AUBLE 1,859,016

CIRCUIT FOR RADIO COMMUNICATION

Filed March 16, 1929

FIG. 1

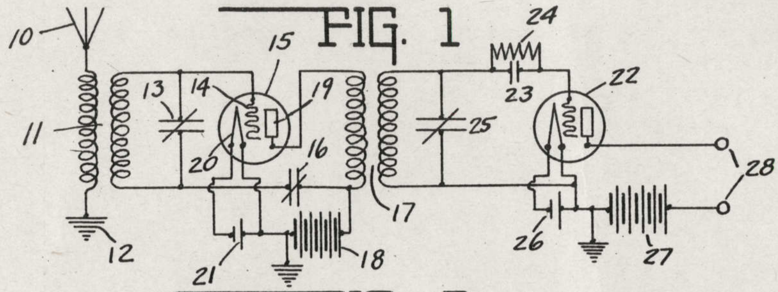


FIG. 2

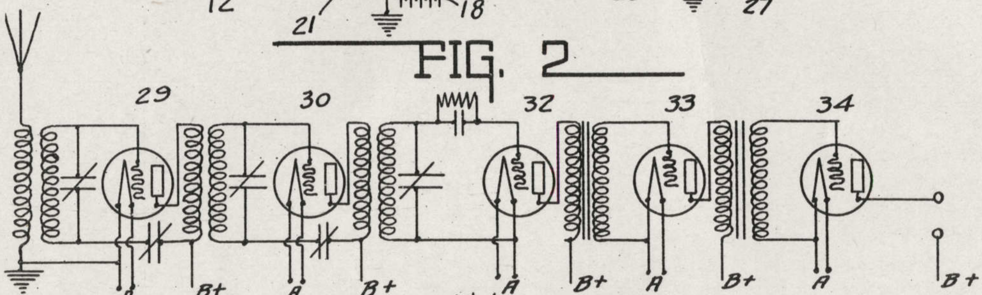


FIG. 3

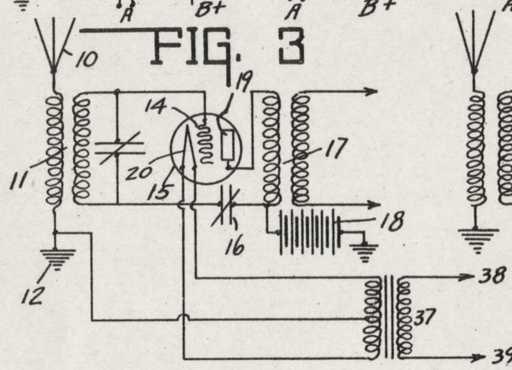


FIG. 4

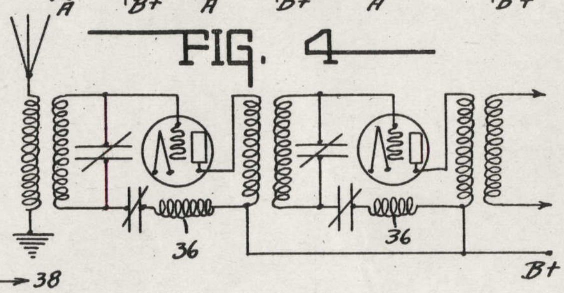
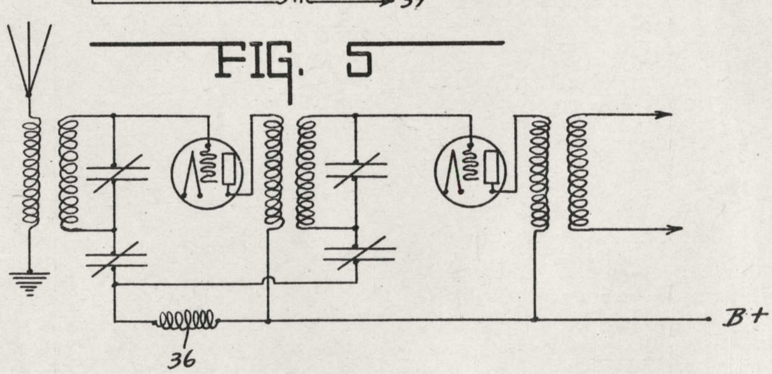


FIG. 5



INVENTOR.
ROBERT NEIL AUBLE.

BY Lockwood, Lockwood, Goldsmith & Galt
ATTORNEYS.

Patented May 17, 1932 1,859,016

UNITED STATES PATENT OFFICE

ROBERT NEIL AUBLE, OF INDIANAPOLIS, INDIANA

CIRCUIT FOR RADIO COMMUNICATION

Application filed March 16, 1929. Serial No. 347,495.

This invention relates to an improved circuit for radio communication and more particularly to a circuit in which a thermionic vacuum tube is used for amplification of the signals.

One of the objects of the invention is to provide a circuit in which there is no inherent tendency to oscillation due to the inter-element capacity in the vacuum tube.

Another object of the invention is to increase the amplification which can be obtained for a given tube at a given plate potential without distortion.

Another object of the invention is to provide a circuit in which either alternating or direct current may be used for heating the cathode of the vacuum tube.

Another object of the invention is to provide a circuit in which no direct current is taken by the grid electrode of the vacuum tube.

One feature of the invention resides in the fact that there is no conductive connection between the grid electrode and either of the other electrodes of the tube.

Another feature resides in the fact that the connection between the input circuit of the vacuum tube and the output circuit is completed through a condenser.

Other objects and features of the invention will be understood from the following specifications and claims and the attached wiring diagrams;

In the diagrams, Fig. 1 shows an application of the invention to a radio receiving apparatus consisting of a single stage of radio frequency amplification and a detector stage. Fig. 2 illustrates the application of the invention in a two-stage radio frequency amplifier coupled to a standard detector tube circuit and two stages of transformer coupled audio frequency amplification. Fig. 3 shows the invention in a circuit wherein the cathode is heated by alternating current from a suitable transformer connected to public service power lines. Figs. 4 and 5 show further modifications of circuits in which the invention is used.

In the drawings an antenna 10 is connected to the primary of the usual type of radio frequency transformer 11 which in turn is grounded at 12. The secondary of the transformer 11 is connected in parallel with the tuning condenser 13 and one end is connected to the grid 14 of a thermionic vacuum tube 15. The opposite ends of the secondary of the transformer 11 and the condenser 13 are connected to one plate of a condenser 16. The opposite plate of the condenser 16 is connected in turn to one side of the primary of the transformer 17 and to the positive terminal of the usual B-battery 18. The plate electrode 19 of the thermionic tube 15 is connected to the opposite side of the primary of the transformer 17. The filament or cathode 20 of the tube 15 is heated by the usual A-battery 21 connected in the usual manner without regard to polarity as shown in the diagram. By this connection the input circuit or grid circuit of the tube is connected to the output circuit or plate circuit through the condenser 16 and there is no conductive connection between the grid and either the filament or plate.

The detector circuit shown in Fig. 1 is a standard detector circuit and consists of the thermionic tube 22, grid condenser 23, grid leak 24, the secondary of the transformer 17, the tuning condenser 25, the usual A- and B-batteries 26 and 27 and the output connections 28 to which may be connected the usual ear phones, loud speaker or audio amplification circuits. Any practical form of detector circuit and audio amplification circuit might be used.

For convenience in this diagram, the audio frequency circuit and the detector circuit are shown using separate batteries instead of the more common method of using the same batteries for both circuits.

In Fig. 2 is shown a radio receiving circuit using two stages of radio frequency amplification indicated generally by the numbers 29 and 30. Each of these stages is exactly similar to the radio frequency amplification stage described for Fig. 1, the output of stage 29 being coupled to the input of stage 30 through the transformer 31.

The remainder of the circuit in Fig. 2 consists of a standard detector circuit indicated at 32 and two stages of standard audio frequency amplification 33 and 34 which will not be described in detail.

In the radio frequency circuits in the two Figures 1 and 2, there is no inherent tendency to oscillation since there is no conductive connection whatever between the grid and the plate of the tube. The grid is free to adjust itself automatically to a potential dependent upon the action within the tube itself and it has been found by experience that the potential so assumed gives much greater amplification for a given plate potential with less distortion of signals than has been possible with any fixed grid bias. The condenser 16 may be set at a value which gives excellent results over a great range of frequency. The condenser value is not a critical factor, being itself variable between wide limits without affecting the stability of the circuit. If the condenser 16 is made variable, the amplification for a given frequency may be considerably varied. This provides a convenient method of volume control and allows the filament current to be maintained at a constant value instead of being varied to provide the desired variations in volume. This has the advantage of allowing the filament temperature to be maintained at the proper position for maximum efficiency of the tube.

An alternating current may be used to heat the tube filament as shown in Fig. 3 wherein a suitable transformer 37 has its primary winding connected to public service power lines 38 and 39 and its secondary winding connected to the filament electrode as shown. The mid-point of the secondary winding is connected to ground. Thus, when the B-battery negative terminal is also connected to ground, as is common practice, there is no change in circuit for adaptation to either alternating or direct current.

In Figs. 4 and 5 inductive choke coils 36 are connected between the condenser 16 and the transformer 17. These provide a means of adjusting the coupling of transformer 17 so that a standard transformer with fixed coupling may be used. If a transformer of proper coupling is originally chosen, the choke coils are unnecessary.

The invention claimed is:

1. A radio frequency amplification circuit including a thermionic tube having filament, grid and plate electrodes, a source of electric potential for heating said filament, an input transformer having one terminal of its secondary winding connected to said grid electrode, a tuning condenser connected in parallel with the secondary winding of said input transformer and having no conductive connection with the filament electrode, a second condenser having one terminal connected to the second terminal of the input transformer, an output transformer having one terminal of its primary winding connected to said plate electrode and the opposite terminal of its primary winding connected to the second terminal of said second condenser, and a source of electric potential having one terminal connected to the second terminal of the primary winding of said output transformer and its other terminal connected to said filament electrode.

2. A radio frequency amplification circuit comprising a thermionic tube having filament, grid and plate electrodes; a source of electric potential for heating said filament; an input circuit including the said grid electrode, the secondary winding of an input transformer, a tuning condenser and one plate of a second condenser; an output circuit including the said plate electrode, the primary winding of an output transformer, a source of electric potential, and the said filament electrode; and a connection between the opposite plate of the second-mentioned condenser and a point in said output circuit, said connection including an inductive choke coil.

3. A radio frequency amplification circuit including a thermionic tube having filament, grid and plate electrodes, a source of electric potential for heating said filament, an input circuit connected to said grid and including a tuning condenser having no conductive connection to said filament or plate, an output circuit including an output transformer having one terminal of its primary winding connected to said plate electrode, and a second source of electric potential having one terminal connected to the second primary terminal of said output transformer and its second terminal connected to said filament and a condenser having only one terminal connected to said input circuit and the opposite terminal connected to a point in the output circuit between said output transformer and said second source of electric potential.

4. A radio frequency amplification circuit including a thermionic tube having filament, grid and plate electrodes, a source of electric potential for heating said filament, an input circuit connected to said grid and including a tuning condenser having no conductive connection to said filament or plate, an output circuit including an output transformer having one terminal of its primary winding connected to said plate electrode, and a second source of electric potential having one terminal connected to the second primary terminal of said output transformer and its second terminal connected to said filament and a condenser having only one terminal connected to said input circuit and the opposite terminal connected to a point in the output circuit between said output transformer and said filament.

5. A radio frequency amplification circuit including a thermionic tube having filament, grid and plate electrodes, a source of electric

potential for heating said filament, an input circuit connected to said grid and including a tuning condenser having no conductive connection to said filament or plate, an output circuit including an output transformer having one terminal of its primary winding connected to said plate electrode, and a second source of electric potential having one terminal connected to the second primary terminal of said output transformer and its second terminal connected to said filament and a condenser having only one terminal connected to said input circuit and the opposite terminal connected to a point in the output circuit between said output transformer and said second source of electric potential, said condenser being variable to provide volume control.

6. A radio frequency amplification circuit including a thermionic tube having filament, grid and plate electrodes, a source of electric potential for heating said filament, an input circuit connected to said grid and including a tuning condenser having no conductive connection to said filament or plate, an output circuit including an output transformer having one terminal of its primary winding connected to said plate electrode, and a second source of electric potential having one terminal connected to the second primary terminal of said output transformer and its second terminal connected to said filament and a condenser having only one terminal connected to said input circuit and the opposite terminal connected to a point in the output circuit between said output transformer and said filament, said condenser being variable to provide volume control.

In witness whereof, I have hereunto affixed my signature.

ROBERT NEIL AUBLE.

TRAFFIC CONTROL SYSTEM FOR MULTIFLOOR GARAGES

Filed Nov. 20, 1926

FIG. 1

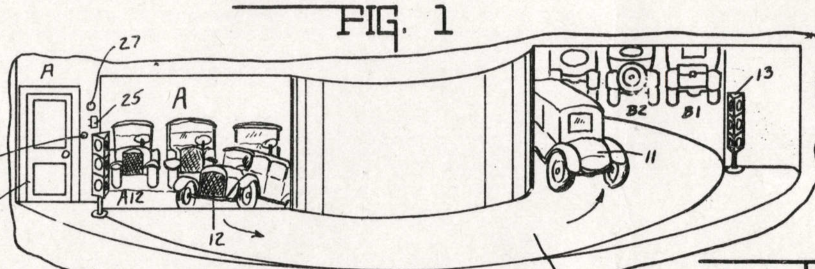


FIG. 2

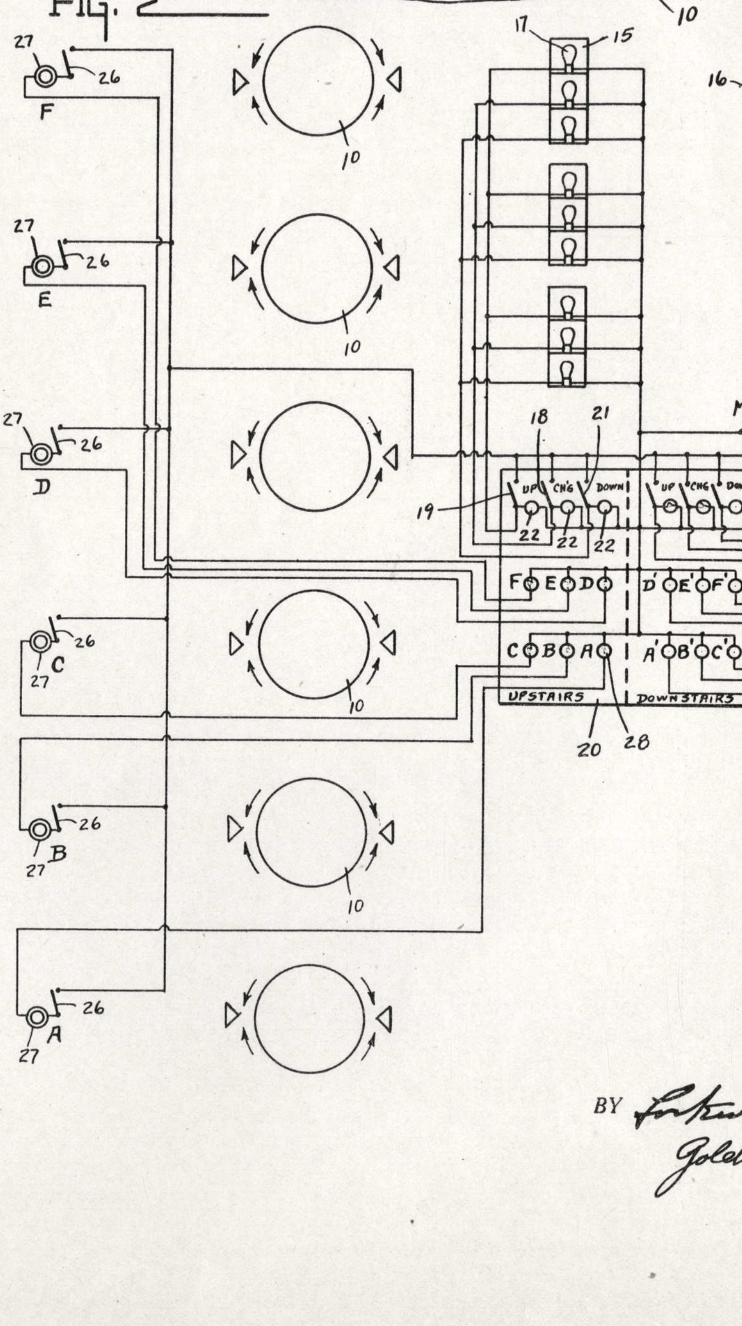
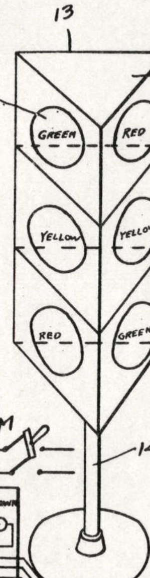


FIG. 3



INVENTOR.
SKILES E. TEST.

BY Lockwood Lockwood
Goldsmith & Galt
ATTORNEYS.

Patented Sept. 15, 1931 1,823,008

UNITED STATES PATENT OFFICE

SKILES E. TEST, OF INDIANAPOLIS, INDIANA

TRAFFIC CONTROL SYSTEM FOR MULTIFLOOR GARAGES

Application filed November 20, 1926. Serial No. 149,633.

This invention relates to a system of traffic control.

The chief object of the invention is to control traffic in a garage or the like where the patrons are constantly bringing cars for storage and are taking their cars from storage, so that the parons' cars may be most expeditiously placed in the garage and taken therefrom and delivered to the patron at the entrance.

The chief feature of the invention in addition to the general arrangement of the storage spaces and car movements, consists in the provision of a traffic control system which permits the main dispatcher to control the entire traffic in the garage and permits intersignaling and inter-communication where necessary from said traffic control station to the several floor stations.

Another feature of the invention consists in the particular arrangement of the traffic controlling signal.

A further feature of the invention consists in the general arrangement and connections associated with the main traffic control panel or board.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

In the drawings Fig. 1 is a perspective view of a portion of the garage showing the single car width traffic driveway or ramp arranged in helical formation and illustrating the sub-station control and signal, intercommunication device and the traffic control signals simultaneously operable from the main or central control station. Fig. 2 is a wiring diagram of the traffic control system circuits. Fig. 3 is a perspective view of one form of traffic signal.

In the drawings 10 indicates a helical driveway or ramp leading from floor to floor and of just sufficient width for a single car to pass either up or down thereon. Said driveway is suitably banked and cars may be driven therefrom to the several floor storage areas which are arranged at approximately half the usual floor elevations, as shown. However, a pair of half floor elevations in the present system have a common floor designation and have a common floor control, and in Fig. 1 the portion of the lower half of floor A is shown with three vehicles parked in certain designated spaces, one of which is numbered A—12. The portion of the lower half of floor B is also shown with cars parked in the spaces B—1 and B—2, as well as B—3 thereon. Vehicle 11 is being driven up the driveway 10 and is followed by vehicle 12.

The system is arranged that at this particular time the traffic signals only permit cars going up to have the right-of-way. At suitable places along the driveway traffic signals 13 are provided and these are suitably supported as by hanging or by being supported on pedestal 14 as herein shown. These driveway signals are positioned so that they are simultaneously visible from opposite directions, that is, the drivers of cars when going up or going down can read the signals indicated thereon. Herein in view of the helical single track arrangement, a triangular outlined signal box is utilized, these being positioned at the outer edge of the ramp.

Each signal includes three superposed compartments 15 and each compartment upon opposite faces includes two visual signal indicators in the form of colored glass or lenses 16 and mounted in each compartment is a lamp 17. Therefore, when lamp 17 is energized in any one compartment, the two visual indicators 16 are simultaneously illuminated. All of the signals above the main station or traffic control station are connected in parallel. Thus, there are three main signaling circuits. For convenience, assume all the signal units to be identical and properly positioned. All of the upper compartment lamps 17 will be simultaneously energized when the main switch controlling the same is closed, said switch being positioned on the main panel board 20 and indicated by the numeral 19. When switch 19 is closed the lamp 17 in the upper compartment 15 of each signal is energized which will indicate in the assumed condition that the green lens 16 is illuminated and shows down the ramp so that it is only visible to a driver approaching from a lower floor and driving up the ramp. Simultaneously at all of the signal units the other and red lens 16 of the same compartment is illuminated and this is only visible to drivers attempting or waiting to come down the ramp so that if any driver attempts to come down the pathway while the signal is set for "up" traffic, he is visually advised at the first signal that traffic direction is against him. Immediately below the upper compartment 15 is another compartment and both lenses 16 therein are preferably colored yellow or orange to indicate caution or change. When lamp 17 in the caution compartment is energized by closing the main switch 18 on the panel board 20, the caution signal is displayed to all drivers throughout the ramp and travelling thereon and will indicate to the drivers that the signal will change. Immediately below the second compartment is a third compartment also containing an individual lamp 17 and having oppositely directed lenses 16 which are simultaneously illuminated when the respective lamp is energized. If the uppermost lower directed lens 16 is green, the lowermost lower directed lens 16 will be red. The upper directed uppermost and lowermost lenses 16 are conversely arranged.

The operator at the main panel board 20 thus is adapted to control traffic by throwing the respective switches 18, 19 or 21, the last mentioned controlling all of the lowermost lamps 17. Thus, if switch 19 is assumed closed, all the traffic will be "up". If it is desired to change the traffic, the switch 18 is closed with switch 19 remaining closed so that the two compartments in each signal unit are both illuminated. After a predetermined period if no other signal indication is received, as will be hereinafter pointed out, switch 19 is opened and the switch 21 is closed permitting reverse travel on the ramp. A lamp 22 is in parallel with each signal circuit and visually indicates which switch is closed.

It may be stated that in public garages of the character indicated traffic has a definite trend at certain periods of the day and night. Thus, patrons will be leaving cars for storage in the early morning hours, will be withdrawing cars from storage around noon, will be returning cars for storage shortly after noon, will be withdrawing cars from storage shortly before evening, will be returning cars for storage early in the evening and withdrawing cars from storage later in the evening. The foregoing are the general traffic trends and during these periods the traffic control system will generally be held without change for considerable periods in the predetermined direction, that is, when cars are being left for storage, traffic control will generally be "up" until a patron desirous to have a car withdrawn from storage, and when patrons are generally withdrawing cars from storage, traffic generally will be down until a patron leaves a car for storage. In each instance the signals are reversed to permit handling of the car to be moved counter to the then prevailing traffic.

At each floor there is provided a telephone 25. A switch in the form of a push button 26 or otherwise, and a light 27 are connected in series and the wires therefrom lead to the main panel board 20 and to a lamp 28 thereon. Thus, when the switch 26 at floor A is closed, light 27 immediately adjacent thereto will be illuminated and light 28 on the panel board and indicated "A" thereon is illuminated. Failure of either lamp will be indicated by the failure of either or both lamps remaining dark. The attendant at floor A, by operating a switch 26, can indicate on the main panel board 28 his desires to the traffic control operator at the main panel board. Thus, for example, a continuous illumination of lamp 28 at the main panel board might indicate that telephone conversation is desired between the attendant and the main traffic control station. Intermittent operation of switch 26 and therefore intermittent operation of lamp 28 at the main board, may indicate a traffic change is desired. Various combinations can be affected. The main operator at central station 20 can flash a reply or indicate that the signal is received by intermittent actuation of main switch 18 which will simultaneously flash intermittently the lamp 17 in the "change" signal compartment of each of the signals. If different grades of traffic or service are employed, that is, "ordinary" and "express," the floor attendant can indicate the same by operating switch 26 to flash the desired signal through lamp 28 to the central station, for example, after the intermittent flashing is obtained and acknowledged through the change signals by the central station attendant, the operator at the floor station can then maintain light 28 illuminated for a considerable period of time until this indication is again acknowledged. The attendant at the central station would thereupon recognize that "express" service was desired in a direction contrary to the general traffic direction heretofore maintained and would immediately close the switch 18 to indicate a change in traffic direction. Since each of the vehicles is equipped with a horn or siren or similar audible warning device, each driver of the vehicle then on the roadway when the "change" signal comes on while he is driving a car to a designated location, energizes the audible signal. The construction of the building is such that this signal is readily heard by the operator at the main station. This audible signal is maintained until the operator of the vehicle arrives at the designated location on the ramp, whereupon it is discontinued. The operator at the central station then knows that the traffic can be safely changed, that is, reversed, whereupon the other main control switch 19 or 21, respectively, will be closed and the other switch 21 or 19 respectively, will be opened, after which switch 18 is opened.

As shown in Fig. 1, a door 30 leads from the floor A and this may be to a stairway, escalator or endless conveyor. This facilitates attendant travel, that is, drivers of vehicles going up after parking their cars or delivering their cars to a floor attendant, will return to the main station by the stairway, or by stepping on the endless conveyor or escalator be conveyed thereto. Likewise, when the traffic is in the reverse direction and patrons are removing cars from the garage, the driving attendants can arrive at the cars at the proper floor by using the stairway, escalator or conveyor. All traffic other than vehicular is thereby eliminated from ramp 10. Of course, in such instances as where a car is being delivered for storage and one is desired to be withdrawn and the cars utilize either the same space or adjacent spaces, the same attendant may deliver the second car and return the first car. Also by having the floors designated and the storage spaces individually designated, the entire capacity of the garage can be utilized with maximum efficiency. It will be apparent also that by employing suitable checks and a tally system the exact location of every car in the garage can be readily designated.

Generally the central control station 20 will be at the entrance or the floor corresponding to the entrance so that the traffic control operator at the panel board 20 can control traffic.

If servicing is performed, such as washing, cleaning, polishing, oiling, greasing, refinishing and repairing and inasmuch as this traffic generally is not of the storage character, that is "in and out", but is of special character, a duplicate panel board is provided for these floors and the duplicate panel board and signaling system for each of these floors is of substantially the same arrangement as that previously described for the main storage floors. It may be desirable where ground area is not available to store cars in the lower floors, that is, the basement and various sub-basements. In this event since traffic is independent above and below the entrance level, although utilizing the same entrance, the duplicate control system described will serve for these lower floors.

The main feature of the invention consists in the simultaneous control of traffic upon a single width ramp by the provision of a plurality of traffic signals simultaneously energized to indicate traffic in one direction and bar traffic in a reverse direction and supplemental thereto, the provision of a signal system between each floor station and the central station for inter-communication or indicating a desire to have the traffic reversed.

While the equilateral triangular signal 13 is shown employed with the circular ramp 10 so that two faces are simultaneously visible for reverse travel, a rectangular or square signal would probably be more satisfactory where a straight ramp is utilized or required so that opposite or adjacent faces may be simultaneously visible for signaling.

The invention claimed is:

1. In combination, a garage having at least three floors for automobile storage and including ramp means leading from floor to floor and of substantially a single car width and upon which automobiles are driven to and from storage places on the floors, traffic directing means visible substantially from any point on the ramp means and the floor portions immediately adjacent thereto for directing traffic to proceed up the ramp and restrain down traffic and vice versa, and a central station control for manually controlling the traffic directing means.

2. In combination, a garage having at least three floors for automobile storage and including ramp means leading from floor to floor and of substantially a single car width and upon which automobiles are driven to and from storage places on the floors, traffic directing means visible substantially from any point on the ramp means and the floor portions immediately adjacent thereto for directing traffic to proceed up the ramp and restrain down traffic and vice versa, a central station control for manually controlling the traffic directing means, and manually operable means for calling the central station from each floor for indicating at the central station the desire at the floor to reverse the direction of traffic.

In witness whereof, I have hereunto affixed my signature.

SKILES E. TEST.

Oct. 20, 1931. W. H. HUBBARD 1,828,114

MATING SPUR GEAR

Original Filed May 29, 1926

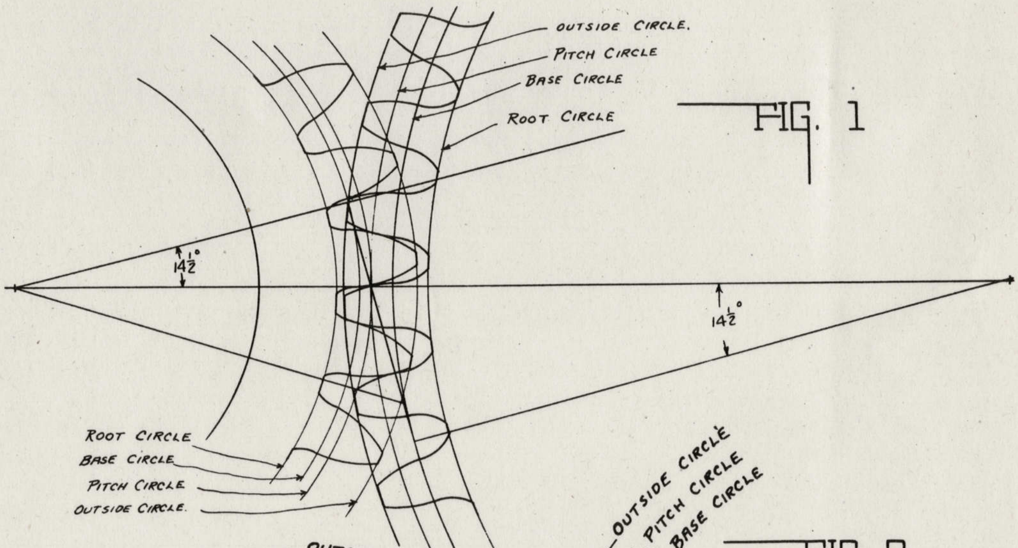


FIG. 1

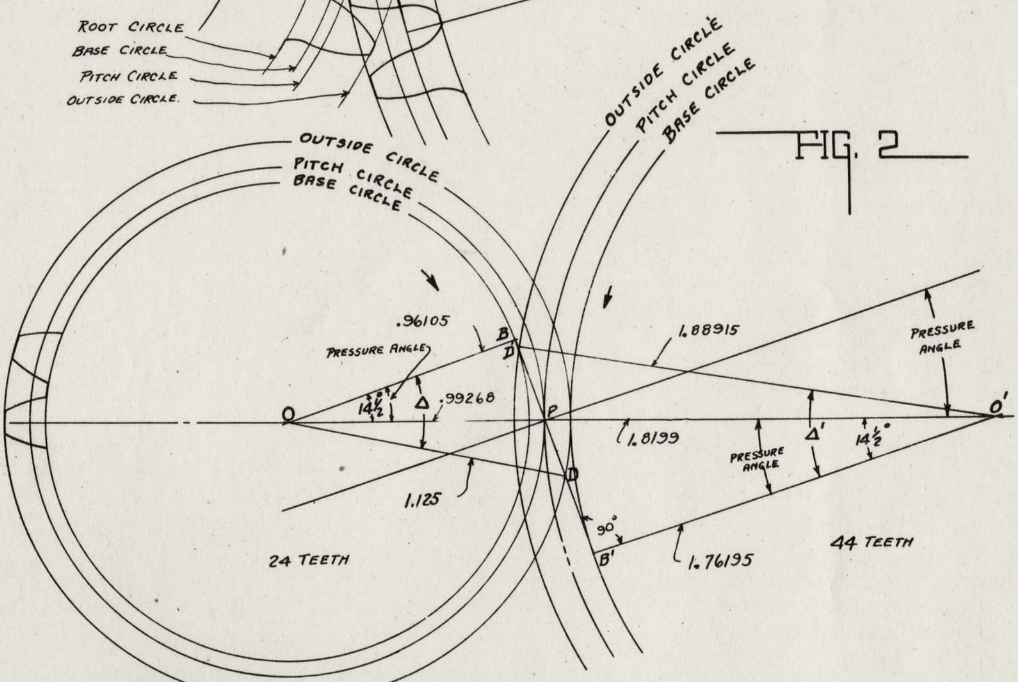


FIG. 2

INVENTOR.
WILLIAM H. HUBBARD.

BY Lockwood & Lockwood

ATTORNEYS.

UNITED STATES PATENT OFFICE

WILLIAM H. HUBBARD, OF MUNCIE, INDIANA

MATING SPUR GEAR

Application filed May 29, 1926, Serial No. 112,522. Renewed March 7, 1931.

This invention relates to mating involute spur gears.

The chief object of this invention is to provide a pair of mating involute spur gears each with a suitable number of teeth and have the same so formed that at all times there will be at least two teeth of either mating gear meshing with at least two teeth on the other gear, or conversely at no time will one tooth bear the entire load.

The chief feature of the invention consists in the selection of special values for certain variables in mating involute spur gear functions, whereby there will always be at least two pairs of teeth in contact, thereby either increasing the factor of safety over a set of substantially similar standard gears or increasing the power transmission capacity with the same factor of safety, or the reduction in size of the gear set for the same power transmission capacity and factor of safety.

The most important variables which are affected and permit two or more teeth of one gear to constantly mesh or engage the teeth upon the mating gear are: the number of teeth, diametral pitch, pressure angle, the addendum, the center distance, and the circular thickness of the teeth.

The selection of these values is dependant upon the conditions under which the gears are to run, such as, the torque to be transmitted, the speed at which the set is run, the ratio between the gears, center distance, number of teeth, and the factor of safety required.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

Fig. 1 is an enlarged diagrammatic view of a specific example of the invention showing the mating portions of involute spur gears. Fig. 2 is a similar view on a somewhat smaller scale of the general gear diagram for multiple mating involute spur gears.

In Fig. 1 of the drawings there is illustrated a specific example of the invention. The following table contains the data for this solution of the problem:

2.1826 center distance	Driver	Driven
Number of teeth	24	44
Diametral pitch	12.0884	12.0884
Outside diameter	2.2500	3.7783
Pitch diameter	1.98536	3.6398
Base circular diameter	1.9221	3.5239
Root diameter	1.797	3.3253
Pressure angle in degrees	14½	14½
Circular pitch	.25988	.25988
Base circular pitch	.25160	.25160
Addendum	.1323	.0692
Dedendum	.0942	.1573
Working pitch	.2015	.2015
Full depth	.2265	.2265
Chordal thickness	.1448	.1140
Corrected addendum	.1396	.0701
Length active profile	.2266	.1318
Teeth in contact	2.234	2.234
Tang. pressure	1045	1045
Width of land	.033	.073

For a better understanding of the general solution, the following definitions or mathematical descriptions are given:

The diametral pitch equals:

$$\frac{\text{No. of teeth}}{\text{diam. of pitch-circle in in.}} = \frac{3.1416}{\text{circular pitch}}$$

Pitch diameter equals:

$$\frac{\text{No. of teeth}}{\text{diametral pitch}}$$

Pressure angle or angle of obliquity is the angle which a common tangent to the teeth, when they are in contact at the pitch point, makes with a line joining the centers of the gears.

Line of action is a line drawn through the pitch point and tangent to the base circles of the mating gears. The normal to these base circle tangential points forms, with the line connecting the centers of the gears, the pressure angle as well. Thus the pressure angle determines the size of the base circle.

The active profile of an involute spur gear has its inception at the base circle and is terminated at the outside circle.

Circular pitch equals:

$$\frac{3.1416}{\text{diametral pitch}}$$

Center distance is the perpendicular distance between the centers of the two mating gears.

The addendum is the difference between the outside circle radius and the pitch circle radius.

Circular thickness is the length of an arc of the pitch circle from one side of the tooth to the other side of the same tooth. Solving Fig. 1 we have:

$$\text{Circular pitch} = \frac{3.1416}{12.0884} = .25988$$

Base circular pitch =
$.25988 \times .96815$ (cosine of $14\frac{1}{2}°$) $= .25160$

$$\frac{.96105}{1.125} = \cos\triangle = .85426;\ 31°\ 19' = \triangle$$

$$.96105 \times .25862 = .24854 = BP$$
$$1.125 \times .51977 = .5847 = BD$$
$$PD = BD - BP = .5847 - .2485 = .3362$$

$$\frac{1.76195}{1.88915} = \cos\triangle' = .93266;\ 21°\ 9' = \triangle'$$

$$1.76195 \times .25862 = .4556 = B'P$$
$$1.88915 \times .36081 = .6818 = B'D'$$
$$PD' = B'D' - B'P = .6816 - .4556 = .2260$$

PD plus PD′ = DD′ active part of line of action

$.3362$ plus $.2260 = .5622$

$\frac{.5622}{.25160} = 2.234$ number of teeth in contact.

$51977 = \text{sine } 31°\ 19'$ $\quad .36081 = \text{sine } 21°\ 9'$
$.25862 = \text{tangent } 14\frac{1}{2}°$ $\quad$ Diametral pitch $= 12.0884$
Pressure angle $= 14\frac{1}{2}°$

The following shows limits of variables used in solution of problem.

Diametral pitch = DP limits 1/8 to 100
Pressure angle B has limits
(0° plus) to (90° minus)

$$\text{Circular pitch} = CP = \frac{3.1416}{DP}$$

Number of teeth =
N has limits two to infinity minus one.

$$\text{Pitch diameter} = PD = \frac{N}{DP}$$

Addendum = A has limits $\left[\frac{(1}{DP}\right.$ plus or minus a limits $\left(0 \text{ to } \frac{1}{DP}\right)$ to $\left.\frac{3.1416}{DP}\right]$

$$\text{Outside diameter} = OD = \frac{N}{DP} \text{ plus } 2A$$

Base circle diameter = BD =
PD × cos pressure angle (B)

Formula for solution of problem: All references to the above carries with it the limits as stated.

	Driver	Driven
Pressure angle	B	B
Circular pitch	$\frac{3.1416}{DP}$	$\frac{3.1416}{DP'}$
Base circular pitch is the circular pitch × the cos of the pressure angle		
Outside circle radius	OD	O′D′
Pitch circle radius	OP	O′P
Base circle radius	OB	O′B′
Active part of line of action	DD′	DD′
Line of action	BB′	BB′

Formula for solution of problem:

Driver	Driven
$\frac{OB}{OD} = \cos\triangle$	$\frac{O'B'}{O'D'} = \cos\triangle'$
$OD \times \text{sine}\triangle = BD$	$O'D' \times \text{sine}\triangle' = B'D'$
$OB \times \text{tangent } B = BP$	$O'B' \times \text{tangent } B = B'P$
$PD = BD - BP$	$PD' = B'D' - B'P$

PD plus PD′ = active line of action

$$\frac{\text{PD plus PD}'}{\text{base circular pitch}} = \frac{\text{number of teeth in con-}}{\text{tact two or more}}$$

For example B′P is the limit of D′P and BP is the limit of DP or when a case arises where D′P is greater than B′P or where DP is greater than BP the value of B′P and BP must be used respectively.

The sum of the circular thickness of one tooth each of both gears must equal the circular pitch less the backlash but not necessarily be equal to each other.

Statement of absurdities

The limits used in the diametral pitch, pressure angle, number of teeth, addendum and circular thickness in some cases when combined would be absurd. The reason for such limits is to include all practical arrangements and applications, and endeavor to express multiple tooth contact as a mathematical function.

The invention claimed is:

1. A pair of mating involute spur gears, the pinion gear having less than thirty teeth, each of said gears at all times having at least two teeth in contact with the teeth of the other gear and operating on fixed centers, said gears having a line of action greater than two and inequally divided by the pitch point with the greater length of active profile included in the pinion.

2. A pair of mating involute spur gears having multiple tooth contact between each

gear at all times, the pinion gear having less than thirty teeth and the gears having the following formula:

Driver	Driven
$\frac{OB}{OD} = \cos\triangle$	$\frac{O'B'}{O'D'} = \cos\triangle'$

$OD \times \text{sine}\triangle = BD$	$O'D' \times \text{sine}\triangle' = B'D'$
$OB \times \text{tangent}\, B = BP$	$O'B' \times \text{tangent}\, B = B'P'$
$PD = BD - BP$	$PD' = B'D' - B'P$

PD plus PD′ active line of action

$$\frac{\text{PD plus PD}'}{\text{base circular pitch}} = \text{number of teeth in continuous contact} = \text{at least two teeth, but is never integral.}$$

3. A pair of mating involute spur gears as defined by claim 2, wherein the gears operate on a fixed center distance and the smaller gear has an addendum, length of active profile, and circular thickness greater than the larger gear for insuring multiple tooth contact.

In witness whereof I have hereunto affixed my signature.

WILLIAM H. HUBBARD.

May 10, 1927. 1,627,656

G. E. LUCE

HACKING MACHINE

Filed Feb. 23, 1926 9 Sheets-Sheet 9

FIG. 18

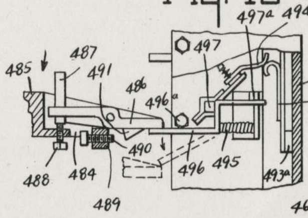


FIG. 17

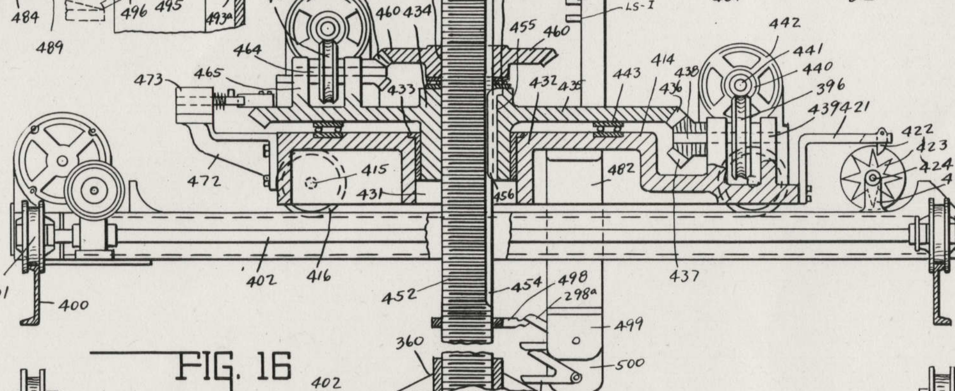


FIG. 19

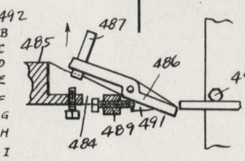


FIG. 16

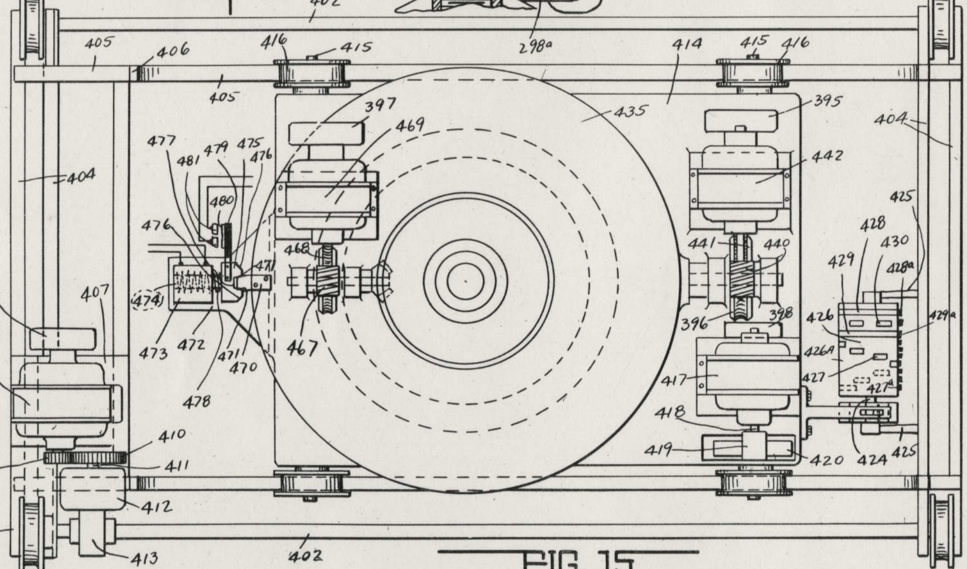


FIG. 15

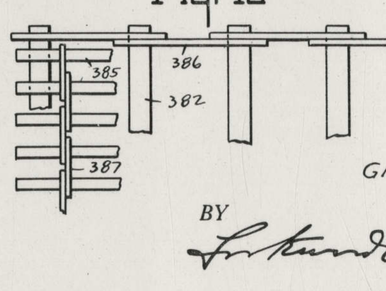
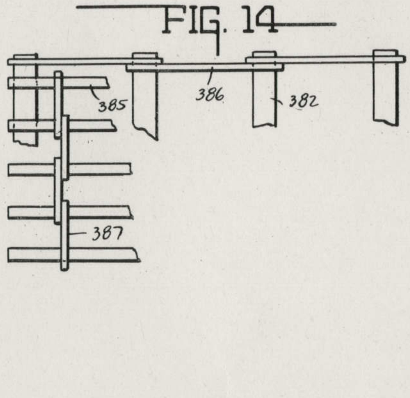


FIG. 14



INVENTOR.
GRAFTON E. LUCE.

BY

Lockwood & Lockwood

ATTORNEYS.

FIG. 13

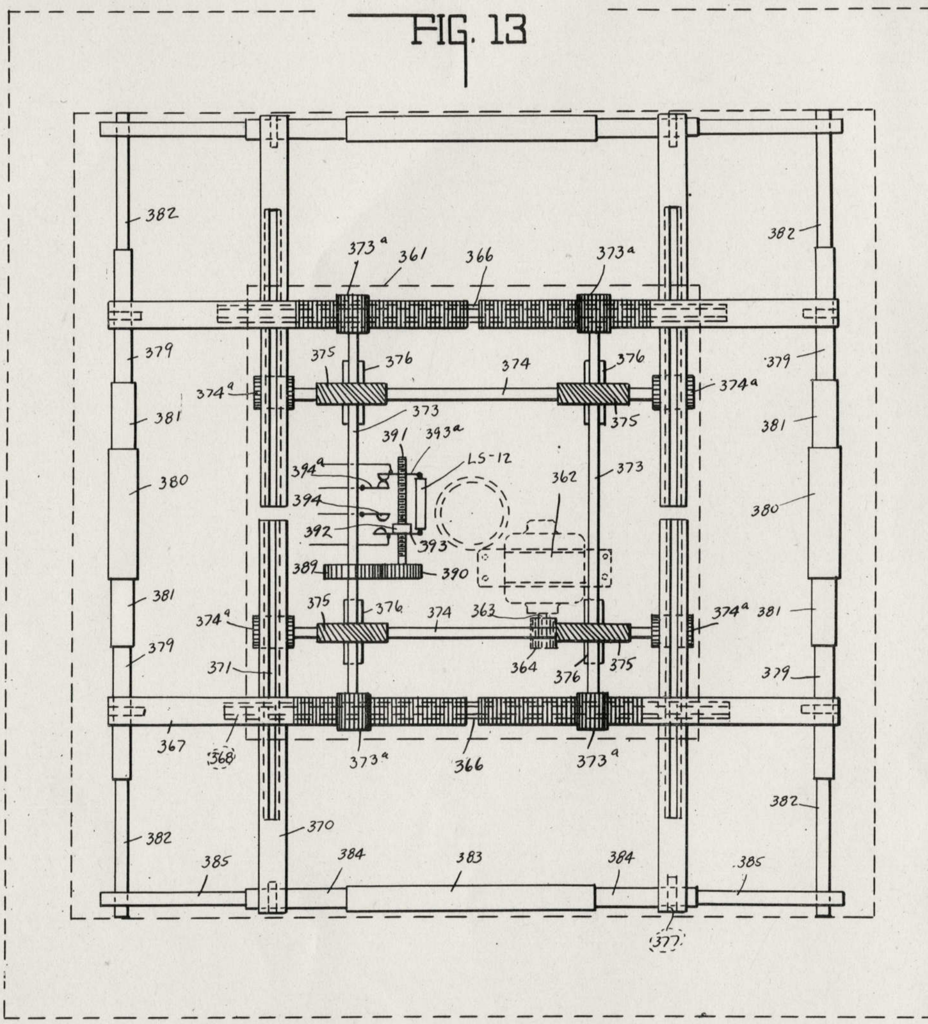
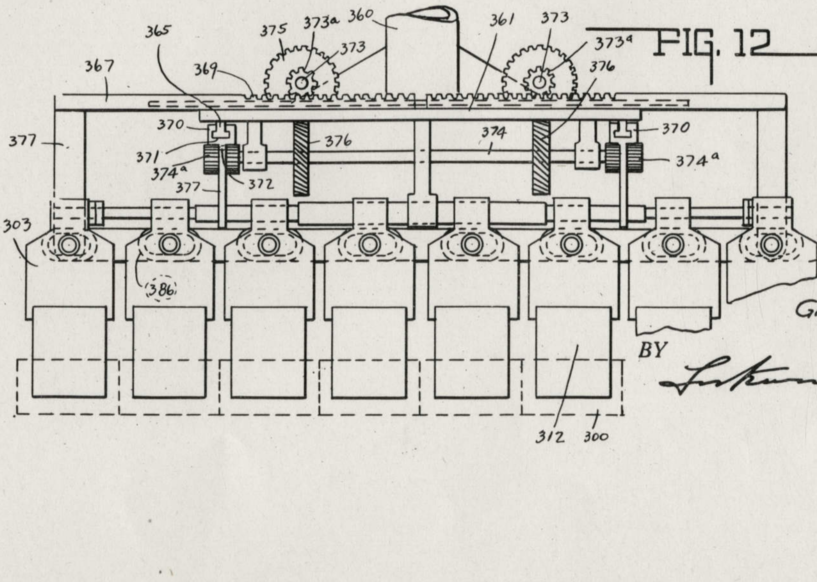


FIG. 12



INVENTOR.
GRAFTON E. LUCE.

BY

ATTORNEYS.

May 10, 1927. 1,627,656

G. E. LUCE

HACKING MACHINE

Filed Feb. 23, 1926 9 Sheets-Sheet 7

FIG. 10

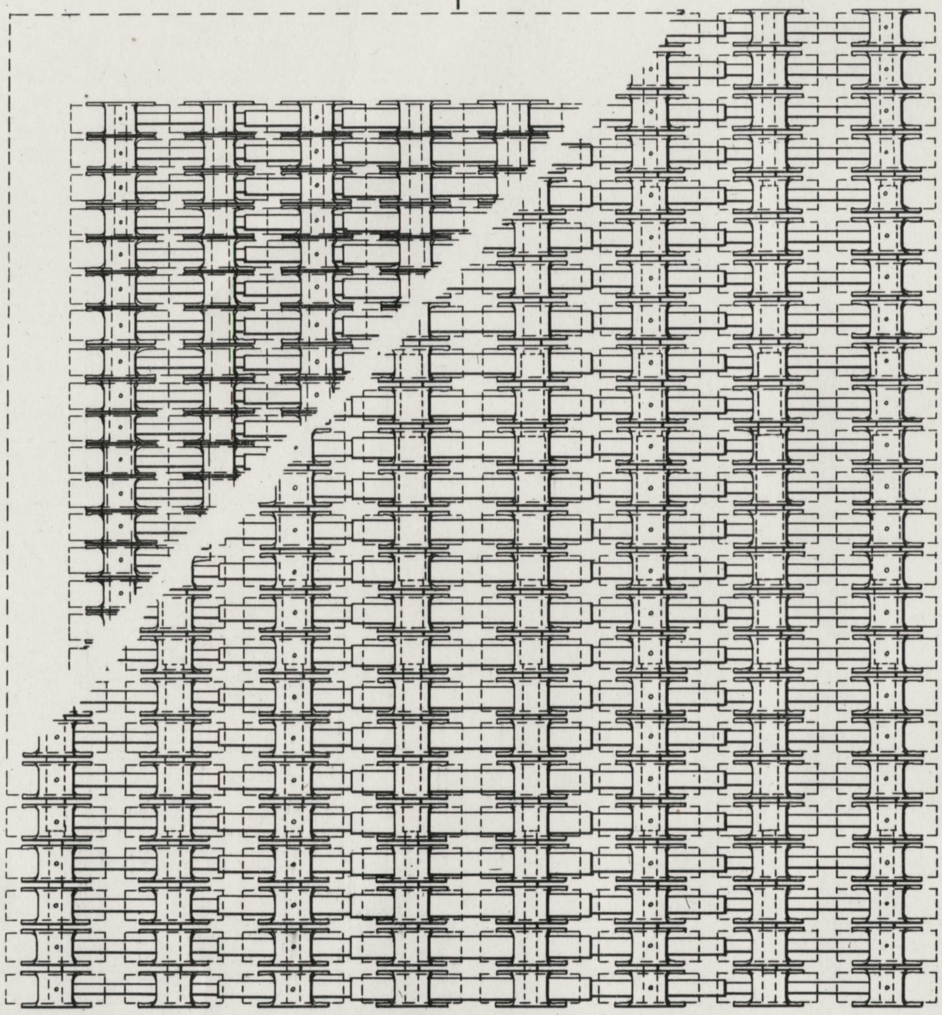
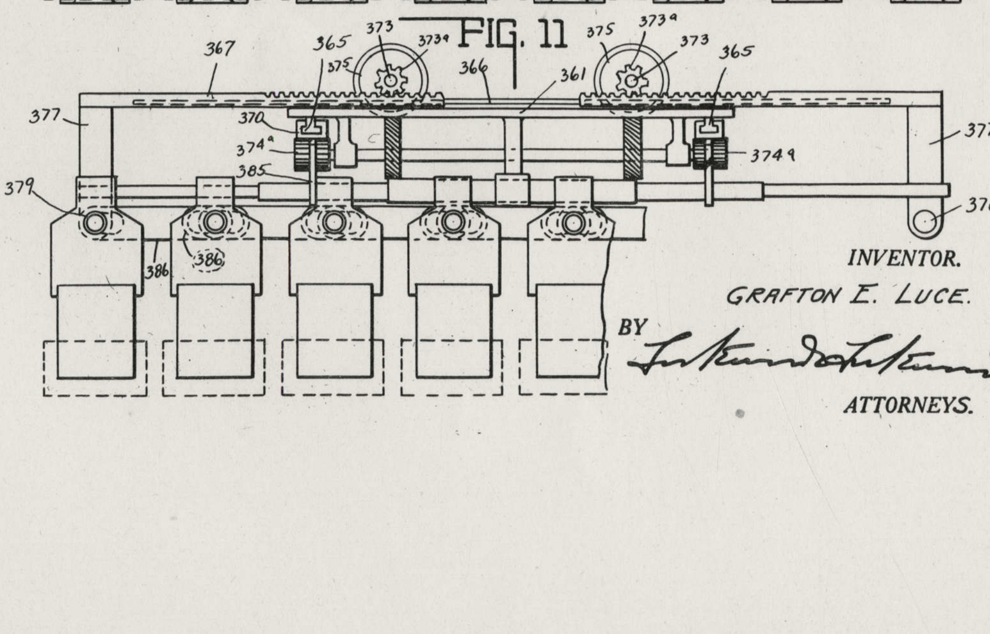


FIG. 11



INVENTOR.
GRAFTON E. LUCE.
BY
[signature]
ATTORNEYS.

May 10, 1927. 1,627,656

G. E. LUCE

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Filed Feb. 23, 1926 9 Sheets-Sheet 6

FIG. 6

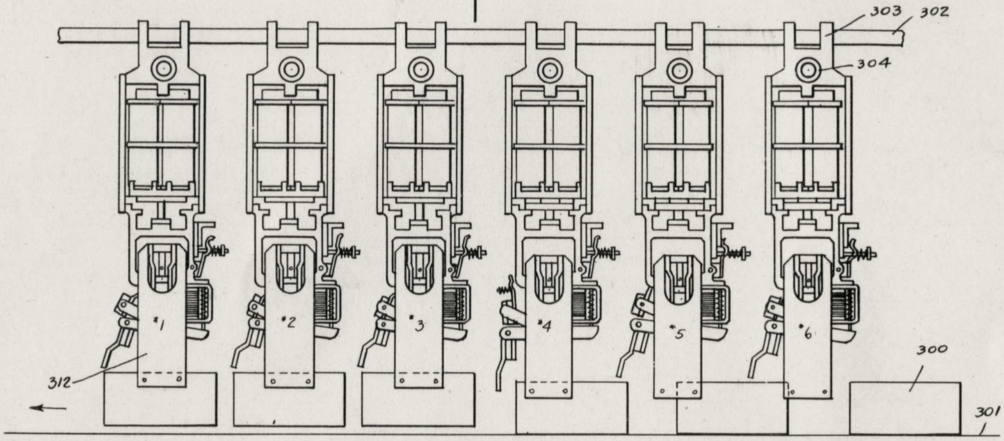


FIG. 7

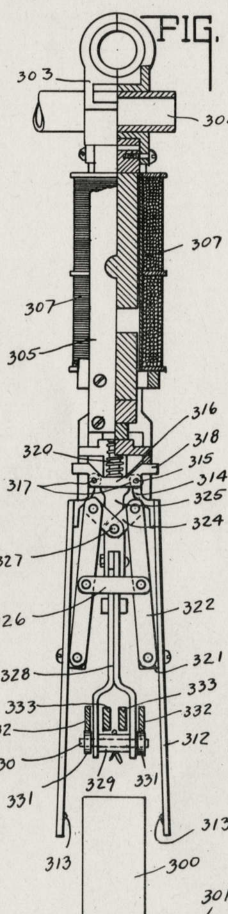


FIG. 8

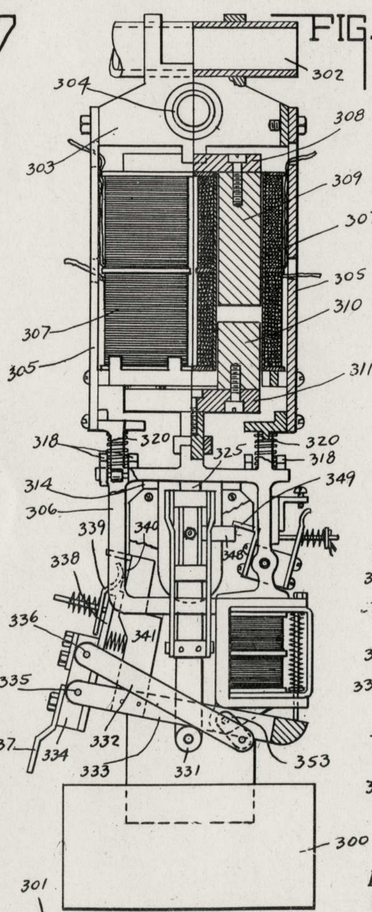
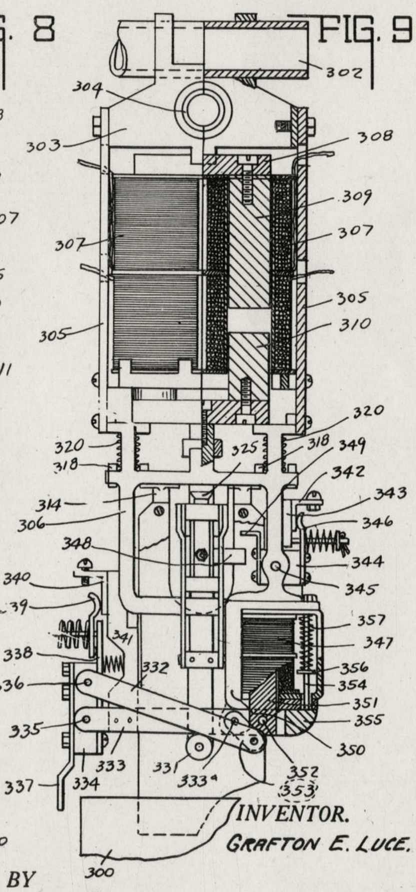


FIG. 9



INVENTOR.

GRAFTON E. LUCE.

BY

[signature]

ATTORNEYS.

May 10, 1927. 1,627,656

G. E. LUCE

HACKING MACHINE

Filed Feb. 23, 1926 9 Sheets-Sheet 5

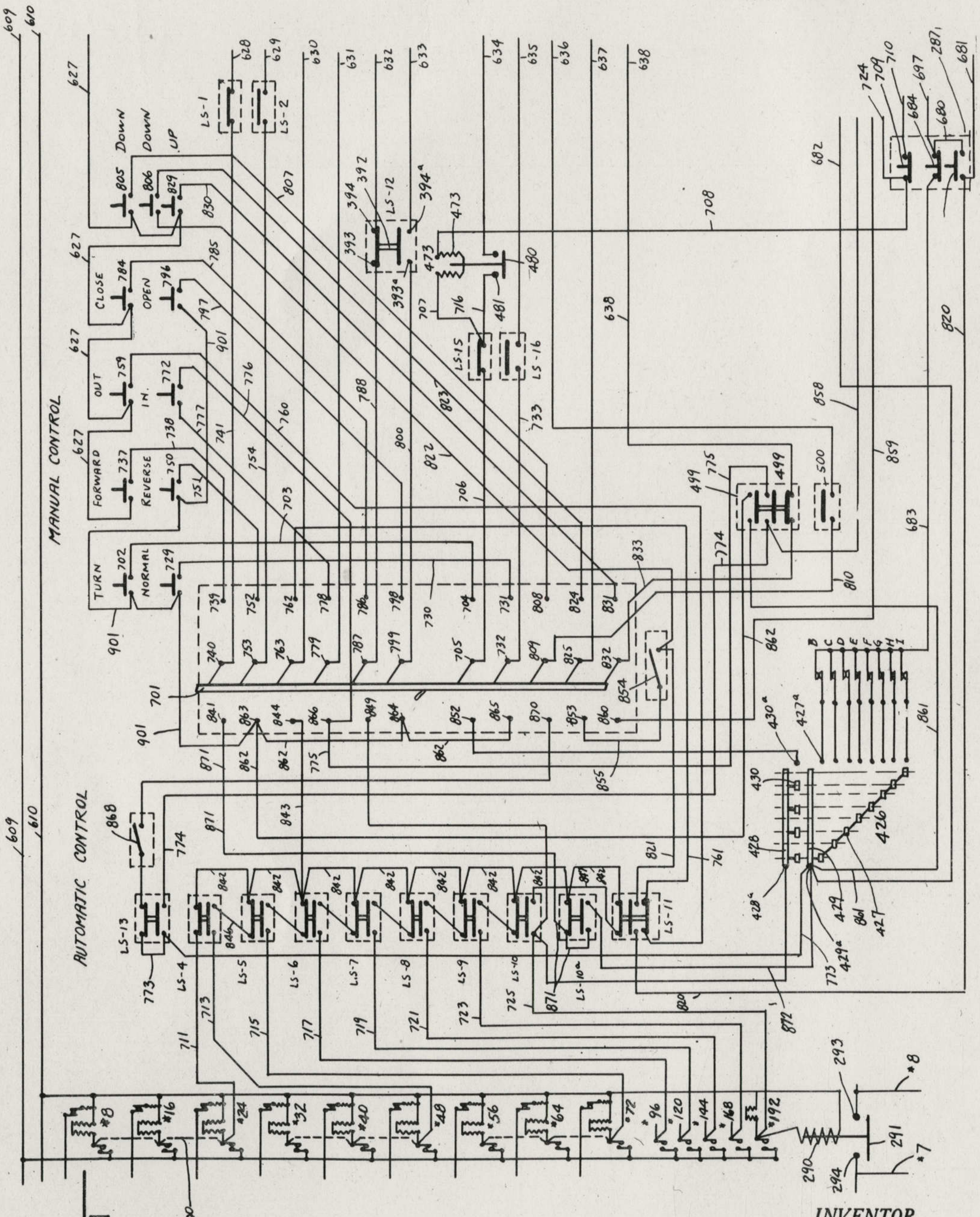


FIG. 5

INVENTOR.
GRAFTON E. LUCE.

By [signature]

ATTORNEYS.

May 10, 1927. 1,627,656

G. E. LUCE

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Filed Feb. 23. 1926 9 Sheets-Sheet 4

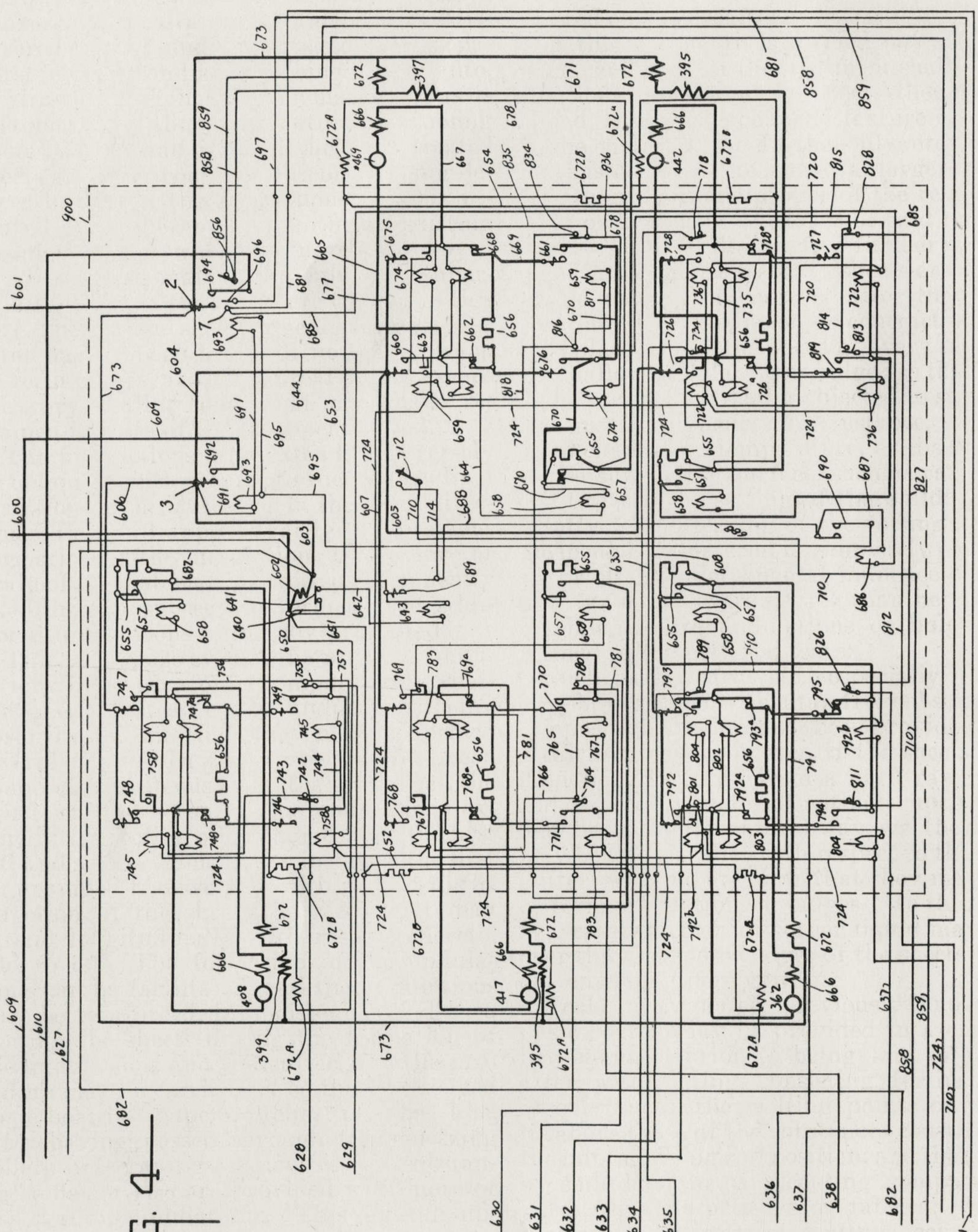


FIG. 4

INVENTOR.
GRAFTON E. LUCE.

BY [signature]

ATTORNEYS.

May 10, 1927. 1,627,656

G. E. LUCE

HACKING MACHINE

Filed Feb. 23, 1926 9 Sheets-Sheet 3

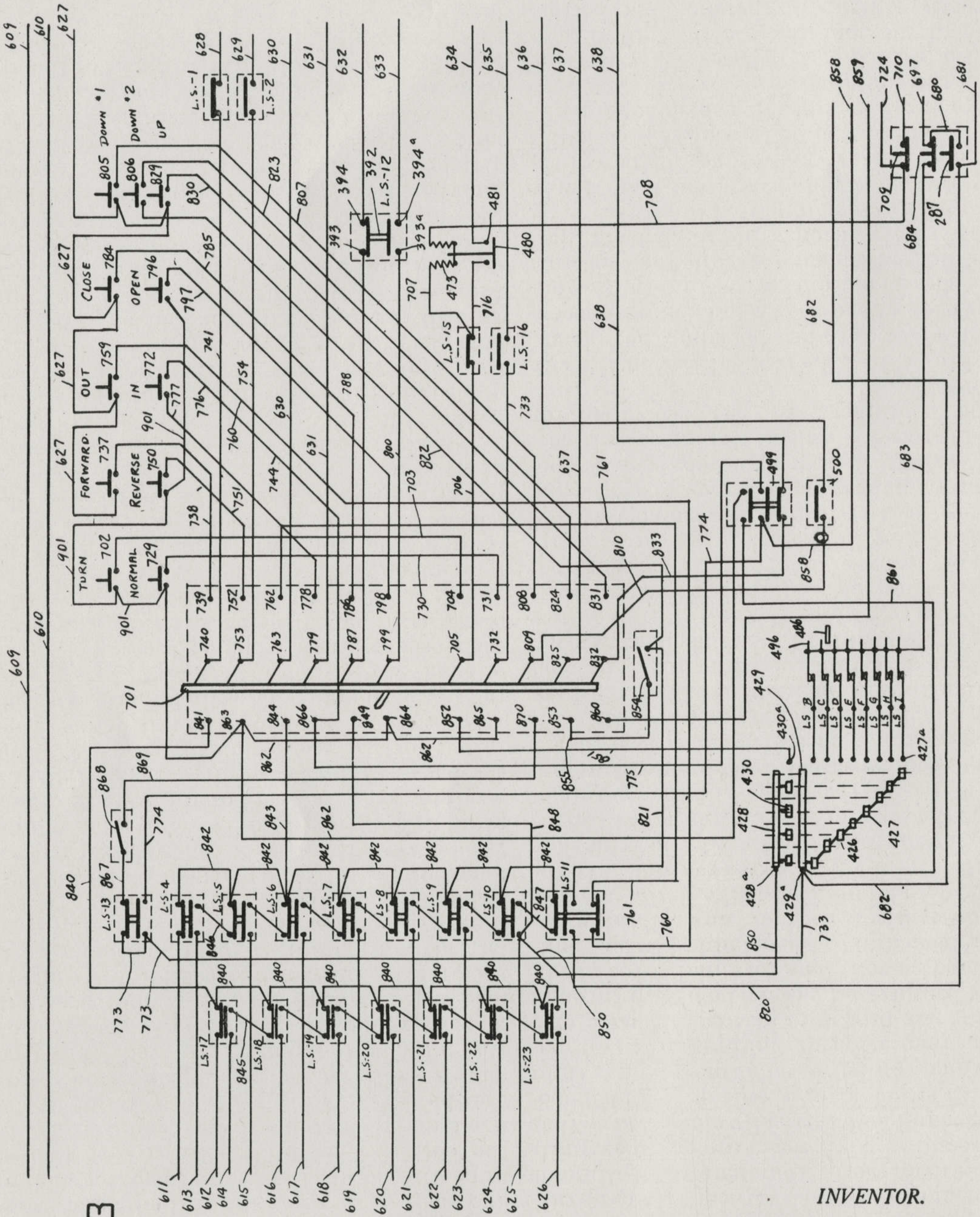


FIG. 3

INVENTOR.

GRAFTON E. LUCE.

BY

Lockwood & Lockwood

ATTORNEYS.

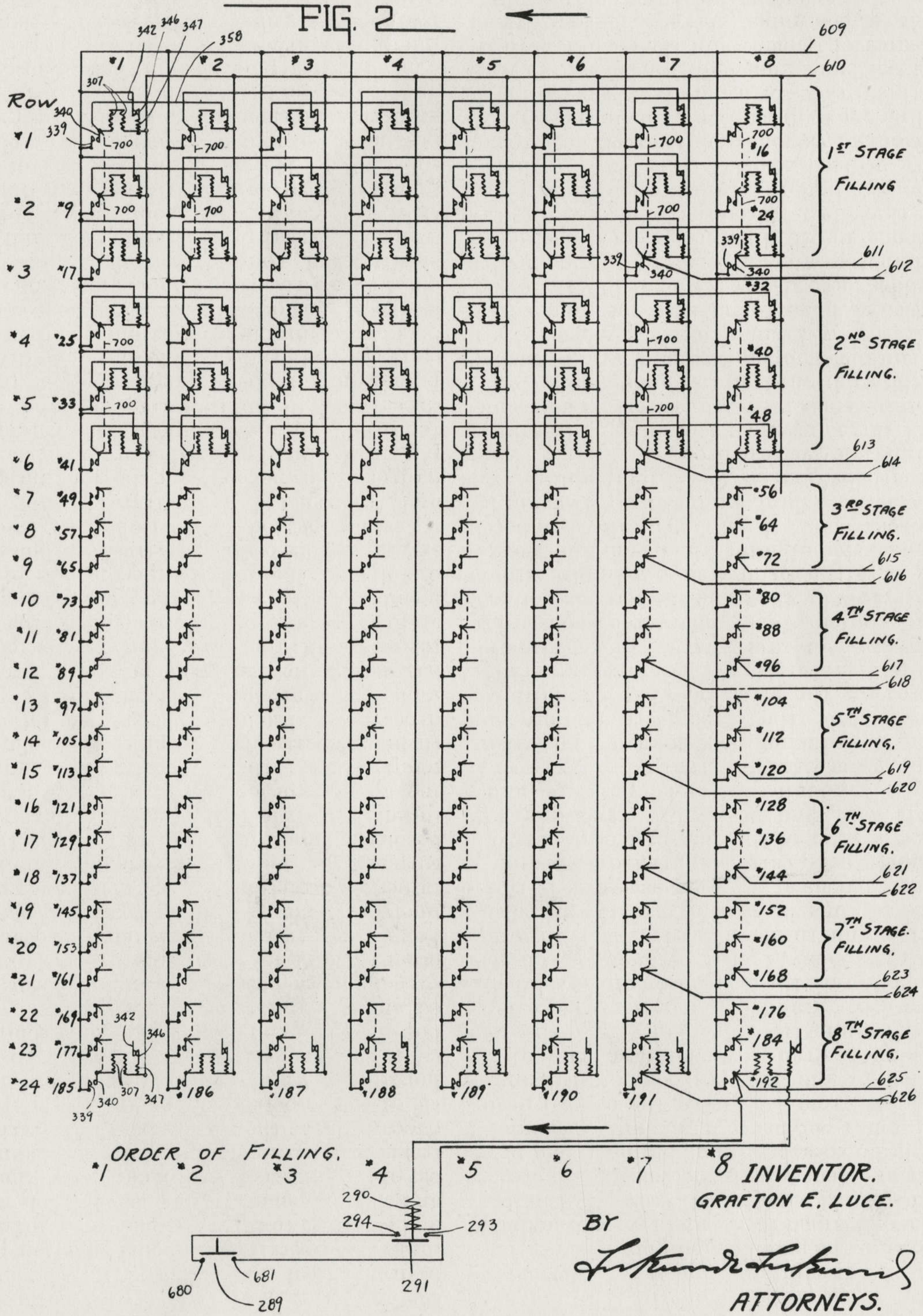
May 10, 1927. 1,627,656

G. E. LUCE

HACKING MACHINE

Filed Feb. 23, 1926 9 Sheets-Sheet 2

FIG. 2



INVENTOR.
GRAFTON E. LUCE.

BY

ATTORNEYS.

May 10, 1927. **1,627,656**

G. E. LUCE

HACKING MACHINE

Filed Feb. 23, 1926 9 Sheets-Sheet 1

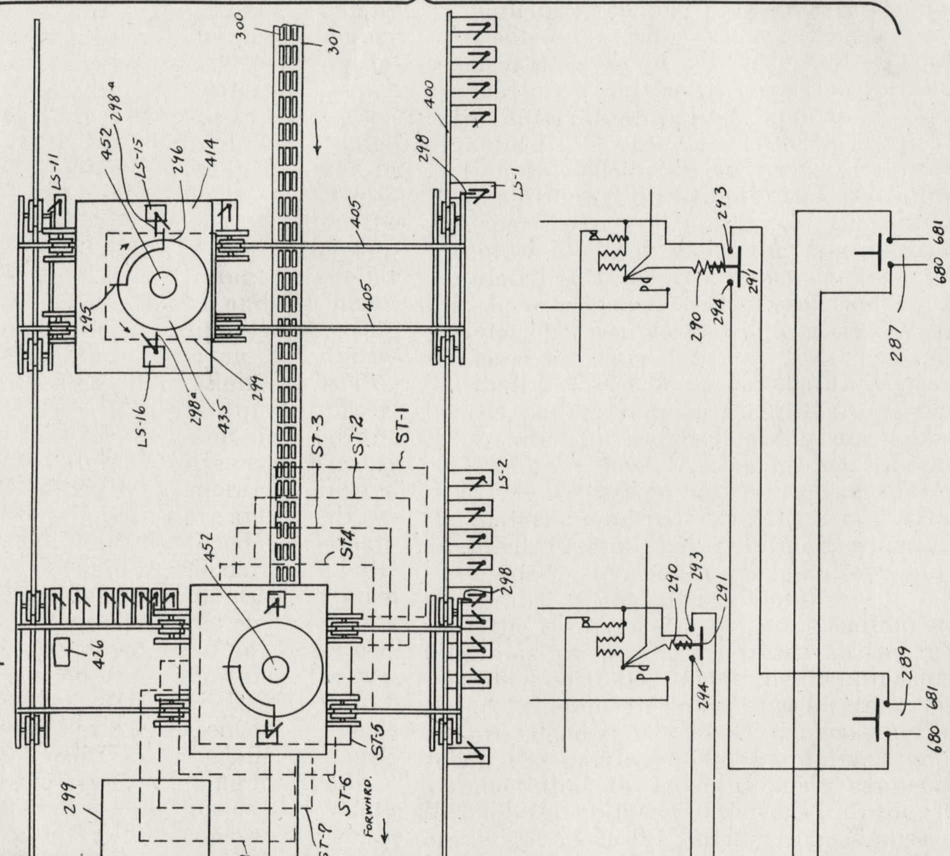


FIG. 1

INVENTOR.
GRAFTON E. LUCE.

BY [signature]

ATTORNEYS.

Patented May 10, 1927. **1,627,656**

UNITED STATES PATENT OFFICE.

GRAFTON E. LUCE, OF CHICAGO, ILLINOIS.

HACKING MACHINE.

Application filed February 23, 1926. Serial No. 90,172.

This invention relates to an improved method of handling articles such as brick and the like, which is generically known as hacking, and the machinery for handling them as indicated.

The term "cross-hacking" in the brick and similar arts and herein, includes the idea of arranging layers of brick with the brick of one layer having a predetermined angular relation to the brick of another layer. The term "segregation" includes the idea of arranging the brick of a layer in predetermined relation with respect to each other.

The chief object of the invention is to mechanically handle brick in the one remaining step in the process of manufacturing of the brick where heretofore and at the present time, manual handling and not mechanical handling is used. With the present invention, used in conjunction with other machines at present in use, brick can be mechanically handled from the beginning of the brick formation to the loading of the completed brick in the shipping container, with none of the disadvantages and very little of the cost of manual handling.

The chief feature of the invention consists in the provision of a machine which is herein called a hacking machine for mechanically handling brick from that stage of the process in their manufacture where they are formed to that stage of the process where they are received by a receiver commonly called a dryer car, or in that stage in a certain brick process, known as the soft mud process where the brick are produced upon pallets received by the dryer and are at present manually handled between the dryer and the kiln.

Briefly, one sequence of operation of the unitary hacking machine is as follows: Brick are supplied usually by a constantly moving belt and the belt supports said brick in stream formation, the brick in each stream being separated or spaced from each other, generally, with regular spacing but not necessarily so. The belt may simultaneously support one or more streams of brick which may or may not be arranged in complete transverse rows. The dryer car is a car adapted to receive a plurality of layers of brick positioned thereon in predetermined relation, and generally the brick in each layer have a predetermined positioning with respect to each other and the brick in each layer have a predetermined positioning with respect to the brick of adjacent layers. Commonly, such last mentioned predetermined relation consists of positioning the brick in alternate courses or layers transversely of each other. The hacking machine is adapted to automatically take enough brick from the belt to complete or substantially complete, the entire layer or a predetermined portion of the layer of brick in the dryer car. The brick, however presented to the machine, are automatically positioned in predetermined relation to each other by the machine before deposition. This action is called segregation. After segregation the brick are automatically deposited on the dryer car in the desired relation with respect to other brick thereon. Following the automatic deposition of the brick in the dryer car the machine automatically returns to its initial position adjacent the belt for another load of brick. The parts of the machine are so arranged that the device is substantially automatic in its operation, that is, in the sequence of steps through which the brick are passed. The machine is so constructed that the omission of one or a few brick from the machine in any layer of brick does not interfere with the brick upon the belt to be immediately handled by the machine, nor does it interfere with any of the automatic operations. It is to be understood that any of the motions described as automatically controlled, either initiated or stopped, or both, may be manually initiated, stopped or controlled as desired without in any way departing from the broad disclosure of the invention.

With relatively slow belt speeds one hacking machine can handle all of the brick on the belt. With high belt speed, the time element is such that it is preferable to employ a plurality of hacking machines successively positioned along the belt. While one hacking machine is filling the other may be segregating, depositing and returning. When more than two machines are employed one may be segregating, another depositing and another returning, while a fourth is filling. Various combinations determinable by the particular plant equipment and operation will determine the number of hacking machines utilized with each belt. The plant requirements will also determine what particular type of hacking will be performed by the machine.

The construction and control are such that when the machine is placed in the proper position for filling with brick, the brick pass through the machine without being engaged until a master control is operated. By actuation of the master control, either manually or automatically, certain parts of the machine are placed in position for brick engagement. Upon brick engagement filling of the machine is automatically initiated and each step of the filling is thenceforward automatically initiated by brick engagement with some part of the machine. The filling or substantially complete filling of the machine with brick automatically initiates the remaining series of operations as before indicated until the machine is again automatically repositioned in the initial position, whereupon the master control is again actuated. The master control may be actuated either manually or automatically. The automatic operation of the master control is employed where two or more hacking machines are used with the same belt, the hacking machines being interconnected so that the filling of one machine to a predetermined point will automatically initiate the filling of another machine.

In the following the terminology "brick", includes a brick or a brick unit, the latter comprising a plurality of contacting brick arranged in unit formation for simultaneous handling, which unit formation usually is maintained until after firing. By the terminology "individually" picking up "brick", is meant the individual picking up of a brick or brick unit as defined above.

Brick in the following specification and claims is not only intended to include a brick or brick unit, but to include similar articles particularly plastic articles such as terra cotta tiles and other tiles.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

In the drawings Fig. 1 is a diagrammatic plan view of an off-bearing belt, a plurality of dryer cars and a plurality of hacking machines, the machines being inter-connected for automatic control. Fig. 2 is a wiring diagram of 192 brick grasping and lifting devices arranged in tandem and transverse row formation of 24 rows of 8 each with their inter-controls for automatic operation and for the automatic initiation of other subsequent operations. Fig. 3 is a diagram of wiring connections and is a continuation of Fig. 2 and of the inter-control between the several parts of the machine whereby the automatic and predetermined sequence of operations is obtained. Fig. 4 is a continuation of the wiring diagram shown in Figs. 2 and 3 and is of the motor automatic controls and of the initiation control for the entire machine. Fig. 5 is a wiring diagram corresponding to Fig. 3 and of a modified form of control whereby a slightly different sequence of operation is secured. Fig. 6 is a side elevational view of a plurality of brick lifting and grasping devices, tandem arranged, with some of the parts in the brick elevated position, another preparatory to elevating and still others in the inoperative position. Fig. 7 is an end elevational view with parts in central section of one form of brick grasping and lifting devices. Fig. 8 is an enlarged side elevational view with parts in central section of a brick grasping and lifting device with parts in the brick elevated position. Fig. 9 is a similar device in position immediately preceding grasping, the parts being arranged for automatic operation. Fig. 10 is a top plan view of the segregator, the major portion of the figure showing the parts in the extended position and one corner of the figure showing the parts in the contracted position. Fig. 11 is a side elevational view of a plurality of brick lifting devices associated with the segregator, and shows the same in the extended position. Fig. 12 is a similar view of the same parts in the contracted position. Fig. 13 is a top plan view of the actuating and supporting mechanism of the segregator, the former being shown in the contracted relation, the outer dotted line of said figure indicating the extended position of the segregator, while the inner dotted line indicates the contracted position corresponding to the position of the parts shown in full line. Fig. 14 is a top plan view of a portion of the segregator device showing the same in the extended position corresponding to that shown in Fig. 11. Fig. 15 is a similar view of the same parts in the contracted or segregated position, and corresponding to that illustrated in Fig. 12. Fig. 16 is a top plan view of the trolley, and level selecting control crane. Fig. 17 is a side elevational view of the same, parts being shown in section to show other parts in detail. Fig. 18 is a central sectional view of one of the level selecting switches and the contactor associated therewith in one position, the dotted lines indicating a second position obtainable in lowering movement. Fig. 19 is a similar view of the same parts showing the same in another position while being elevated.

The several parts of the hacking machine are described, illustrated and claimed per se and without the inter-control in the following copending applications: "Brick lifter", filed August 1, 1925, Serial No. 47,515, "Segregator", filed July 14, 1925, Serial No.

726,032, and "Automatic crane", filed November 14, 1924, Serial No. 749,929. For a clear understanding of the interaction of the several parts and the inter-controls associated therewith, a substantial duplication of the subject matter of the before mentioned applications is given hereinafter.

Brick lifter.

The brick grasping and lifting mechanism in its preferred form is shown in Figs. 6 to 9 inclusive. Fig. 6 illustrates a plurality of lifters upon a common support positioned immediately over a belt carrying brick in spaced relation and which is positioned beneath the lifter so as to pass the brick through the lifter, the latter straddling the brick.

In the drawings 300 indicates a brick unit or brick carried by a belt 301 commonly called an off-bearing belt, or other suitable movable support. These brick are formed by a brick making machine and are removed from said machine by the off-bearing belt. Various other types of removal and formation may be employed, but the invention depends upon the relative movement of the brick and the brick lifting devices for controlling the operation of the latter. A tubular shaft 302 constitutes a support which slidably supports a plurality of brick lifting devices in tandem relation. The hanger for each brick lifting device is hereinafter termed the saddle and is indicated by the numeral 303. Slidably associated with the saddle 303 and upon an axis transverse to the shaft axis 302 is a shaft 304. As hereinafter pointed out this shaft 304 is associated with a plurality of brick lifting devices arranged in transverse row formation, whereas shaft 302 is associated with brick lifting devices arranged in tandem row relation.

The details of each brick lifting device, that is, the preferred form of the invention, is shown clearly in Figs. 7 to 9 inclusive. In these figures the support framework includes a pair of straps or side members 305 depending from the saddle 303 and depending from said sides is a cradle construction 306 on which is movably mounted the brick grasping and lifting mechanism. Mounted within the aforesaid framework between the cradle and the saddle is a fluid operable power unit consisting of a pair of solenoids each including an upper and lower coil, said coils being in aligned relation and indicated by the numeral 307. A common armature 308 is stationarily associated with cores 309. In aligned relation with cores 309 is another core 310 which is slidably supported within the coil. Slidably supported cores 310 are connected by a movable armature 311. The magnetic path of the solenoid construction, therefore, includes the armature 308 and 311 and the cores 309 and 310. Current supplied to the coils 307 will build up the magnetic field in the resultant construction and cause the armature 311 with the cores to move upwardly from the position shown in Fig. 7 to the position shown in Fig. 8. The amount of reciprocatory movement of the armature and cores is predetermined and naturally can be adjusted. As shown clearly in Fig 9 the upper end of the cradle 306 supports the movable armature and cores when in the lowered position.

The brick grasping mechanism consists of a pair of plates 312 which may or may not be provided on their adjacent and inner faces with small projections 313. The plates 312 are hingedly supported through a hinge member 314 rigid therewith which is pivotally supported on pin 315 carried by a combination pivotal support and spring retainer 316. A roller 317 is adapted to roll along the side of the cradle 306 and thus insure aligned movement of the hinge member. As shown clearly in Figs. 7 and 8, a pair of spring retainers 316 are provided and the ends thereof are bifurcated as at 318 and straddle the cradle framework 306 and align the movable mechanism associated therewith. The spring 320 is interposed between the cradle and the movable spring retainer 316 forming the support for the hinge members 314 and serves to normally maintain the members 316 and all of the mechanism supported thereby in the lower position.

Intermediate the ends of each of the plates and centrally positioned is a pivot supporting block 321. Pivotally supported on said block 321 is a link 322, the upper end of which is pivotally connected by a link 324 to a draw-bar 325. A transverse link 326 is pivotally connected at each end to a pair of the links 322. The draw-bar 325 has a detachable and adjustable connection with the movable armature 311. Thus, reciprocatory movement of the armature through the draw-bar will elevate and lower the hinge pin 327 connecting the two links 324 each connected to the free end of the links 322, the other end of which is pivotally connected to a plate 312. An upward pull on the draw-bar will serve to elevate the two links 324 and tend to throw the pivots and therefore the upper ends of links 322 outwardly and away from each other. Because the two links 322 are connected by a spacing link 326, this movement serves to draw the clamping plates 312 towards each other and thus grasp the article. This inward movement of the plates continues until such time as the plates have grasped the article with just sufficient force to permit of its being lifted. Continued upward movement of the draw-bar, therefore, will elevate the plates 312 with links 322, 324 and 326, said upward movement being in opposition to the springs 320 and continuing to the point determined by the seating of the armature in closed relation. The foregoing constitutes the simplified brick grasping and lifting device.

Each brick lifting device includes a pair of yoke forming straps 328 which are connected at their upper end to the draw-bar 325 and at their lower end are spaced by a sleeve or bushing 329, said bushing being carried by a pin 330 upon the outer and projecting ends of which are mounted rollers 331. These rollers 331 slidably support a pair of links 332, one end of each of which is pivotally connected to a link 353 which link is in turn pivotally connected to the frame 306 at 333ª. Within the pair of links 332 and within the yoke construction, is another pair of links 333, pivotally supported by the frame 306 at 333ª. A switch contact support 334 is preferably in the form of insulation and is pivotally supported at 335 and 336 in the free ends of the pairs of links 332 and 333, respectively. The insulation block 334 supports a trigger 337 adapted to be engaged by the brick 300, which engagement tilts said insulation block and causes the contact plate 338, yieldingly mounting the contact finger 339, to engage the relatively stationarily mounted contact plate 340 carried by the insulation block 341, in turn stationarily mounted upon links 333. Thus, tilting of the block by reason of the trigger engaging the brick causes the contact finger 339 to engage stationary contact switch 340 and this switch is the control for the solenoids 307. When current is supplied through said switch to the solenoids it immediately elevates the draw-bar and causes the draw-bar to tilt the entire switch mechanism into the positions shown in Fig. 8. These positions are also shown in the first three left hand devices illustrated in Fig. 6.

Stationarily supported by the cradle 306 is a back contact 342 insulated from the same by a block 343. An insulation block 344 is pivotally mounted at 345 upon the cradle 306 and carries a switch contact finger yieldingly mounted at 346. Said switch contact finger 346 is normally maintained in engagement with contact member 342 and this is a control switch for an auxiliary solenoid 347. The draw-bar construction 325 carries a stop or trigger 348 which in the upward movement of the draw-bar is adapted to engage a bracket or projecting finger 349 and tilt the switch block 343 upon its pivot 345, and thus open the circuit at the switch 342—346.

Stationarily mounted by the cradle 306 is a solenoid frame 350 which encloses the auxiliary solenoid 347. When this solenoid is energized it raises the core 351 pivotally supported at 352 by the links 333. This movement tends to throw downwardly into brick engageable position the contact or trigger 337 for brick engagement and the closure of the switch 339—340 controlling the solenoids 307.

Adjacent to solenoid 347 is a plunger rod 354 adapted to engage a transverse connector 355 carried by the free ends of the links 333, and said rod 354 includes a spring retainer 356 between which, and the solenoid support 350, is interposed a spring 357. This spring acting through said plunger normally maintains the trigger mechanism in the non-engaging position when solenoids 307 and 347 are both deenergized.

The sequence of operation is as follows: Coil 347 is manually or automatically actuated, which projects and drops downwardly into brick engageable position the contact or trigger 337. Immediately upon brick engagement the switch 339—340 carried by the block 334 is closed, which energizes solenoid 307. This elevates the draw-bar, causes the clamping plates to clamp the brick and then the remainder of the application of the solenoid force is applied to elevational movement in opposition to springs 320. The substitution of springs of different strength will regulate the force actually applied for grasping, and if desired springs 320 may be entirely omitted, in which event gravity will cause the parts to operate as if springs were utilized provided the weight of the several parts is adjusted to give the desired grasping force. As the draw-bar moves upwardly the stop 348 engages bracket or finger 349 and opens the switch 342—346 previously closed. Simultaneously therewith the draw-bar elevates and tilts the switch 339—340 into the position shown in Fig. 8, the pressure of the draw-bar on links 332 through rollers 331 maintaining the switch in closed position. Breaking the contact at 342—346 deenergizes the auxiliary solenoid 347 which allows the elevating and tilting of the switch 339—340 to be accomplished without the necessity of opposing the pull of said solenoid. When the solenoids 307 are deenergized, the brick are dropped and the plates and linkages returned by gravity and the action of springs 320 and 357 to their original position, that is, with the plates lowered, separated and straddling the path of the brick and the trigger 337 in the non-engaging position above the path of the brick. When the auxiliary solenoid is again energized the trigger is again placed in the path of the brick and upon brick engagement the cycle is repeated.

In the operation of a tandem row of brick lifters such as shown in Fig. 6, the auxiliary solenoid of brick lifter number 1 is energized by a manually or automatically operated master control to place the trigger of this lifter in the path of the brick. Closing of the switch 339—340 of this lifter by brick engagement not only actuates the lifting solenoid for grasping and elevating brick but actuates the auxiliary solenoid of lifter number 2 to place the trigger of that lifter in the path of the next succeeding brick. Upon brick engagement of lifter number 2 the trigger of number 3 is placed. In this manner the lifters in the row are successively filled.

In Fig. 2 is illustrated the wiring of a unit of 192 brick lifters arranged in tandem and transverse rows, with the inter-connections between brick lifters the details of which are subsequently described under the head "Brick lifter control wiring".

Segregator.

In Figs. 12 and 13 a reinforced collar 360 is associated with a rectangular framework 361 and mounted thereon is a motor 362 having the driving shaft 363 and spiral driving gear 364. The rectangular framework 361 is provided upon two opposite and parallel edges with two T-shaped depending guides 365, and upon its upper surface and upon adjacent and parallel edges with a pair of T-shaped guides 366. See Figs. 11, 12 and 13. Slidably supported upon each of the T-shaped upwardly extending projecting or guide members 366, is a pair of outwardly extensible arms 367 having the T-shaped groove 368 therein for engagement with the T-shaped projections 366. The upper surface of the arm 367 is toothed as at 369 to provide a rack. Other arms 370 are provided with T-shaped slots 371 for receiving the suspending T-shaped guide and support 365 previously described. The lower face of each of the slotted arms 370 are also toothed as at 372.

In suitable supporting brackets carried by the rectangular framework 361, there is rotatably mounted parallel shafting 373 and other parallel shafting 374, said shaftings being at right angles to each other and lying in superposed planes. Shafting 373 includes a plurality of spiral gears 375, one of which meshes with the driving spiral gear or pinion 364 driven by motor 362. Each spiral gear 375 meshes with a spiral gear 376 carried by one of the shafts 374. Each shaft 373 includes at each end a pinion 373^a and each shaft 374 includes at each end a pinion 374^a, which pinions mesh with the toothed portions of the arms 367 and 370 respectively. The resultant construction is a closed spiral gear drive, power operable by the motor 362 for the extension and contraction of the arms 367 and 370. Whenever motor 362 is energized the power is transmitted through the gearing and will either simultaneously retract the transversely positioned arms 367 and 370 or will simultaneously extend the same. Each of the arms 367 terminates in a depending bracket member 377 provided with an opening 378.

A tubular shaft 380 (see Figs. 11 and 13,) supports a pair of tubular extensions 381 each of which include similar extensions 379 terminating in the shafting 382, said tubular shafting being extensible and contractable axially. The depending arms 377 having the openings 378 receive sleeve shafts 379. The foregoing construction is such that the telescopically sectionalized shafting is associated with the pair of projecting arms 367, so that a pair of said telescopically sectionalized shafts are caused to move inwardly and outwardly towards and away from each other, respectively, in parallel and spaced relation and simultaneously.

A similar sleeve shaft 383 includes the telescopically associated sleeves 384 which also support the shafting extensions 385. The sleeves 384 are mounted in openings 378 carried by depending supports 377 in turn suspended from the projecting arms 370. Thus, each telescopically associated shaft 383, 384 and 385 is associated with a pair of parallel rack supports and a pair of said constructions are caused to move inwardly and outwardly towards and away from each other, respectively, in spaced and parallel relation. Herein the arrangement is such that the two sets of shafts are simultaneously movable inwardly or outwardly and are positioned transversely of each other at all times.

The shafting is shown tubular for convenience only. The sectionalizing is required where the length of the fingers is insufficient to position the brick without considerable dropping in the car with the segregator remaining above the dryer car. Thus the shafting and segregator framework can be received within the dryer car by sectionalizing the shafting.

It will be recalled, each of the saddles of the brick lifting devices indicated in Figs. 6 to 9, indicated by the numeral 303, includes a pair of transverse bearings. In the before mentioned figures the numerals 302 and 304 indicate the tubular shafting herein indicated by the several numerals 379 to 385 inclusive, respectively. The segregator construction includes eight parallel positioned shaftings 379 to 382, inclusive, and twenty-four parallel positioned shaftings 383 to 385, inclusive, that is, there is provided one hundred ninety-two brick clamping devices arranged in rows of eight each in tandem relation and in twenty-four transverse rows. The foregoing eight by twenty-four arrangement, in the case of brick, permits eight brick to be positioned in tandem and abuttable relation as shown by the dotted lines in Fig. 12, and twenty-four rows of such abutted brick to be positioned in spaced relation suitably separated by at least the width of the finger. The last mentioned arrangement is shown clearly by the upper left-hand corner of Fig. 10. The extended relation is shown by the lower right-hand corner of Fig. 10. It is not essential that the movement in two transverse directions, even though simultaneous, be equal but the mechanism is such that said movement may be equal.

The means for insuring accurate spacing include suitable linkage and reference is now had particularly to Figs. 11, 12, 14 and 15. The links 386 are associated with the ends of the shafting 382. The distance between the openings in each link constitute the mechanism clearance distance between said shaftings in the contracted or telescopic position. The distance from the farthest point on the elongated slots of the link constitutes the maximum spacing distance between said shaftings. Similarly, links 387 are associated with the ends of the shafts 385 and said links are similarly formed and have the same limiting factors. It will be apparent that the two types of links need not necessarily be of the same length and as shown in Figs. 14 and 15 are not of the same length. Furthermore, the openings need not be of the same diameter, for, as shown in Fig. 14, the size of the shaft does and may vary. It is only necessary to provide two transverse sets of linkages but for equal movement two parallel sets are utilized, and these are associated with the outer ends of the several shafts. When the shafting is in the contracted or telescopic position the linkages are in their collapsed position. It will be apparent that adjacent links are alternately offset from each other. When the shafting is extended the links are extended and limit the extreme movement of the several shafts. By the foregoing construction the position of each brick engaging unit is equally determined in the extended and contracted position which are the two essential positions.

In Fig. 13 there is illustrated a travel limit switch designated LS 12 used as control for the reversible motor 362. Herein said limit switch consists of a suitable gear 389 which meshes with the gear 390 carried by the threaded shaft 391. The threaded shaft 391 carries a collar 392 and this collar is adapted to movement to and fro on the shaft thru the rotation thereof. A pair of switches include movable contacts 393 and 393^a and stationary contacts 394 and 394^a. The collar 392 is adapted to alternately engage one or the other of the movable contacts in its reciprocatory movement and open the circuit through the switch at the end of its reciprocatory movement in one direction, which automatically will stop the motor 362 at that point but will permit the circuit to be closed thru the motor in the reverse direction when other suitable controls are actuated. Thereupon when so actuated current is supplied to the motor for reverse rotation, which reverses the travel of the block 392 permitting the switch heretofore open to close making ready for the reverse movement and continuing the motor movement until such time as the block or contact 392 engages the other movable contact to open the switch therethrough and stop the motor. The foregoing constitutes the automatic travel limit and reverse switch mechanism provided for the segregator motor. This motor also is provided with dynamic braking and if desired, may include a solenoid brake.

Crane.

Means are provided for positioning the segregator and brick lifters for brick engagement and for deposition of brick on the dryer car. Such a means includes a suitable movable support which is hereinafter termed the crane, which movably supports a trolley. The crane and trolley are capable through switch control means of a step by step movement for successively presenting unfilled brick lifting devices to brick supplied in stream formation by the off-bearing belt. Such a construction is shown diagrammatically in Fig. 1 and in detail in Figs. 16 and 17, while Figs. 18 and 19 in addition to 16 and 17, illustrate suitable controls for the crane construction. In said figures 400 indicates a pair of crane supporting tracks illustrated as channels and shown supporting a crane or movable framework which includes a plurality of flanged wheels 401 supported by said track-ways. These wheels are connected by shafts 402 which are rotatably supported by the outwardly projecting bracket portion 403 included in the framework members 404. Said members 404 connected by transverse members 405, constitute the remainder of the open rectangular framework. The members 405 are so formed that they constitute a trolley track-way and are substantially transverse to the crane track-way. Suitable stops 406 are associated with the track-ways 405 for limiting the travel of the trolley thereon.

Upon a base plate 407 is mounted an electric motor 408 and herein termed the crane motor. This includes a driving pinion 409 meshing with a driving gear 410, which rotates shaft 411 supporting a worm 412 which meshes with a worm wheel 413 carried by one of the shafts 402. Forward and reverse rotation, respectively, of the motor 408 will cause forward and reverse movement of the entire crane construction upon the crane track-ways 400. Forward and reverse movement of the crane upon the track-way may be continuous or intermittent, or step by step, or any combination thereof. Motor 408 includes a solenoid brake 399 which together with dynamic braking, secures substantially instantaneous stoppage of the crane in any desired position through the use of travel limit switches, the particular location of which is hereinafter to be described. For one form of movement preferred, reference will be had to the control description to be given hereinafter. The trolley 414 is provided with a pair of axles 415 that extend transversely of the shaft 402 and said axles support flanged wheels 416 which roll upon trolley trackways 405. The trolley 414 supports a motor 417, the shaft 418 of which carries a worm 419 meshing with a worm wheel 420 carried by one of the shafts 415. The solenoid brake 398 is also associated therewith. Thus the trolley is caused to reciprocate on the crane at right angles to the crane movement as desired. In addition to the solenoid brake, dynamic braking is also employed on motor 417.

The trolley 414 is herein shown provided with a central aperture 431 defined by a collar 432, which includes a bushing 433 for rotatably supporting a hub 434 carried by turn table 435. Turn table 435 at its outer periphery is provided with inclined teeth 436 which form a bevel gear. A bevel pinion 437 is carried by shaft 438 in brackets 439 upon the table 414. A worm wheel 396 upon the shaft 438 meshes with a worm 440 carried by shaft 441. This shaft is driven by the quarter turn motor 442 supported upon the table 414. The motor also is provided, in addition to dynamic braking, with a solenoid brake 395. Interposed between the turntable 436 and the trolley 414, is a suitable anti-friction construction herein shown in the form of an annular ball race 443. Positioned within the central opening 431 is a stem 452 which is rigid with the collar 360 supporting the rectangular segregator framework. This stem 452 is threaded but is slidably supported in the central aperture 453 formed in the turn table 435. The stem 452 includes a key-way 454 and the hub 434 of the turn table 435 includes a complementary key-way 455. These receive a locking key 456 which prevents relative rotation of the stem 452 and the turn table 435. Therefore, rotation of the turn table by means of the quarter turn motor 442 also rotates the stem 452 and the segregator support 360.

The turn table 435 mounts a projecting tongue or latch 470 having the tapered faces 471. In bracket 472 on trolley 414 is mounted solenoid 473, the core 474 of which carries on its free end a plunger 475, which has tapered faces 476, and a wedge shaped notch or socket 477 adapted to receive the locking projection 470. Spring 478 yieldingly retains said plunger or catch in latch retaining position and thus locks the turn table and consequently the segregator support in a predetermined position. Plunger 475 carries an insulation support 479 which carries a bridging contact 480 adapted to bridge a pair of contacts 481. These contacts 481 are in the control for forward or cross turning movement of the quarter turn motor. Thus until the solenoid 473 has been actuated to retract the plunger 475 the switch 480—481 will remain open and the motor will not be energized. When the plunger is retracted the switch will be closed to energize the motor 442 and rotate the turn table 435. There may be included a pick up and maintaining relay arrangement so that the solenoid 473 may be deenergized and permit opening of switch 480—481 and yet permit the quarter turn motor to rotate the turn table 435. This latch mechanism is necessary only when the motion of the turn table is to be so rapid that the ordinary solenoid brake and dynamic brake fail to stop the turn table at the proper position at the end of each cycle.

Rotatably mounted on turn table 435 is a bevel gear 460 having a threaded central aperture 461 which has threaded engagement with the threaded stem 452. The gear 460 is supported on the turn table 435 by an anti-friction support or ball race 462. Meshing with the gear 460 is a bevel pinion 463 carried by a shaft 464, in turn supported by brackets 465 upon the turn table 435. A worm wheel 466 upon said shaft is actuated by a worm 467 upon a motor shaft 468, operable by a reversible raising and lowering motor 469. The shaft 468 also carries a solenoid brake 397. When the motor 469 is energized it causes rotation of gear 460 in the proper direction to secure raising or lowering of the stem 452 and the segregator support 360. Since the stem 452 is keyed to the turn table 435 as before described, the raising and lowering is not accompanied by relative rotation of the segregator and the turn table.

The gear 460 also serves as a support for the stem 452 and the entire segregating and brick lifting mechanism since the pitch of the threads is made such that the action of gravity is not sufficient to run the gear backward and lower the stem without help from the raising and lowering motor.

Level selectors and rotary limit switch.

In the normal operation of the machine, it is required that at certain times the segregator support 360 be positioned at predetermined levels for depositing brick on the drier car. For this purpose there is provided an upright 492 upon which are mounted a plurality of level selecting switches, LS B, LS C, LS D, LS E, LS F, LS G, LS H and LS I. See Figs. 17, 18 and 19. These level selecting switches have projecting triggers 496. A collar 485 is carried by the threaded stem 452, and a pair of side portions 484 project therefrom. Pivotally supported thereby is a tripping member 486, engageable upon triggers 496 for opening the level selecting switches.

Side portions 484 are connected by transverse portions 489 and an adjustable stop 490 is carried thereby which is engageable by a projecting portion 491 upon the tripping member 486. Thus, in the upward movement of the collar 485 by reason of the rising of the threaded stem 452, the tilting movement of the tripping member is limited as shown in Fig. 19 to clearance of the triggers 496. The tripping member 486 carries a member 487 which abuts an adjustable mounted screw 488 carried by the collar 485. Member 487 also acts as a counterweight and insures that the normal position of the tripping member is as shown in Fig. 18.

The switch mechanism associated with the trigger 496 consists of a contact 493 carried by the support 492 and engageable by a yieldingly mounted contact 494 pivotally supported at 497. A spring 495 normally maintains contact or trigger 496 in the horizontal position abutting a stop 496^a carried by the support 492 and in this position the switch contact 494 engages switch contact 493. Insulation blocks 497^a and 493^a insulate the two contacts from the remainder of the machine.

In the lowering movement of the threaded stem 452, the tripper 486 engages trigger 496 and opens the circuit across the switch points 493—494. In the elevational movement the tripper 486 is tilted out of the way and the switches remain in the normally closed position. The eight projecting triggers 496 shown in Fig. 17, are each associated with a switch and it is apparent that if the current for energizing the lowering of the raising and lowering motor is passed through any one of said switches that the lowering motion will be stopped as soon as the tripper 486 reaches the proper level to break the contact at that particular switch. In order to stop the lowering motion at the desired level, it is only necessary to send the current controlling the lowering motor through the proper level selecting switch.

The actuation of the active level selector switch is accomplished by means of the rotary controller 426 shown in detail in Figs. 3, 5, 16 and 17. This switch consists of a rotatable insulation drum 426^a upon which is mounted a plurality of electrically connected contacts 427 arranged around the drum in offset relation and equal in number to the number of level selector switches 493—494 and a continuous contact 429 which extends around the drum and is electrically connected to contacts 427. Bearing upon the drum and insulated from each other and from the remainder of the machine is a series of brushes 427^a for individual engagement with a contact 427 and a brush 429^a for the continuous contact 429. Each of the brushes 427^a corresponding to one of the contacts 427 is connected to the contact 494 on one of the level selecting switches. The brush 429^a corresponding to the continuous contact 429 is connected into the main control line for the lowering motor as is hereinafter described. It is apparent from the foregoing description that for any position of the rotating drum 426^a one and only one of the brushes 427^a will be in contact with a contact 427 and the circuit only can be made through that particular brush and its corresponding level selector switch. To select the proper level it is necessary to have the proper brush engage its contact 427 either by hand or by automatic means.

In Figs. 16 and 17 is shown a means for automatic setting of the rotary limit switch consisting of an overhanging arm 421 carried by trolley 414 and pivotally supporting a pawl or tooth 422 adapted to engage a star wheel 423 mounted on the shaft 424 which also carries the rotating drum 426^a of the rotary controller. The said shaft is supported from one of the crane members 404 by the brackets 425. In each return movement of the trolley the star wheel 423 will be actuated by the pawl 422 thereby moving the rotating drum 426^a a predetermined portion of a revolution. Since pawl 422 is free to pivot from its normal position in one direction the star wheel has unidirectional rotation only. Herein eight points are shown on the star wheel corresponding to eight brushes 427^a and eight level selecting switches, and therefore, the drum 426^a is moved through an eighth of a revolution for each return of the trolley. In this manner eight successive courses of brick are set on the dryer car and on the ninth return of the trolley the first or lowest level is set to commence the filling of an empty car.

The rotary controller 426 also carries on its drum 426^a another continuous contactor 428, having a brush 428^a associated therewith. Also mounted on said drum is a series of segmental contacts 430 having a brush 430^a associated therewith. The contacts 430 are each electrically connected to the contact 428. The brushes 428^a and 430^a are included in the circuit for controlling the quarter turn motor as hereinafter described. When the drum is in such position that brush 430^a is in contact with one of the segmental contacts 430 the circuit may be completed and a quarter turn will take place at the proper point in the cycle of operations. In Figs. 3 and 5 one contact 430 is shown for each alternate position of the drum 426. By this arrangement alternate courses of brick on the dryer car will be cross hacked. It will be apparent that by a different arrangement of the segmental contacts the first two courses might be cross hacked, the second two not, and so forth or any desired combination of cross hacking might be obtained.

Travel limit switches.

To control and limit the several travels of the several mechanisms included in the hacking machine a number of travel limit switches are used in addition to the level selectors, the rotary controller and the segregator limit switch previously described. These travel limit switches are shown particularly in Figs. 1 and 17 and suitably indicated in the wiring diagrams.

Fixedly and successively mounted along the crane trackway 400, see Fig. 1, is a plurality of travel limit switches designated LS 2, LS 17 to LS 23 inclusive, and LS 1. Each of said switches carries a projecting fork 298^a engageable by a trigger 298 carried by the crane. When the fork is engaged by the trigger passing in one direction, a circuit is completed within the limit switch; when passing in the opposite direction the circuit is broken. Certain of the switches include or control a plurality of circuits which may or may not be independent of each other. If independent they may be differentially controlled. The above switches are used to suitably limit and control the travel of the crane in the several operations of the hacking machine, said travel being termed "forward" and "reverse".

Fixedly and successively mounted along the trolley trackway 405 is a plurality of similar travel limit switches designated LS 13, LS 4 to LS 10 inclusive, LS 10^a and LS 11. Each of said switches carries a projecting fork 298^a engageable by a trigger 297 carried by the trolley 414. These switches with the exception of switch LS 10^a are used to limit and control the travel of the trolley, which travel is termed "out" or "in". In addition, switch LS 11 conditions circuits for both manual and automatic operation of the raising and lowering motor 469 for lowering and switch LS 13 conditions a circuit for automatic lowering. In addition, for certain types of automatic control, the switches LS 4 to LS 10 inclusive are used to control simultaneously the trolley and crane travels. In this case switch LS 10^a is a cut over switch for controlling the crane travel independently of the trolley travel at certain points in the automatic cycle.

Mounted on the trolley 414, see Fig. 1, are two similar travel limit switches designated LS 15 and LS 16 each of which carries a projecting fork 298^a engageable by triggers 296 and 295 respectively, which have a predetermined relationship and are carried by the turn table 435. These switches are used to limit the travel of the turn table which is termed "cross turn" and "normal turn".

Carried by the trolley 414 are two travel limit switches 499 and 500, see Fig. 17. Each of these switches carries a projecting fork 298^a engageable by the arcuate collar 498 carried by stem 452. The arcuate formation of the collar insures engagement of the respective forks by the collar independent of the oscillatory rotation of the stem 452. These switches are used in addition to the level selectors previously described for limiting the vertical travel of the stem 452, termed "up" and "down". In addition the switch 499 conditions circuits for both manual and automatic actuation of the trolley motor for travel toward the offbearing belt, for automatic actuation of the segregator motor for opening the segregator, for automatic actuation of the quarter turn motor for the normal turning of the turn table, and for automatic actuation of the reverse crane travel.

The number and locations of, and the circuits controlled by the travel limit switches as described above may be and are varied to obtain the sequence of operations desired. The inter-connection and two examples of the sequence of control of the several switches are hereinafter described.

Operation.

The foregoing completely describes the mechanical construction of one hacking machine except for the wiring. The combined operation of the several hacking machines and the electrical control circuits by which the exemplified operation is obtained is as follows:

Three hacking machines, see Fig. 1, on a common crane trackway are shown associated with a single offbearing belt 301 carrying a plurality of brick 300, herein shown arranged in transverse rows three brick to the row. These machines are shown inter-connected for automatic operation. There are also shown a plurality of dryer cars 299, one for each machine. Hacking machine No. 1 at the right in Fig. 1 is shown positioned over its dryer car with a course of brick in cross-hacked relation, that is, turned at 90 degrees to the position of the brick on the belt. Hacking machine No. 2 in the middle of Fig. 1 is shown partially filled and filling with brick. Hacking machine No. 3 is in the starting position ready to begin filling when the filling of number 2 is completed. In the usual sequence of operations machine No. 1 fills first. It then moves to the dryer car. The master control of No. 2 is actuated automatically by machine No. 1 to initiate the filling of No. 2. When hacking machine No. 2 is filled, the master control of machine No. 3 is similarly actuated. During the filling of No. 2 and No. 3 No. 1 has deposited its brick and returned to the start and filling position with the brick passing through between the plates of the brick lifters and with the brick engaging triggers in non-engageable position. When enough brick have passed through No. 1 machine to substantially complete the filling of hacking machine No. 3 the master control of hacking machine No. 1 is actuated automatically and the filling of hacking machine No. 1 is again initiated.

Herein each hacking machine is assumed to have 24 rows of brick lifters and since three streams of brick are presented on the belt there must be eight stages in the filling of the complete unit. The position of the segregator of machine No. 2 for each of the eight stages of filling is shown by dash lines designated ST-1, ST-2, ST-3 etc. to ST-8. At stage 1 the first three rows of brick lifters are filled. The machine then moves to the stage 2 position where the fourth, fifth and sixth rows of lifters are filled. This continues for the eight stages whereupon the machine moves into position over the dryer car. The divisibility of 24 by several common divisions results in a convenient convertible interchangeable construction with 24 rows.

Herein the motion from stage to stage is shown to be diagonal, the forward component being for the purpose of clearing the oncoming brick on the belt. The minimum amount of the forward travel necessarily depends on the speed of the offbearing belt and the spacing of the brick on the belt. For relatively slow belt speeds or wide brick spacing the forward travel is not necessary, and the stage to stage movement is lateral only. The two components of the diagonal movement may take place simultaneously or successively. Each dryer car is herein shown square, so that it may fit the dimensions of the same course of brick when cross hacked or when not cross hacked. It is possible, however, to place a square unit of brick on two dryer cars each of the dimension of half the square and positioned side by side. It is also possible for two hacking machines to deposit brick on one dryer car positioned between them. When two hacking machines alternately deposit on the same dryer car, one machine may deposit courses cross hacked, while the other will deposit them non-cross hacked. In this case any shape of car might be used, the segregators of the two hacking machines being built to fit the car in the position for which each is intended to deposit. It is also possible for two hacking machines to deposit brick on a single pair of half square dryer cars positioned side by side and between the hacking machines.

It is also possible for one hacking machine to fill a half of a course at each trip on a half square car. These and many other variations are possible and are included in this invention.

Brick lifter control wiring.

Fig. 2 diagrammatically shows the wiring of a mechanism including 192 brick lifters arranged in 24 tandem rows, 8 lifters to each row. Each lifter, as previously described, includes a pair of lifting solenoids 307, an auxiliary solenoid 347, a normally open switch 339—340 and a normally closed auxiliary switch 342—346.

A pair of mains 609 and 610 are energized by a circuit to be hereinafter described upon actuation of the master control of the hacking machine. From each of these mains a branch extends to each of the 192 lifters as shown. The auxiliary coils 347 of the first finger in each row are connected directly across these two lines through the auxiliary switch 342—346 and when these lines are energized the auxiliary coils are energized to place the trigger of the lifter in the path of the brick as previously described. Upon brick engagement switch 339—340 is closed and solenoids 307 are energized for brick lifting. At the same time the auxiliary solenoid 347 of the second finger in the row is energized through line 358 and its auxiliary switch 342—346 to drop the trigger of the second finger for brick engagement.

Where several streams of brick are simultaneously picked up electrical cross ties 700 are used between the lifters to be simultaneously operated, herein shown connected in groups of threes. These cross ties insure that all of auxiliary solenoids 347 in a transverse group of three will be actuated and their triggers placed for brick engagement upon the actuation for brick lifting of any one of the lifters in the preceding similar group of three. Therefore, if a brick is removed from the belt by accident or for inspection the next following brick will be caught by the intended lifter as if the preceding brick had not been removed. The lifter corresponding to the brick removed will be left vacant and the subsequent operation of the machine will not be interfered with in any way. The cross ties 700 also insure that all the lifters in a transverse group of three will be actuated for lifting even though one or more of the switches 339—340 fails to make contact through a coating of clay, mis-adjustment or any other cause, so long as one of the switches 339—340 in the group makes contact.

Multiple hacking machine control.

In the lower part of Fig. 1 is represented a master control push button for each of the three hacking machines together with the inter-connections for the automatic actuation of the master controls. Herein 287 represents a push button which energizes the lines 609 and 610 of hacking machine No. 1, for manually conditioning this machine for filling by making contact between a line 680 and a line 681 by a circuit to be hereinafter described. Similar push buttons 289 and 288 are similarly associated with hacking machines Nos. 2 and 3 respectively. Associated with the last brick lifter to be filled, No. 192, of hacking machine No. 1 is a relay 290 which is energized to close a switch 293—294 when the said brick lifter is actuated for lifting. The switch 293—294 short circuits the master control push button 289 of hacking machine No. 2 conditioning this machine for receiving brick.

By a similar relay 293—294 the last lifter to be filled in machine No. 2 conditions machine No. 3 for filling. By a similar relay a certain predetermined lifter of hacking machine No. 3 similarly conditions hacking machine No. 1 for filling. The particular lifter of machine No. 3 to be used is selected such that enough brick are left on the belt between machines Nos. 1 and 3 to substantially complete the filling of No. 3. If automatic actuation of the master control is not desired the same brick lifter in each machine may be used to ring a bell or give some other warning signal to the operator that it is time to actuate manually the master control.

Wiring diagram.

Figs. 2, 3 and 4 combined give the complete wiring diagram for one form of operation of the hacking machine. Lines terminating at the left in Fig. 3 connect to like numbered lines terminating at the right in Fig. 2. Lines terminating at the right in Fig. 3 connect to like numbered lines terminating at the left in Fig. 4.

Fig. 5 is a diagram of a modification of that portion of circuits of the entire wiring diagram shown in Fig. 3. Figs. 2, 5 and 4 combined in the order named illustrate the complete wiring diagram of a modified form of operation of the hacking machine.

Master control circuits.

Associated with each hacking machine is a panel board on which is mounted all of the electrical apparatus inclosed within a dash line 900 in Fig. 4. A main supply line 600 and a main return line 601 supply direct current to the electrical apparatus from a suitable generator. Current from line 600 first passes through an overload relay 602. From the live side of the overload relay leads a line 640 connected through a normally closed bridging bar 641 operable by the overload relay, and through a line 642 to a solenoid 643 having its opposite side connected through a line 644 to the main return line 601. Solenoid 643 when energized maintains a normally open control relay 689 in the closed position. As will be hereinafter shown all of the motor control circuits and the master control circuit for the brick lifters pass through the control relay 689. This serves as overload protection for the entire hacking machine circuits except the motor shunt fields.

In Figs. 3 and 5 is shown the master control push button 287 previously described and which may be connected to the automatic relay as shown in Fig. 1. Pressing the push button 287 or operating the corresponding automatic relay closes the connection between lines 680 and 681 to set the master control circuit for the brick lifters as follows: from the main supply line 600 and over-load relay 602, thru a line 682 to the rotary controller 426. From the rotary controller thru any one of the level selectors LS B, C, D, E, F, G, H, or I and a line 683 to a normally closed "drop" push button 684, thru the line 680 and the switch 287 to the line 681 to a point 7 on the panel board and thence thru a line 685 to a solenoid 686, thence on a line 687 and a line 688 to the control relay 689 which is normally closed unless the over-load relay has dropped out. From the control relay 689 the circuit continues thru the line 644 to a point 2 on the main return line 601. This circuit energizes the coil 686 which operates to close a slow drop out switch 690. Closing this switch 690 sets a circuit as follows:

From the main supply line at 600 thru the over-load relay 602 and a line 603 to a point 3, from the point 3 thru a line 691 to each of a pair of parallel connected coils 693; from these coils thru a line 695 to the slow drop out switch 690 and thence thru the line 688 and the control relay 689 and the line 644 to the point 2 on the main return line 601. This circuit energizes the coils 693 which closes a pair of main line contactors 692 and 694. Closing the contactor 692 connects the brick lifter supply line 609 to the line 600 by way of the overload relay and the line 603. Closing the contactor 694 connects the brick lifter supply line 610 with the return line 601. Movable with the switch 694 is an interlock 696 which is also closed when switch 694 is closed. This interlock is connected in parallel with the push button 287 by lines 681 and 697. It, therefore, maintains the previously described circuits complete even after the operator's finger has been removed from the push button.

The master control circuit is broken when the tripper 486 on the vertical stem 452 engages the trigger 496 of the "active" level selector, when the drop push button 684 is pressed, or when the control relay 689 is opened by actuation of the over-load relay.

The solenoid 686 operating the slow drop out switch 690 is a highly inductive coil which requires a fraction of a second more time to become deenergized than any of the other coils used. There is therefor a slight time lag between the breaking of the master control circuit and the opening of the switch 690. The purpose of this time lag is hereinafter stated in the section headed "Automatic control".

When the master control circuit is broken the main line contactors 692 and 694 are opened deenergizing all of the brick lifter solenoids. The opening of the contactor 694 also opens the interlock 696 which prevents the circuit from being again completed until the push button 287 or its associated automatic relay is again actuated.

Motor wiring.

In addition to the apparatus previously described the panel board, see Fig. 4, also mounts all of the automatic switches interlocks and resistors necessary to the control of the several motors.

It will be remembered that all of the motors are described as reversible and all are similarly controlled and all have the same parts, except the segregator motor 362 which, as before stated, is not provided with a solenoid brake. Each of the motors includes a commutating field 666 and a series field 672 in addition to the shunt field 672^A and the shunt field discharge resistance 672^B. In addition thereto each of the motors includes a starting resistance 655 and a dynamic brake resistance 656. Controlling each starting resistance is the contact switch normally open 657 which is automatically controlled thru a starting solenoid 658 to automatically cut out the starting resistance when the motor is up to speed. Since all of the circuits are the same, except as before noted, a description of one will suffice for them all, the distinctions being that each of the motor circuits are controlled by different control circuits which will be described in detail hereinafter.

By way of example, the raising and lowering motor 469 is taken. It will be assumed that the motor is to be energized to cause down travel. In this event a pair of coils 659 is energized by a suitable control circuit. This immediately closes a pair of normally open switches 660 and 661 and simultaneously opens a normally closed switch 662. These switches complete the armature circuit for the motor as follows: from the main supply line 600 and overload relay 602 thru the line 603 to the point 3, and a branch 604 to the switch 660, thence to a line 665, thru the armature of the motor 469, the commutating field 666, a line 667, a normally closed switch 668, and a line 669, to the switch 661 which has been closed by coil 659. Thence thru a line 670 to the starting resistance 655 and thru a line 671 to the solenoid brake 397, (releasing the brake) and thence, through the series field 672 and a line 673 to the point 2 on the main return line 601.

The movable portion of the switch 660 carries a switch member 663 which, when switch 660 is closed, also completes a circuit through a line 664 to the solenoid 658, the opposite end of which solenoid is connected to the armature of the motor 469 through the line 670, the switches 661 and 668 and the line 667 successively. This circuit connects solenoid 658 across the armature of the motor and when the back voltage of the armature has built up to a predetermined value the solenoid is energized to close the switch 657 which cuts out the starting resistance.

The shunt field circuit of the foregoing motor is as follows: from the live side of the overload relay 602 by a line 653 to the shunt field 672^A, through a line 678 to line 671 and thence to the main return line 601 by the same path as in the armature circuit. The field discharge resistance 672^B is connected in parallel with the shunt field across the lines 653 and 678.

To stop the motor the control coils 659 are deenergized, the switches 660 and 661 are opened and the switch 662 is closed. The latter switch short circuits the armature of the motor through the dynamic brake resistance 656 as follows: from the armature 469 through the commutating field 666, the line 667 and the switch 668 to the dynamic brake resistance 656 and thence through the switch 662 and the line 665 back to the armature. This circuit applies dynamic braking.

To reverse the raising and lowering motor 469 a pair of coils 674 are energized by the "up" control circuit as will be hereinafter described in detail. These coils close a pair of switches 675 and 676 and open the normally closed switch 668. This sets the armature circuit as follows: from the main supply line 600 to point 3 as before; from the point 3 through the line 604 and a branch line 677, through the switch 675 and the line 667 to the commutating field 666, and the armature of the motor 469; thence through the line 665 and the switches 662, and 676, to the line 670, to the starting resistance 655; from the starting resistance through line 671, through the solenoid brake 397 (releasing the brake), through the series field 672 to point 2 on the main return line 601 through the line 673. This circuit reverses the current direction in the armature and commutating field but maintains the current direction in the series field and solenoid brake.

By similar circuits the forward rotation of the crane motor 408 is started when a pair of switches 748 and 749 are closed and a normally closed switch 748^a is opened.

Similarly the reverse rotation of the crane motor 408 is started when a pair of switches 746 and 747 are closed and a normally closed switch 747^a is opened. The incoming current for this motor is supplied from point 3 on a line 606 to the switches 747 and 748.

Similarly the "out" travel or travel toward the dryer car of the trolley motor 417 is started when a pair of switches 768 and 770 are closed and a normally closed switch 768^a is opened.

Similarly the "in" travel of the trolley motor is started when a pair of switches 769 and 771 are closed and a normally closed switch 769^a is opened.

The incoming current for the trolley motor is supplied from the point 3 through the line 604 and a branch 607 to the switches 769 and 768.

Similarly the closing motion of the segregator motor 362 is started when a pair of switches 792 and 795 are closed and a normally closed switch 792^a is opened.

Similarly the opening motion of the same motor is started when a pair of switches 793 and 794 are closed and a normally closed switch 793^a is opened.

The incoming current for the segregator motor is supplied from the point 3 through the line 604 and its extensions 605 and 608, to the switches 793 and 792.

Similarly the cross turn motion of the quarter turn motor 442 is started when a pair of switches 726 and 727 are closed and a normally closed switch 726^a is opened.

Similarly the normal or returning motion of the same motor is started when a pair of switches 728 and 819 are closed and a normally closed switch 728^a is opened.

The incoming current for the quarter turn motor is supplied from the point 3 by the lines 604 and 605, to the switches 728 and 726.

The series fields of all of the motors are connected to a pair of common return lines 673 leading to the main return line 601 at point 2.

The shunt field current for the crane motor 408 is supplied from the live side of the overload relay 602 by a line 650; that for the trolley motor by a line 651; that for the segregator by the line 651 and an extension 652; that for the quarter turn motor by the line 653 and an extension 654. Otherwise all of the shunt field circuits are exactly similar to that of the raising and lowering motor previously described.

Motor control circuits.

The motors may each be controlled either manually or automatically, the change from manual to automatic control and vice versa being accomplished by means of a switch 701 shown in Figs. 3 and 5, and hereinafter termed the "automatic manual" switch. This switch is multiple pole, double throw, and manually operable and has on the left side a series of contact points 841, 863, 844, 866, 849, 864, 852, 865, 870, 853 and 860 which are included in circuits for the automatic control of the several motors. On the right side of said switch is a series of contacts 739, 752, 762, 778, 786, 798, 704, 731, 808, 824 and 831, which are included in circuits for manual control of the several motors. A series of corresponding common points 740, 753, 763, 779, 787, 799, 705, 732, 809, 825 and 832 are included in the circuits leading to the motor controls on the panel board. When the switch is thrown to the left the common points are connected to their respective automatic control points and control of the motor motions is automatic. When the switch is thrown to the right the common points are connected to their respective manual control points and the motor motions are thereupon controllable by a series of manually operable push buttons. When the switch is held in an intermediate position none of the motor circuits can be completed.

Figs. 3 and 5 illustrate the corresponding manual control circuits to be identical and a description of these circuits as shown in Fig. 3 will suffice also for Fig. 5.

Manual control—cross turning.

The manual cross turn is controlled by a normally open push button switch 702. When this button is pressed a circuit is completed as follows:

From the main supply line 600, overload relay 602 a line 682 and a line 861 to limit switch 499, thence by a line 862 and a line 901 to the push button 702 through a line 703, to a point 704 on the automatic manual switch 701, to the point 705 on the same switch, through a line 706 to the travel limit switch LS 15, through a line 707 and the latch coils 473, through a line 708 to a "stop" push button 709, through a line 710 to a control switch 712; and thence through a line 714 to the control relay 689 and the line 644 to the point 2 on the main return line 601. This circuit operates the latch for releasing the turn table for turning as previously described. The latch coils 473 operate to bridge across the contacts 481 and make the following circuit:

From the main supply line at 600 to the limit switch LS-15, as in the circuit above described, through a line 716 and the contacts 481 to a line 634; through the line 634 to an interlock 718 and thence through a line 720 to a pair of parallel connected coils 722, and from these coils by a line 724 to the "stop" push button 709, through a line 710 to the control switch 712 and through a line

714 to the control relay 689 and through the line 644 to point 2 on the main return line 601. This circuit energizes the two coils 722 which close the switches 726 and 727 and open switch 726ᵃ for starting the turn motor as previously described. The line 724 in this circuit leading from the coils 722 to the "stop" push button 709 is a common line for similar coils controlling the various other motor switches hereinafter described. Thus the part of the above circuit including the line 724, the stop push button 709, the line 710, the control switch 712, the line 714, the control relay 689, the line 644, to the main return line 601 is common to all of the motor control circuits hereinafter described, and therefore each of the circuits may be broken by pressing the stop push button, opening the control switch 712 or actuation of the control relay 689 by the overload relay 602 as previously described. The interlock 718 in the circuit just described is mechanically connected to the contact 728, which controls the "normal" or reverse rotation of the motor 442 in such a way that this circuit cannot be completed if the contact 728 is closed. In other words, the circuit cannot be set for cross turning if the motor is already turning in the opposite direction. The connection through limit switch LS-499 prevents this circuit from being completed unless the segregator has been raised to the extreme upper level. It therefore prevents cross turning when the segregator is positioned within the dryer car or when brick are passing through the brick lifter at the brick receiving level. The cross turning circuit as above described is broken when trigger 296 actuates limit switch LS-15 when the complete quarter turn has been made or when the operator releases the push button 702.

Manual control—normal turning or reverse turning.

This motion is controlled by the normally open push button 729. When this push button is pressed the circuit is completed as follows:

From the main supply line 600 to the line 901, as in the previous circuit, to push button 729, through a line 730 to the point 731 on the automatic-manual switch 701 to the point 732 on the same switch, through a line 733 to the limit switch LS-16 thence through a line 635 to an interlock 734, through a line 735 to a pair of parallel connected coils 736 and from these coils to the common line 724 and thence to the main return line 601 as in the previous circuit. This circuit energizes the coils 736 which close switches 728 and 819 and open switch 728ᵃ which starts the "normal" rotation of the quarter turn motor as previously described. The interlock 734 is mechanically connected to the switch 726 which controls the cross turn motion in such a way that the interlock 734 is always open when switch 726 is closed. In other words, it prevents the circuit for the normal motion from being completed if the cross turning motion in the opposite direction is in progress. Limit switch 499 in this circuit performs the same function as in the previous circuit. The above circuit is broken when trigger 295 actuates limit switch LS-16 at the original or start position of the turn table, or when the operator releases the push button 729.

Manual control—"forward" motion.

The forward motion or motion in the direction, of brick travel on the belt, is manually controlled by a push button 737. When this push button is pressed the circuit is completed as follows:

From the main supply line at 600, the overload relay and the line 627 to the push button 737, to a line 738, to the point 739 on the "automatic-manual" switch, to the point 740 on the same switch, to a line 741, through the limit switch LS-1, to a line 628 to an interlock 742, and from there through a pair of lines 743 and 744 to a pair of parallel connected coils 745, and from these coils to the common line 724 and thence to the return line 601 as in the previous circuits. The interlock 742 is mechanically connected to the switch 746, which controls the reverse rotation of the same motor, in such a way that 742 is always open when switch 746 is closed. In other words it prevents the forward circuit from being completed if the reverse motion circuit is in operation. This circuit energizes the coils 745 which close switches 748 and 749 and opens the switch 748ᵃ, which starts the crane motor in the "forward" direction as previously described. The forward circuit is stopped when the operator releases the push button or when the crane reaches the limit switch LS-1 at the extreme limit of the crane travel.

Manual control—reverse motion.

The "reverse" motion of the crane is controlled by a normally open push button 750. The circuit is as follows:

From the main supply line at 600 to the line 901 as in the manual cross turning circuit, through the push button 750 and a line 751 to the point 752 on the automatic-manual switch to the point 753 on the same switch, through a line 754 and the limit switch LS-2 to a line 629, to an interlock 755, through a pair of lines 756 and 757 to a pair of parallel connected coils 758, and thence to the common line 724, and thence to the main return line 601 as in the previous circuits.

Interlock 755 is mechanically connected to switch 749 which switch controls the forward motion of the same motor in such a way that the interlock 755 is always open when switch 749 is closed. In other words, it prevents the "reverse" circuit from being completed when the "forward" motion is already in progress. The connection through limit switch 499 prevents the circuit from being completed unless the segregator has been raised to the extreme upper level clear of the dryer car. This circuit energizes the coils 758 which close the switches 747 and 746 and open the switch 747[a] starting the crane motor in the reverse direction as previously described. The reverse circuit is broken when the operator releases the push button 750 or when the crane actuates the extreme limit switch LS-2.

Manual control—out motion.

The "out" motion or motion of the trolley toward the dryer car is manually controlled by an operator's push button 759. When this push button is pressed the circuit is completed as follows:

From the main supply line at 600 to the line 627 as in the manual forward circuit to the push button 759, through a line 760, to the limit switch LS-11, through a line 761 to the point 762 on the automatic-manual switch, to the point 763 on the same switch and through a line 630 to an interlock 764, and from there through a pair of lines 765 and 766 to a pair of parallel connected coils 767 and from there to the common line 724 and thence to the main return line 601 as in the previous circuits. Interlock 764 is mechanically connected to switch 771 which controls the "in" travel in such a way that the interlock is always open when contact 771 is closed. In other words, it prevents the "out" circuit from being completed if the "in" motion of the trolley is already in progress. The above described circuit energizes the two coils 767 which close the switches 768 and 770 and open switch 768[a] starting the trolley motor in the "out" direction as previously described. The "out" circuit is broken when the operator releases the push button 759 or when the trolley actuates limit switch LS-11 at the extreme "out" position over the dryer car.

Manual control—"in" motion.

This motion is controlled by a push button 772. When this button is pressed the circuit is completed as follows:

From the main supply line at 600 through the over-load relay 602 and a line 682 to the rotary controller 426 and from there on a line 773 to the limit switch LS-13, to a line 774 to the limit switch 499, through a line 775 and a line 776 to the push button 772, thence through a line 777 to the point 778 on the automatic-manual switch, to the point 779 on the same switch, thence through a line 631 to an interlock 780, through a line 781, to a pair of parallel connected coils 783 and from there to the common line 724 and thence to the main return line 601 as in the previous circuits. The interlock 780 is mechanically connected to the switch 770 which controls the "out" motion of the trolley motor in such a way that the interlock is always open when the switch 770 is closed. In other words, it prevents the "in" circuit from being completed if the "out" motion of the trolley is already in progress. The above described circuit energizes the two coils 783 which close the switches 771 and 769 and open the switch 769[a] starting the trolley motor in the "in" direction as previously described. The connection in the limit switch LS-499 between line 774 and 775 is only completed when this limit switch has been actuated by the machine having been raised to the highest position. In other words, the trolley cannot be moved toward the off bearing belt unless the machine has been raised to a level at which it will clear the off bearing belt and the brick traveling thereon. The "in" circuit is broken when the operator releases the push button 772 or when the trolley actuates the limit switch LS-13 at the extreme "in" position over the belt.

Manual control—closing motion.

This motion is manually controlled by a push button 784. When this button is pressed a circuit is completed as follows:

From the main supply line at 600 to the line 627 as has been previously described for the manual forward circuit, to the push button 784, to a line 785 to the point 786 on the automatic-manual switch, to the point 787 on the same switch, to a line 788 to the segregator limit switch LS-12, to a line 632, to an interlock 789, and from there on a pair of lines 790 and 791 to a pair of parallel connected coils 792[b], and from these coils to the common line 724 and thence to the main return line at 601, as in the circuits previously described. Interlock 789 is mechanically connected to switch 793 which controls the opening of the segregator in such a way that the interlock is always open when contact 793 is closed. In other words it prevents the closing circuit from being completed when the segregator is in the act of opening. The above described circuit energizes the coils 792[b] which close the switches 792 and 795 and open the switch 792[a], starting the segregator motor in the closing direction as previously described. This circuit is broken when the operator releases the push button 784 or when the segregator limit switch LS-12 is actuated by the segregator reaching the extreme closed position.

Manual control—open motion.

This motion is manually controlled by a push button 796. When this button is pressed the circuit is completed as follows:

From the main supply line at 600 to the line 901 as in the manual cross turning circuit, to the push button 796, through a line 797 to the point 798 on the automatic manual switch to the point 799 on the same switch, through a line 800 to the limit switch LS-12, through a line 633 to an interlock 801 and thence on a pair of lines 802 and 803 to a pair of parallel connected coils 804 and from there on to the common line 724 and thence to the main return line 601 as in the previous circuits. The interlock 801 is mechanically connected to the switch 792 which controls the opening of the segregator, in such a way that the interlock is always open when the switch 792 is closed. In other words, it prevents the opening circuit from being completed if the segregator is in the act of closing. The connection thru limit switch 499 prevents this circuit from being completed until the segregator has been raised to the extreme upper level clear of the dryer car. This circuit energizes the two coils 804, which close the switches 793 and 794 and open the switch 793ª starting the segregator motor in the "open" direction as already described. The circuit is broken when the operator releases the push button 796 or when the segregator limit switch LS-12 is actuated by the segregator reaching its extreme open position.

Manual control—down motion.

This motion is controlled manually by means of a pair of push buttons 805 and 806. The push button 805 is for the purpose of lowering the machine when any part of it is positioned over the off bearing belt. Push button 806 is for lowering when the machine is positioned free of the offbearing belt. When the push button 805 is pressed a circuit is completed as follows:

From the main supply line at 600 to the line 627 as in the manual forward circuit, to the push button 805, through a line 807 to the point 808 on the automatic manual switch to the point 809 on the same switch, through a line 810 to the limit switch 500, through a line 636 to an interlock 811, through a line 812 to an interlock 813 through a line 814 and a line 815 to an interlock 816 and thence on a pair of lines 817 and 818 to a pair of parallel connected coils 659 and from there to the common line 724 and thence to the main return line at 601, as in the previous circuits. The interlock 811 is mechanically connected to the switch 794, which switch controls the opening of the segregator, in such a way that the interlock is always open if the switch 794 is closed. In other words, this circuit cannot be completed if the segregator is in the act of opening. The interlock 813 is mechanically connected to the switch 819, which switch controls the normal or reverse turn of the quarter turn motor, in such a way that the interlock is always open when the switch 819 is closed. In other words, it prevents this circuit from being completed if the turn-table is in the act of returning to its normal or starting position. The interlock 816 is mechanically connected to the switch 676, which switch controls the "up" motion, in such a way that the interlock is always open when the switch 676 is closed. In other words, it prevents the "down" circuit from being completed if "up" motion is in progress. The above described circuit energizes the coils 659, which close the switches 660 and 661 and open the switch 662 starting the down travel as previously described. This circuit is broken when the operator releases the push button 805 or when the limit switch 500 is actuated by the machine being lowered to the brick receiving level. This circuit therefore can not be used to lower the brick lifters below the brick receiving level.

When the push button 806 is pressed the following circuit is completed:

From the main supply line at 600 through the overload relay 602 and the line 682 to the rotary controller 426, through one of the level selectors LS-B, C, D, E, F, G, H, or I, through the line 683 to the drop push button 684, through the line 697 to the interlock 696, through the line 681 and a line 820 to the limit switch LS-11, through a line 821 and a line 822 to the push button 806, through a line 823 to the point 824 on the automatic-manual switch, to the point 825 on the same switch, through a line 637 to an interlock 826, through a line 827 to an interlock 828, through the line 815 to the interlock 816, and thence to coils 659 and the main return line at 601 as in the previous circuit. The interlock 826 is mechanically connected to the switch 795, which switch controls the closing motion of the segregator, in such a way that the interlock is always open when the switch 795 is closed. In other words, it prevents the completion of this circuit if the segregator is in the act of closing. The interlock 828 is mechanically connected to the switch 727, which switch controls the cross turning motion of the segregator, in such a way that the interlock is always open when the switch 727 is closed. In other words, it prevents the completion of the circuit if the turn-table is in the act of cross turning. The interlock 816 in this circuit performs the same function as in the previous circuit.

This circuit energizes the two coils 659 and starts the down travel as previously described. This circuit is broken when the operator releases the push button 806 or when the active level selector is broken. The connection between the lines 820 and 821 in the limit switch LS-11 is not made unless the limit switch LS-11 has been actuated by the trolley reaching the extreme "out" position. This prevents this down circuit from being completed unless the hacking machine is free of the offbearing belt.

Manual control—up motion.

The up motion is manually controlled by a push button 829. When this button is pressed the circuit is completed as follows:

From the main supply line at 600, to the line 627 as in the manual forward circuit, to the push button 829, through a line 830 to the point 831 on the automatic-manual switch to the point 832 on the same switch, through a line 833 to the limit switch 499, through a line 638 to an interlock 834 and thence on a pair of lines 835 and 836 to the two coils 674 and from there to the common line 724 and thence to the main return line at 601 as in the previous circuits. Interlock 834 is mechanically connected to the switch 661, which switch controls the down motion, in such a way that the interlock is always open when the switch 661 is closed. In other words, it prevents the up circuit from being completed if the down travel is in progress. This circuit energizes the two coils 674 and starts the up travel as previously described. The circuit is broken when the operator releases the push button 829 or when limit switch 499 is acutated, by the machine reaching the extreme upper level.

Automatic control circuits.

The foregoing is a detailed description of the manual control of the various motor operations. These are secured through the positioning of the automatic-manual switch 701 to the right. When said switch is positioned to the left the motor control is automatic and none of the manual circuits can be completed. Two examples of the automatic control will be considered in detail.

In Fig. 3 is shown a differentiated automatic control used with a comparatively fast moving offbearing belt or with comparatively close spacing of brick travelling on the belt. This is hereinafter termed "fast belt control".

In Fig. 5 is shown a simplified, consolidated automatic control used with a comparatively slow moving offbearing belt or with a comparatively wide spacing of brick on the belt. This is hereinafter termed "slow belt control".

The sequence of operations for automatic control commonly starts with the hacking machine in a start position illustrated by hacking machine No. 3 in Fig. 1. In this illustration the first three rows of brick lifters are positioned over the offbearing belt at the proper level to receive the three rows of brick traveling on the belt. In the wiring diagrams, all limit switches are shown in the position in which they will be when the machine is in the said start position. As an example, consider limit switch LS-2 in Figs. 3 and 5. In this limit switch the circuit is shown broken and in Fig. 1 the trigger 298 on the crane of hacking machine No. 3 is shown positioned adjacent to this limit switch. As soon as the crane moves forward away from the start position sufficiently for the trigger 298 to engage the limit switch LS-2, the said limit switch takes the reverse position and the circuit through it is completed.

The form of automatic control shown in Fig. 3 will now be described in detail.

Automatic control—fast belt operation.

In the fast belt form of automatic operation the two components of the movement of the hacking machine from one filling stage to the next are independently initiated and independently stopped. In order to prevent collision of the oncoming column of brick with the last brick picked up by the machine, the forward crane motion circuit is completed before each stage of filling is completed and the stages of filling are completed with the crane in motion during the acceleration of the crane motor. The out trolley motion circuit is not completed until the filling of each stage is complete. Assuming eight brick lifters in each row, the forward crane travel may be initiated by the filling of the seventh, sixth, fifth, or any preceding lifter in the row, depending upon the speed of the belt, the spacing of the brick upon the belt and the acceleration rate of the motor. Herein the seventh lifter is used for that purpose. The crane and trolley travels are independently stopped by independent limit switches as hereinafter described.

With the machine in the start position, the master control circuit is set, and the first three rows of brick lifters are filled with brick as previously described. The seventh brick to enter one of its rows, as for example, No. 23 in Fig. 2, closes its appropriate switch 339—340 and makes a circuit through a line 612 as follows:

From the main supply line at 600 to the line 609 as previously described, to the contact 339 on finger No. 23 through the contact 340 and the line 612 to the limit switch LS-17, on a line 840 to the point 841 on the automatic-manual switch, to the point 740 on the same switch and thence on the line 741 through the limit switch LS-1 to the control of the forward motion of the crane motor 408 as previously described for the manual control of this motion. As the crane circuit is completed and the crane gathers speed, the eighth brick in each of the first three rows catches up to its brick lifter and is picked up. Picking up the eighth brick in a row, for example, No. 24, in the third row, initiates a circuit through a line 611 as follows:

From the main supply line at 600 to the line 609 as in the previous circuit, to the contact 339 on finger 24 to the contact 340 on the same finger, through the line 611 to the limit switch LS-4, thence on a line 842 to a line 843 to the point 844 on the automatic-manual switch to the point 763 on the same switch and from there on line 630 to the control for the out-travel of the trolley motor 417 as previously described in the section on manual control of the same motion.

It will be understood that the seventh brick in any one of the first three rows, as for example, No. 7, in row 1, or 15 in row 2, will start the forward motion as described, making the circuit through the cross tie 700 in Fig. 2. Similarly the eighth brick in each row, as for example, No. 8 in row 1 and 15 in row 2, can start the out travel of the trolley. Thus the automatic action is not hindered by removal of a brick from the belt.

When the forward travel of the crane has progressed to a point where the trigger 298 engages the fork on the limit switch LS-17 shown in Fig. 1, said limit switch is operated to open the connection between the line 612 and the line 840 and to close the connection between a line 614 and a line 845. Opening the connection 612—840 breaks the "forward" circuit and stops the crane travel. Similarly the limit switch LS-4 is operated by the trigger 297 carried on the trolley 414 to break the connection between the lines 611 and 842 and complete the connection between a line 612 and a line 846. This stops the out travel of the trolley. LS-17 has stopped the crane travel and LS-4 has stopped the out travel at such positions that the second three rows of brick lifters are aligned properly for receiving brick.

The second three rows of brick lifters, that is, rows 4, 5 and 6 are now filled in exactly the same manner as the first three rows and the circuit completed for starting the forward travel through the line 614, the limit switch LS-17, the line 845 and the limit switch LS-18, to the line 840 and thence to the forward motor controls by the same path as before. The circuit for starting the out motion of the trolley is completed through the line 613, the limit switch LS-4, the line 846, the limit switch LS-5, and the line 842 to the out motion controls by the same path as before. The forward circuit is broken when the trigger 298ᵃ actuates limit switch LS-18 to break the contact between the lines 845 and 840 and the out circuit is broken when the trigger 297 actuates the limit switch LS-5 to break the contact between the lines 846 and 842.

Successive groups of three rows of lifters are filled in like manner, the forward travel in each case being stopped by one of the limit switches LS-17 to LS-23 inclusive, successively, and the out travel being stopped in each case by one of the limit switches LS-4 to LS-10 inclusive successively.

When the seventh brick in row, 22, 23 or 24, is picked up, the circuit is made through a line 626 and the limit switch LS-23 to the line 840 to the motor controls as before. However, the forward travel this time is not stopped until the trigger 298 actuates limit switch LS-1 to stop the forward travel with the crane positioned over the dryer car. When the eighth brick in the 22nd, 23rd or 24th row is picked up, a circuit is made through a line 625 to start simultaneously three independent, separate and distinct motor motions. The out travel of the trolley is started by the following circuit: from the main supply line at 600 to the line 625 as in the previous circuits, to the limit switch LS-10 which at this point in the cycle has been moved to the opposite position from that shown on Fig. 3, thence through a line 847 to the limit switch LS-11, through the line 842 and the line 843 to the out motion controls as in the previous circuits. This circuit is broken when trigger 297 actuates limit switch LS-11 to break the contact between the lines 847 and 842. This brings the trolley as well as the crane in position over the dryer car.

At the same time the circuit is completed for closing the segregator as follows:

From the main supply line at 600 to the line 625 as before, to a line 848, to the point 849 on the automatic-manual switch to the point 787 on the same switch and from there to the closing control of the segregator motor by the same path as described in the paragraph on manual control of the same motion. This circuit is broken when the contact 393 to 394 is broken by the nut 392 in the travel limit switch LS-12 as shown in Fig. 13. This occurs when the segregator has completely closed.

At the same time quarter turn motor circuit is completed on alternate trips only, for quarter turn motion to cross back the brick on the dryer car as follows:

From the main supply line at 600 to the line 625 as before, to a line 850 to the brush 428ᵃ on the rotary controller 426, and thence on alternate trips over the dryer car only, through the circular contact 428 and one of segmental contacts 430 to the brush 430ᵃ, thence through a line 851 to the point 852 on the automatic-manual switch to the point 705 on the same switch and from there on the line 706 to the turning motor controls as previously described in the paragraph on manual control of the same motion. This motion is stopped when the trigger 296 on the turn table 435 actuates the limit switch LS-15 to open the contact between the line 706 and the line 716. This occurs when the turn table and segregator have been turned to an angle of 90 degrees to deposit the brick in cross hacked relation to a previously deposited course of brick.

When all of these motions have been completed, the circuit is completed for the down motion of the raising and lowering motor 469. This circuit is the same as that used for the manual control of the same motion as previously described in the paragraph on that subject, with the exception that the push button 806 is short circuited. This circuit is as follows:

From the main supply line 600 through the overload relay 602 and line 782 to brush 429[a] on the rotary controller 426, and thence through circular contact 429 and one of the contacts 427 and its appropriate brush 427[a] to the proper level selector LS-B, C, D, E, F, G, H or I, depending upon which level above the dryer car is desired; thence through line 683 to the drop push button 684 and line 697 to interlock 696 on the line contactor 694, which interlock is always closed when said line contactor is closed, or in other words, when the master control circuit is completed for brick engagement. From interlock 696 the circuit continues on line 681 and line 820 to limit switch LS-11 and from there on line 821 to the normally closed knife switch 854, through a line 855 to point 853 on the automatic-manual switch and from there to point 825 on the same switch, through a line 637, and the interlocks 826 and 828 to the controls for the down motion as previously described in the paragraph on the manual control of this motion. It will be remembered that interlock 826 prevents this circuit from being completed while the closing of the segregator is in progress and that interlock 828 prevents the circuit from being completed while the turning of the segregator is in progress. Likewise limit switch LS-11 prevents the circuit from being completed until the out motion has positioned the trolley over the dryer car. In this manner the segregator cannot be lowered over the dryer car until all of the three preceding motions have been completed. There is no similar interlock provided between this down circuit and the forward motion of the crane since the forward motion is invariably completed to bring the crane over the dryer car before any of the other three before mentioned motions are completed. It may be provided if desired.

The purpose of the knife switch 854 is to allow the down travel to be manually operated rather than automatically, even when all of the other motions are automatically actuated. When this switch is opened manual control of the down travel must be used.

The down motion is stopped when the tripper 486 carried on the stem 452 reaches the proper level selecting switch for setting the desired layer of brick on the dryer car. Breaking contact at the selected level selector not only stops the down travel but drops the brick as described in the paragraph headed "Master control circuits."

However, the slow drop out switch 690 which is included in the master control circuit of the brick lifters is not included in the down circuit. The slow drop out delays dropping the brick until the dynamic and solenoid brakes of the raising and lowering motor have had time to bring the motor to a stop. This delay prevents possible damage to the brick from contact with the brick lifters after deposition due to continuing travel of the motor after the circuit is broken.

Breaking the master control circuit opens the line contactors 692 and 694 whereupon the interlock 856 mechanically connected to line contactor 694 is closed. Closing said interlock 856 completes a circuit for the up travel of the raising and lowering motor as follows:

From the main supply line 600 through the overload relay 602, through line 682 and line 773 to limit switch LS-13, which limit switch at this point in the cycle is in the opposite position from that shown in Fig. 3. From limit switch LS-13 on line 774 and line 858, to the interlock 856 and from there on line 859 to point 860 on the automatic-manual switch to point 832 on the same switch, through line 833 and limit switch 499, to line 638 and the up control of the raising and lowering motor 469 as previously described in the paragraph on manual control of the same motor.

The up travel continues until the collar 498 actuates the fork of limit switch 499 to break the circuit between lines 833 and 638. This occurs when the segregator has been raised to the extreme upper level, at which level the plates of the brick lifters are above the level of the offbearing belt and the brick thereon.

When this level has been reached, the actuation of limit switch 499 simultaneously sets the circuits for four separate and distinct motor motions as follows:

The circuit for the reverse motion of the crane is from the main supply line at 600 through the overload relay 602 and the line 682 to a line 861, to limit switch 499 and a line 862 to point 863 on the automatic-manual switch, to point 753 on the same switch, through line 754 to the reverse controls of the crane motor 408, by the same path as described in the paragraph on manual control of the same motion. This circuit is broken when the trigger 298 actuates limit switch LS-2 which occurs when the crane has returned to its start position.

Simultaneously with the above the circuit for the open motion of the segregator is set from the main supply line 600 to line 862 as in the reverse crane circuit just described, to point 864 on the automatic-manual switch to point 799 on the same switch, and from there through line 800 to the opening controls of the segregator motor 362 as in the circuit previously described for the manual control of the same motion. This circuit is broken when the contacts 393[a] and 394[a] are separated by the nut 392 in the limit switch LS-12. This occurs when the segregator has opened into brick receiving position.

At the same time the circuit is set for the normal turn or reverse turn of the turn table, on alternate trips only, as follows:

From the main supply line 600 to line 862 as in the two circuits just described, to point 865 on the automatic-manual switch to point 732 on the same switch, through line 733, limit switch LS-16 and line 635 to the normal motor control by the same path as previously described in the paragraph on manual control of the same motion. This circuit is broken when the trigger 295 actuates the limit switch LS-16 to break the contact between lines 733 and 635. This occurs when the turn table has turned through an angle of 90 degrees to return to its start position. During cycles in which a quarter turn has not been made, LS-16 is already open so that this circuit cannot be completed and no turning motion takes place at this point.

At the same time the circuit is set for the in motion of the trolley as follows:

From the main supply line at 600, through the overload relay 602, on line 682 and line 773 to limit switch LS-13, which limit switch at this point of the cycle is in the opposite position from that shown in Fig. 3; thence through line 774 to limit switch 499, which limit switch at this point in the cycle is in the opposite position from that shown in Fig. 3, thence on line 775 to point 866 on the automatic-manual switch to point 779 on the same switch and from there on line 631 to the in control of the trolley motor 417 by the same path as previously described in the paragraph on manual control of the same motion. This circuit is only possible when limit switch 499 is in the position corresponding to the extreme upper travel of the segregator. In other words, the machine cannot move in over the belt until it has been raised to a level sufficient for the brick lifters to clear the belt and the brick thereon. This circuit is broken when the trigger 297 actuates limit switch LS-13 and breaks the contact between line 773 and 774. This occurs when the trolley has returned to the start position with the first three rows of brick lifters aligned with the three rows of brick traveling on the belt.

The segregator may now be lowered to the brick receiving level. This is accomplished by the actuation of limit switch LS-13 which sets the following circuit:

From the main supply line at 600 to limit switch LS-13 by the same path as in the circuit just described. From there on a line 867 to a normally closed knife switch 868, through a line 869 to point 870 on the automatic-manual switch to point 809 on the same switch, through line 810 to limit switch 500, through line 636 to the interlock 811 on the panel board, to interlock 813 on the panel board, to the control for the down motion of the raising motor 469 by the same path as previously described in the paragraph on the manual control of the same motion.

As will be remembered interlock 811 prevents the foregoing circuit from being completed if the segregator is in the act of opening, and interlock 813 prevents the foregoing circuit from being completed if the turn table is in the act of returning to the normal position. The open circuit in limit switch LS-13 prevents the circuit from being completed until the trolley has reached its start position over the belt. There is no electrical connection between this circuit and the reverse crane motion circuit since the crane motion is invariably completed and the circuit broken before the three previously mentioned motions are completed. The down travel motion lowers the segregator with the plates of the brick lifters straddling the path of the oncoming brick, but does not initiate the picking up of brick until the master controls are operated as previously described in the section on "master control circuits". The down travel is stopped when collar 498 on the vertical stem 452 actuates limit switch 500 to open the circuit between lines 810 and 636.

The machine has now returned to its start position and is ready for initiation of the master controls to start the picking up of brick for another cycle.

Automatic control—slow belt operation.

When a relatively slow off-bearing belt speed is used, the forward crane travel and the out trolley travel may both be started when the eighth or last brick lifter in each row is filled. This permits a simplified modification of wiring, the diagram of which is shown in detail in Fig. 5. Figs. 2 and 4 complete the diagram. In Fig. 5, the eighth or last brick lifters in the first three rows are represented by the numerals 8, 16 and 24, respectively. When one of these brick lifters is energized to pick up a brick, the circuits are simultaneously set for the forward and out travel.

The out circuit is from the main supply line 600 to line 609, as in the fast belt control, to brick lifter 24, through a line 711 to limit switch LS-4, through lines 842 and 843 to point 844 on the automatic-manual switch to point 763 on the same switch, through line 630 to the out controls of the trolley motor 417 as before. The forward circuit is from the main supply line 600 to line 711 as before, through limit switch LS-4 and line 842, to a limit switch LS-10[a], through a line 871 to point 841 on the automatic-manual switch to point 740 in the same switch, through line 741 and limit switch LS-1 to the forward controls of the crane motor 408 as before. These circuits are simultaneously broken when trigger 297 actuates limit switch LS-4 to break the connection between lines 711 and 842 and make the connection between lines 713 and 846.

When the fourth to sixth rows of brick are filled, the circuit is made through brick lifter 48 and line 713, limit switch LS-4, line 846, limit switch LS-5 and line 842 to the forward and out controls as before. The two motions are stopped when trigger 297 actuates limit switch LS-5.

This is repeated for each succeeding three rows of brick until the last rows are filled, when the circuits are made through brick lifter 192, a line 725 and limit switch LS-10, line 847 and limit switch LS-11. This time trigger 297 actuates limit switch LS-10[a] in passing and breaks the connection between line 842 and line 871 and makes the connection between line 871 and a line 872. Line 872 is connected to the main supply line through line 682 and the overload relay 602, and thus the circuit for the forward travel now passing through this latter path is independent of the circuit of the out-travel. The out-travel this time is stopped by actuation of limit switch LS-11 and the forward travel is stopped by actuation of limit switch LS-1 to bring the trolley and crane both into position over the dryer car.

Aside from the circuits as just described all other parts of the slow belt control are exactly similar to corresponding parts of the fast belt control shown in Fig. 3.

Variations of the automatic control.

Other variations of the automatic control are possible and are included in this invention.

As an example, the limit switches LS-17 to LS-23 inclusive may be omitted and the circuits controlled by these switches be controlled by additional contacts placed in limit switches LS-4 to 10 inclusive, respectively. That is, limit switch LS-4 would carry two circuits in addition to those shown herein and which additions are now included in limit switch LS-17. Similarly, limit switch LS-5 would include two additional circuits controlled by limit switch LS-18 and so on. By this wiring a combination of slow belt and fast belt control is obtained whereby the forward and out travels are independently initiated as in fast belt control but are simultaneously stopped as in slow belt control.

Another variation is a fast belt control wherein the seventh brick or any other brick preceding the last brick in each row initiates the forward travel through a suitable resistance which limits the speed of the crane motor to secure slower crane speed than that of the belt. The last brick in each row is then used to cut out the said resistance to bring the crane motor up to speed and at the same time to start the trolley out travel. This system can be more advantageously used with a varying speed of belt and spacing of brick on the belt than the fast belt control of Fig. 3.

Another variation of automatic control is one for use with two hacking machines depositing on the same dryer car. The dryer car is positioned to one side of the belt and between the two hacking machine filling or start positions. The first hacking machine operates as in the preceding control systems. When the second machine has completed filling it runs "forward" and "out" to clear the brick on the belt and when clear of the brick a limit switch is actuated to stop the forward travel and start the reverse movement, moving the machine parallel to the belt in the reverse direction until it is over the dryer car. The circuits for the two machines are so interlocked that when one is depositing brick the other cannot approach the dryer car position. With this arrangement one machine would do no turning while the other would always turn the brick if alternate courses were to be cross-hacked.

Hereinbefore the controls have been described of such a character that the level of the dryer car is lower than the level of the brick when lifted. The invention includes not only the foregoing arrangement, but also an arrangement, whereby the dryer car level is the same as the level of the brick when lifted, or is higher than the level of the brick when lifted from the belt unless the claims specifically set forth a sequence of operation which necessarily includes the lowering of the brick from the lifted level to the dryer car level.

The invention claimed is:

1. The combination of a brick supporting belt, a brick receiver, and a brick handling machine comprising mechanism for picking up brick, other mechanism for segregating the same and automatically controlled by the first-mentioned mechanism and other mechanism for depositing the segregated brick in said receiver.

2. The combination of a brick supporting belt, a brick receiver, and a machine for automatically and successively picking up brick until the machine is substantially filled, segregating said brick while in said machine and depositing the segregated brick in said receiver.

3. The combination of a brick supporting belt, a brick receiver, and a brick handling machine comprising mechanism for picking up brick, other mechanism for segregating the brick while picked up and automatically operable by the first-mentioned mechanism and other mechanism for depositing the segregated brick in said receiver.

4. The combination of a brick supporting belt, a brick receiver, and a machine for picking up brick, automatically segregating said brick, and automatically depositing the segregated brick following segregation.

5. The combination of a brick supporting belt, a brick receiver, and a machine for automatically picking up brick, segregating the same and automatically depositing the segregated brick following segregation.

6. The combination of a brick supporting belt, a brick receiver, and a machine for automatically and successively picking up of the brick until the machine is substantially filled, automatically segregating said brick and automatically depositing the segregated brick following segregation.

7. The combination of a brick supporting belt, a brick receiver, and a machine for picking up brick, segregating the same, depositing the segregated brick in said receiver, and automatically repositioning said machine adjacent the supporting belt for brick reception.

8. A device of the character defined by claim 7 characterized by the machine automatically and successively picking up brick until the machine is substantially filled.

9. A device of the character defined by claim 7, characterized by the automatic picking up of the brick and the automatic segregation of the same.

10. A device of the character defined by claim 7 characterized by the automatic segregation of the brick and the automatic deposition of the segregated brick following segregation.

11. A device of the character defined by claim 7 characterized by the automatic picking up of the brick and the automatic deposition of the segregated brick following segregation.

12. A device of the character defined by claim 7 characterized by the automatic and successive picking up of the brick until the machine is substantially filled, the automatic segregation of the same and the automatic deposition of the segregated brick following segregation.

13. The combination of a brick supporting belt, a brick receiver, and a hacking machine for individually picking up brick, cross-hacking the same and depositing the cross-hacked brick in said receiver.

14. A device of the character defined by claim 13 characterized by the machine automatically and successively picking up brick until the machine is substantially filled.

15. A device of the character defined by claim 13 characterized by the automatic picking up of the brick and the automatic cross-hackng of the same.

16. A device of the character defined by claim 13, characterized by the automatic cross-hacking of the brick and the automatic deposition of the brick in cross-hacked relation.

17. A device of the character defined by claim 13, characterized by the automatic picking up of the brick and the automatic deposition thereof following cross-hacking.

18. A device of the character defined by claim 13 characterized by the automatic and successive picking up of the brick until the machine is substantially filled, the automatic cross-hacking of the same and the automatic deposition of the cross-hacked brick following cross-hacking.

19. The combination of a brick supporting belt, a brick receiver, and a hacking machine for picking up brick, segregating the same, cross-hacking the segregated brick, and depositing the segregated and cross-hacked brick in said receiver.

20. A device of the character defined by claim 19 characterized by the machine automatically and successively picking up brick until the machine is substantially filled.

21. A device of the character defined by claim 19 characterized by the automatic picking up of the brick and the automatic segregation of the same.

22. A device of the character defined by claim 19 characterized by the automatic segregation of the brick and the automatic depositon of the segregated brick following segregation.

23. A device of the character defined by claim 19 characterized by the automatic picking up of the brick and the automatic deposition of the segregated brick following segregation.

24. A device of the character defined by claim 19 characterized by the automatic and

successive picking up of the brick until the machine is substantially filled, the automatic segregation of the same and the automatic deposition of the segregated brick following segregation.

25. A device of the character defined by claim 19 characterized by the automatic picking up of the brick and the automatic cross-hacking of the same.

26. A device of the character defined by claim 19 characterized by the automatic cross-hacking of the brick and the automatic deposition of the brick in cross-hacked relation.

27. A device of the character defined by claim 19 characterized by the automatic picking up of the brick, the automatic segregation of the same following picking up, and the automatic cross-hacking of the brick following picking up.

28. A device of the character defined by claim 19 characterized by the automatic segregation of the brick, the automatic cross-hacking of the brick, and the automatic deposition of the segregated and cross-hacked brick.

29. A device of the character defined by claim 19 characterized by the automatic picking up of the brick, the automatic segregation of the brick, and the automatic deposition of the segregated brick.

30. A device of the character defined by claim 19 characterized by the automatic picking up of the brick, the automatic cross-hacking of the same, and the automatic deposition of the cross-hacked brick.

31. The combination of a brick supporting belt, a stream of separated brick thereon, and a machine comprising a plurality of brick grasping devices arranged in tandem and transverse row formation, and control means for said devices for automatically and successively filling the same in tandem row formation and automatically positioning succeeding tandem rows of said devices for successive filling.

32. The combination of a brick supporting belt, a plurality of streams of separated bricks thereon, and a machine comprising a plurality of brick grasping devices arranged in tandem and transverse row formation, the number of said tandem row formations being a multiple of the number of streams of brick, and control means for said devices for automatically and successively substantially filling the number of tandem rows of devices corresponding to the number of streams of brick and automatically and successively positioning a similar number of tandem rows of devices for subsequent filling.

33. The combination of a brick supporting belt, a plurality of streams of separated brick thereon, and a machine comprising a plurality of brick grasping devices arranged in tandem and transverse row formation, and control means for said devices for automatically and successively substantially filling the number of tandem rows of devices corresponding to the number of streams of brick and automatically and successively positioning a similar number of tandem rows of devices for subsequent filling.

34. The combination of a brick supporting belt, a plurality of streams of separated brick thereon and a machine comprising a plurality of brick grasping devices arranged in tandem and transverse row formation, and control means for said devices for automatically and successively filling at least one of the number of tandem rows of devices and automatically and successively positioning at least one of the unfilled tandem rows of devices for subsequent filling.

35. The combination of a brick support, a stream of brick thereon in spaced relation and a machine including a plurality of mechanisms for picking up brick in separated relation, and other mechanism for moving said first mentioned mechanisms relatively of each other for positioning the picked up brick other than the initial spacing of first mentioned mechanisms.

36. The combination of a brick support, a stream of brick thereon in spaced relation, and a machine including mechanism for picking up brick in separated relation, and other mechanism for moving said first mentioned mechanism for moving the brick into abutting relation.

37. The combination of a brick supporting belt, a brick receiver, and a hacking machine comprising a framework adjacent both, and means carried by the framework for picking from the belt enough brick substantially to form a layer of brick and positioning the same on said receiver and returning to the belt for a second layer of brick and depositing them in cross-hacked relation to a previously deposited layer of brick on said receiver.

38. The combination of a brick supporting belt, a brick receiver, and a hacking machine comprising a framework adjacent both, and means carried by the framework for successively picking from the belt no more than a predetermined maximum of brick and positioning the same in layer formation on said receiver and returning to the belt for a second layer of brick and positioning said second layer of brick in cross-hacked relation to a previously deposited layer of brick on said receiver.

39. In a device for moving brick from a brick support adapted to support a stream of separated brick, the combination of a mechanism support, a plurality of tandem arranged brick grasping devices movably supported by said mechanism support, means connecting said devices together for suc-

cessive operation, means for moving said devices with respect to said mechanism support, and a control actuated by one of the later operated brick grasping devices upon actuation thereof for actuating said moving means.

40. In a device for moving brick from a brick support adapted to support a plurality of separated brick, the combination of a mechanism support, a plurality of brick grasping devices movably supported by said mechanism support, means for moving said devices with respect to said mechanism support, and a control actuated by a predetermined brick grasping device for actuating said moving means.

41. In a device for moving brick from a brick support adapted to support a plurality of separated brick, the combination of a mechanism support, a plurality of brick grasping devices movably supported by said mechanism support, means connecting said devices together for successive operation, means for moving said devices with respect to said mechanism support, and a control actuated by a predetermined brick grasping device for actuating said moving means.

42. In a device for moving brick from a brick support adapted to support a plurality of streams of brick, the combination of a mechanism support, a plurality of brick grasping devices arranged in row formation, means connecting together for simultaneous operation a number of said devices equal to the number of streams of brick, and means for moving said brick grasping devices with respect to said mechanism support and initiable by the first operated of the connected brick grasping devices.

43. In a device for moving brick from a brick support adapted to support a plurality of streams of brick, the combination of a mechanism support, a plurality of brick grasping devices arranged in row formation, and means connecting together for simultaneous operation a number of said devices equal to the number of streams of brick, and means for moving said brick grasping devices with respect to said mechanism support and initiable by the first operated of the connected brick grasping devices which also insures operation of the remainder of the connected brick grasping devices.

44. In a device for moving brick from a brick support adapted to support a stream of brick, the combination of a mechanism support, a plurality of brick grasping devices arranged in row formation, and means for moving said mechanism support and operable by a brick grasping device for positioning a second brick grasping device for brick reception.

45. In a device for moving brick from a brick support adapted to support a plurality of streams of brick, the combination of a mechanism support, a plurality of brick grasping devices arranged in row formation, and means for moving said support and actuatable by one of said brick grasping devices for positioning a plurality of brick grasping devices for brick reception.

46. In a device for moving brick from a brick support adapted to support a plurality of streams of brick, the combination of a mechanism support, a plurality of brick grasping devices arranged in row formation, and means for moving said support and actuatable by one of said brick grasping devices for positioning a plurality of brick grasping devices for brick reception, the initially actuated brick grasping devices and the successively positioned brick grasping devices corresponding in number to the streams of brick.

47. In a device for moving brick from a brick support adapted to support separated brick, the combination of a movably mounted mechanism support, a plurality of brick grasping devices carried by said support, means connected to said mechanism support for automatically moving the same and said brick grasping devices to position one of said devices for brick reception upon actuation of another brick grasping device.

48. A device of the character defined by claim 47 characterized by the mechanism support movably supporting said brick grasping devices, and means for moving said brick grasping devices with respect to each other upon said support, and means operable upon actuation of one of said brick grasping devices for automatically moving said actuated brick grasping devices with respect to each other upon said movable support.

49. In a device for moving brick from a brick support adapted to support separated brick, the combination of a movably mounted mechanism support, a plurality of brick grasping devices carried by said support, means connected to said mechanism support for automatically moving the same and said brick grasping devices to position a plurality of said devices for brick reception upon actuation of a similar number of brick grasping devices.

50. A device of the character defined by claim 49 characterized by the mechanism support movably supporting said brick grasping devices, and means operable upon actuation of one of said brick grasping devices for automatically moving said actuated brick grasping devices with respect to each other upon said movable support.

51. A device of the character defined by claim 49 characterized by the mechanism support movably supporting said brick grasping devices for movement in two transverse directions, and means for moving said brick grasping devices with respect to each

other upon said support in the two transverse directions.

52. A device of the character defined by claim 49 characterized by the mechanism support movably supporting said brick grasping devices for movement in two transverse directions, and means for simultaneously moving said brick grasping devices with respect to each other upon said support in the two transverse directions.

53. The combination of a brick support having a predetermined level, a brick receiver having a predetermined level, and a brick handling mechanism for removing brick from the support to the receiver and automatically positioning loads of brick in successively elevated levels upon said receiver.

54. The combination as defined by claim 53 characterized by the successive picking up of brick by the mechanism until the mechanism has been substantially filled and the simultaneous deposition of all of the picked up brick.

55. The combination as defined by claim 53 characterized by the automatic elevation of the brick handling mechanism to the same predetermined level following each deposition of brick upon the brick receiver.

56. The combination as defined by claim 53 characterized by the automatic elevation of the brick handling mechanism to the same predetermined level following each deposition of the brick upon the brick receiver, and the automatic return on said level of said brick handling machine to the brick support for successive loading.

57. The combination of a brick support having a predetermined level, a brick receiver having a predetermined level, a brick handling mechanism adapted to receive brick from the support and thereafter automatically position said brick over said receiver with a predetermined clearance between said brick and the brick supporting surface of the receiver or the brick previously deposited thereon.

58. The combination of a brick receiver having a predetermined level, a brick support having a predetermined level, and a brick handling mechanism adapted to successively position brick in superposed relation upon said receiver and automatically move in a predetermined plane from said receiver to a position adjacent said support for subsequent loading.

59. The combination of a brick receiver having a predetermined level, a brick support having a predetermined level and brick handling mechanism adapted to successively deposit brick in superposed relation upon said receiver and automatically elevate above the deposited brick following deposition until the deposited brick are cleared, move to position the mechanism over the brick support to an elevation at least sufficient to clear the brick thereon, and thereafter lower the mechanism into position immediately adjacent the belt for brick engagement.

60 The combination as defined by claim 59, characterized by the mechanism automatically positioning the brick before deposition with the same clearance either above the level of the receiver or the level of the previously deposited brick thereon.

61. The combination of a brick receiver having a predetermined level, a brick support having a predetermined level, a brick handling mechanism adapted to receive brick from the support, automatically elevate the same to a predetermined plane and thereafter lower the same into position above the receiver with a predetermined clearance between the brick and the brick supporting surface of the receiver or the previously deposited brick thereon, deposit the same, and thereafter return to the brick support for subsequent loading.

62. The combination of brick receiving means, a plurality of hacking machines, a single offbearing belt having brick thereon, and a control interposed between said hacking machines for automatically insuring the loading of each of said machines, movement thereof when loaded to the brick receiving means and deposition of the brick thereon in timed relation with a similar cycle for another of said hacking machines.

63 The combination as defined by claim 62 characterized by the automatic return of each of the unloaded hacking machines to the belt for loading and the actuation for loading of each of said unloaded hacking machines by the then loading hacking machine at such time that each hacking machine is supplied with a sufficient number of brick from belt to substantially fill the same.

64. The combination as defined by claim 62 characterized by all of the hacking machines being positioned in tandem relation along the belt.

65. The combination of a plurality of brick receivers, an offbearing belt, and a plurality of hacking machines, and means connecting said hacking machines for the successive actuation of each machine for automatically and successively filling the same and transporting the brick to and depositing the same upon one of the receivers and returning to the belt for subsequent filling.

66. A combination of the character defined by claim 65, characterized by each of the hacking machines filling automatically from said belt in a plurality of stages.

67. The combination of brick receiving means, a plurality of hacking machines, a single offbearing belt having brick thereon, said hacking machines being arranged in

tandem relation with respect to said belt, and a control interposed between the several hacking machines for automatically initiating the filling of one of the hacking machines at such a time as a predetermined number of brick have passed the filling position thereof.

68. The combination of brick receiving means, a plurality of hacking machines, a single offbearing belt having brick thereon, said hacking machines being arranged in tandem relation with respect to said belt, and a control interposed between the several hacking machines for automatically initiating the filling of one of the hacking machines at such time as a predetermined number of brick have passed the filling position thereof to substantially fill the last positioned hacking machine.

69. The combination as defined by claim 67, characterized by said automatic initiation of one of the hacking machine being secured at a predetermined point in the filling of another of said hacking machines.

70. In a hacking machine, the combination of mechanism for picking up brick, means for moving said brick relatively of each other, means for moving said brick with respect to the original axis thereof, means for moving said brick from one position to another position in the same plane, means for moving said brick from one plane to another, and switch means interposed between all of the before mentioned means for securing automatic actuation thereof or permitting the manual actuation thereof.

71. The combination of an offbearing belt having brick thereon, a brick receiver adjacent thereto, and a hacking machine for removing brick from the belt and transporting the same to and depositing the brick upon the receiver including an automatic manual switch for securing automatic operation of the machine or permitting the manual operation of the machine.

72. The method of hacking brick comprising picking up brick individually, arranging them in tandem and transverse row formation having predetermined relationships between brick and depositing all of the brick as a layer while in said relationship.

73. The method of handling brick, consisting of successively picking up sufficient brick to substantially form a layer thereof of predetermined dimensions, positioning said brick in predetermined relation with each other, and simultaneously depositing said brick in layer formation while maintaining said predetermined relationship.

74. The method of handling brick comprising continuously conveying brick, removing the conveyed brick at a plurality of stations, arranging the brick removed at each station in layer formation with a predetermined relationship therebetween, and depositing said brick while in layer formation and with said predetermined relationship maintained between the brick.

75. The method of handling brick as defined by claim 72, characterized by cross hacking an alternate layer of brick and depositing the same while in cross hacked relation.

76. The method of handling brick as defined by claim 73, characterized by cross hacking an alternate layer of brick, and depositing the same while in cross hacked relation.

77. The method of handling brick as defined by claim 74, characterized by cross hacking an alternate layer of brick, and depositing the same while in cross hacked relationship.

78. In a hacking machine, the combination of mechanism for picking up brick, means for moving said brick relatively of each other, means for moving said brick from one position to another in the same plane, means for moving said brick from one plane to another, and switch means interposed between all of said before mentioned means for securing automatic actuation thereof or permitting the manual operation thereof.

79. In a hacking machine, the combination of mechanism for picking up brick, means for moving said brick relatively of each other, means for moving said brick with respect to the original axis thereof, means for moving said brick from one position to another position in the same plane, and switch means interposed between all of the before mentioned means for securing automatic actuation thereof or permitting the manual actuation thereof.

80. In a hacking machine, the combination of mechanism for picking up brick, means for moving said brick relatively of each other, means for moving said brick with respect to the original axis thereof, means for moving said brick from one plane to another, and switch means interposed between all of the before mentioned means for securing automatic actuation thereof or permitting the manual actuation thereof.

81. In a hacking machine, the combination of mechanism for picking up brick, means for moving said brick from one position to another in the same plane, means for moving said brick from one plane to another, and switch means interposed between all of the before mentioned means for securing automatic actuation thereof or permitting manual actuation thereof.

82. In a hacking machine, the combination of mechanism for picking up brick, means for moving said brick relatively of each other, means for moving said brick with respect to the original axis thereof, and

switch means interposed between all of the before mentioned means for securing automatic actuation thereof or permitting manual actuation thereof.

83. In a hacking machine, the combination of mechanism for picking up brick, means for moving said brick relatively of each other, means for moving said brick from one position to another position in the same plane, and switch means interposed between all of the before mentioned means for securing automatic actuation thereof or permitting manual actuation thereof.

84. In a hacking machine, the combination of mechanism for picking up brick, means for moving said brick relatively of each other, means for moving said brick from one plane to another, and switch means interposed between all of the before mentioned means for securing automatic actuation thereof or permitting manual actuation thereof.

85. In a hacking machine, the combination of mechanism for picking up brick, means for moving said brick with respect to the original axis thereof, means for moving said brick from one position to another in the same plane, and switch means interposed between all of the before mentioned means for securing automatic actuation thereof or permitting manual actuation thereof.

86. In a hacking machine, the combination of mechanism for picking up brick, means for moving said brick with respect to the original axis thereof, means for moving said brick from one plane to another, and switch means interposed between all of the before mentioned means for securing automatic actuation thereof or permitting manual actuation thereof.

87. In a hacking machine, the combination of mechanism for picking up brick, means for moving said brick from one position to another in the same plane, means for moving said brick with respect to the original axis thereof, means for moving said brick from one plane to another, and switch means interposed between all of the before mentioned means for securing automatic actuation thereof or permitting the manual operation thereof.

88. In a hacking machine, the combination of brick lifting means, segregating means for moving said brick lifting means relatively of each other, a supporting framework, a crane movably supported thereon, a trolley movably supported on said crane for movement transversely of the crane movement, a turn table rotatably supported upon said trolley, and a support movable transversely of said turn table, trolley and crane and supporting said segregator for raising and lowering the latter.

89. A device as defined by claim 88, including the addition of individual power means for securing each of the foregoing movements, and control means associated with said power means for automatically operating the same in predetermined timed relation.

90. In a hacking machine for removing brick from a belt, the combination of brick lifting means, segregator means for moving said brick lifting means relatively of each other, a framework, a support movably supported by said framework for movement in a plane parallel the belt, a turn table rotatably supported with respect to said support and another support supported by said last mentioned support for movement transversely of the first support movement plane for raising and lowering the segregator means with respect to said plane.

91. A device as defined by claim 90, including the addition of individual power means for securing each of the foregoing movements, and a control associated with said power means for automatically operating the same in predetermined timed relation.

92. In a hacking machine for removing brick from a belt, the combination of brick lifting means, a support therefor, a framework, a second support movably supported by said framework for movement in a plane parallel to the belt, a turn table rotatably supported by said second mentioned support for turning said first mentioned support, said first mentioned support being movably supported upon said turn table for movement transversely to the second support movement plane.

93. A device as defined by claim 92 including the addition of individual power means for securing each of the before mentioned movements, and a control for said power means for securing automatic operation thereof in predetermined timed relation.

94. In a hacking machine for removing brick from a belt, the combination of brick lifting means, segregator means supporting said brick lifting means for securing predetermined relative movement between the same, a framework, a support movably supported thereon for movement in a plane parallel to the belt, and a second support supported by said first mentioned support and supporting said segregator means and having movement transverse to the plane of the movement of the first mentioned support.

95. A device as defined by claim 94 including the addition of individual power means for securing each of the before mentioned movements, and control means for automatically operating said individual power means in predetermined timed relation.

96. In a hacking machine for removing

brick from a belt, the combination of brick lifting means, segregator means supporting the same for relative movement therebetween, a framework, a support thereon movably supported thereby for movement in a plane parallel to the belt, and a rotatable support rotatably supported by said first mentioned support and supporting said segregator means.

97. A device as defined by claim 96, including the addition of individual power means for securing each of the before mentioned movements, and a control for securing automatic operation of said several power means in predetermined timed relation.

98. In a hacking machine for removing brick from a belt, the combination of brick lifting means, segregating means supporting the same for relative movement therebetween, a framework, a support movably supported thereby for movement transverse to a plane parallel to the belt, and another support rotatably supported by said framework for supporting and turning said first mentioned support.

99. A device as defined by claim 98 including the addition of individual power means for securing each of the foregoing movements, and a control for securing automatic operation of said several power means in predetermined timed relation.

100. In a hacking machine for removing brick from a belt, the combination of brick lifting means, segregator means supporting the same for relative movement therebetween, a framework, and a segregator support movably supported thereby for movement in a plane parallel to the belt.

101. A device as defined by claim 100, including the addition of individual power means for securing each of the foregoing movements, and a control for securing automatic operation of said several power means in predetermined timed relation.

102. In a hacking machine for removing brick from a belt, the combination of brick lifting means, segregating means supporting the same for relative movement therebetween, a framework, and another support rotatably supported by said framework for supporting and turning said segregator means.

103. A device as defined by claim 102, including the addition of individual power means for securing each of the foregoing movements, and a control for securing automatic operation of said several power means in predetermined timed relation.

104. In a hacking machine for removing brick from a belt, the combination of brick lifting means, segregator means supporting the same for relative movement therebetween, a framework, a support supported thereby for movement transverse to the plane parallel to the belt for supporting and moving said segregator means.

105. A device as defined by claim 104 including the addition of individual power means for securing each of the foregoing movements, and a control for securing automatic operation of said several power means in predetermined timed relation.

106. In a hacking machine for removing brick from a belt, the combination of brick lifting means, a framework, a support movably supported thereby for movement in a plane parallel to the belt, and another support rotatably supported by said first mentioned support for supporting and turning said brick lifting means.

107. A device as defined by claim 106 including the addition of individual power means for securing each of the foregoing movements, and a control for securing automatic operation of said several power means in predetermined timed relation.

108. In a hacking machine for removing brick from a belt, the combination of brick lifting means, a framework, a support movably supported thereby for movement in a plane parallel to the belt, and another support supporting said lifting means and supported by said first mentioned support and having movement transverse to the first support movement plane.

109. A device as defined by claim 108 including the addition of individual power means for securing each of the foregoing movements, and a control for securing automatic operation of said several power means in predetermined timed relation.

110. In a hacking machine for removing brick from a belt, the combination of brick lifting means, a framework, a turn table supported thereby for rotational movement with its axis transverse to a plane parallel to the belt, and another support for supporting said brick lifting means and supported by said last mentioned support for movement longitudinally of said transverse axis for raising and lowering the brick lifting means with respect to said plane.

111. A device as defined by claim 110 including the addition of individual power means for securing each of the foregoing movements, and a control for securing automatic operation of said several power means in predetermined timed relation.

112. A device as defined by claim 90 including the addition of individual reversible power means for securing each of the before mentioned movements, and travel limit switch means for each of the individual power means for limiting said reversible movements to predetermined distances.

113. A device as defined by claim 92 including the addition of individual reversible power means for securing each of the before

mentioned movements, and travel limit switch means for each of the individual power means for limiting said reversible movements to predetermined distances.

114. A device as defined by claim 94 including the addition of individual reversible power means for securing each of the before mentioned movements, and travel limit switch means for each of the individual power means for limiting said reversible movements to predetermined distances.

115. A device as defined by claim 96 including the addition of individual reversible power means for securing each of the before mentioned movements, and travel limit switch means for each of the individual power means for limiting said reversible movements to predetermined distances.

116. A device as defined by claim 98 including the addition of individual reversible power means for securing each of the before mentioned movements, and travel limit switch means for each of the individual power means for limiting said reversible movements to predetermined distances.

117. A device as defined by claim 100 including the addition of individual reversible power means for securing each of the before mentioned movements, and travel limit switch means for each of the individual power means for limiting said reversible movements to predetermined distances.

118. A device as defined by claim 102 including the addition of individual reversible power means for securing each of the before mentioned movements, and travel limit switch means for each of the individual power means for limiting said reversible movements to predetermined distances.

119. A device as defined by claim 104 including the addition of individual reversible power means for securing each of the before mentioned movements, and travel limit switch means for each of the individual power means for limiting said reversible movements to predetermined distances.

120. A device as defined by claim 106 including the addition of individual reversible power means for securing each of the before mentioned movements, and travel limit switch means for each of the individual power means for limiting said reversible movements to predetermined distances.

121. A device as defined by claim 108 including the addition of individual reversible power means for securing each of the before mentioned movements, and travel limit switch means for each of the individual power means for limiting said reversible movements to predetermined distances.

122. A device as defined by claim 110 including the addition of individual reversible power means for securing each of the before mentioned movements, and travel limit switch means for each of the individual power means for limiting said reversible movements to predetermined distances.

123. In a hacking machine, the combination of a relatively stationary support, a turn table rotatably supported thereby, power means for turning said turn table upon said support, a latch and catch construction interposed between said turn table and said support, and a control for releasing said latch prior to actuation of said power means.

124. In a hacking machine, the combination of a relatively stationary support, a second support movable relative thereto, a tongue carried by one of said supports, a socket carried by the other support, and a yielding connection between said tongue and socket for said socket receiving said tongue in the relative movement of said supports and retaining said supports in predetermined position.

125. In a hacking machine, the combination of a relatively stationary support, a second support relatively movable thereto, a tongue carried by one of said supports, a socket carried by the other support, a yielding connection between said tongue and socket permitting relative movement between said supports until said tongue and socket register and thereafter maintain said supports in predetermined relation, and a control for disconnecting said tongue and socket to permit relative movement of said supports.

126. A device as defined by claim 125 including the addition of power means for securing said relative movement between said supports, and a switch controlling said power means and arranged for operation for securing said power means operation only when said control means is actuated.

127. A combination as defined by claim 104, characterized by the addition of individual power means for securing each of the before mentioned movements, and an interlock between said power means whereby the power means for securing the second mentioned movement is inoperable during the operation of the power means for securing the first mentioned movement.

128. A combination as defined by claim 110, characterized by the addition of individual power means for securing each of the before mentioned movements, and an interlock between said power means whereby the power means for securing the second mentioned movement is inoperable during the operation of the power means for securing the first mentioned movement.

129. In a hacking machine, the combination of a plurality of relatively movable parts, a reversible power means for actuating one of said movable parts for securing predetermined movement thereof with respect to the remaining parts, a control for actuating said power means in one direction,

a second control for actuating said power means in the opposite direction, and an interlock between said controls, whereby either control is inoperable during the operation of the power means while under the control of the other control.

130. In a hacking machine, the combination of a plurality of parts having relative movement with respect to each other, individual power means for each of a plurality of parts for securing a predetermined relative movement thereof with respect to another of said parts, a control for each of said power means for securing actuation thereof in a predetermined direction, and another control for each of said power means for securing actuation of the said power means in the opposite direction, and a plurality of interlocks, each interposed between a pair of controls whereby one control of each pair is inoperable during the operation of the power means while under the control of the other control means.

131. In a hacking machine, the combination of a support, a trolley movably supported thereon, a turn table rotatably supported upon said trolley, a motor for actuating said turn table, and a rotary controller automatically rotatable in the reciprocatory movement of the trolley upon the support for actuating said turn table motor for turning.

132. In a hacking machine, the combination of a support, a trolley movably supported thereby, a member movably supported by said trolley, power means for moving said last mentioned member transversely of the plane of movement of the trolley, and a rotary controller automatically operable in the reciprocatory movement of the trolley for actuating the power means to move the member transversely of the trolley movement plane.

133. In a hacking machine, the combination of a support, a trolley movably supported thereby, a turn table rotatably supported by the trolley, a member coaxial with the axis of the turn table and supported thereby, power means for turning the table upon the trolley, other power means for moving the member with respect to said turn table in a direction transverse to the plane of the movement of the turn table, and a rotary controller automatically operable by the movement of the trolley upon its support for conditioning both power means for operation.

134. In a hacking machine, the combination of a supporting framework, a support movably supported thereby a member movably supported by said support for movement transverse to the plane of movement of the support upon said framework, a controller automatically operable in the movement of said support upon said framework and including a plurality of controls arranged in successive relation, a similar number of controls arranged in superposed relation, said superpositioned spacing being proportional to predetermined distances for securing selective levels of the member, power means for moving said member from one level to another, and connections between the controls of said controller and the superposed controls for controlling said power means to position automatically said member at a predetermined level.

135. In a hacking machine, the combination of a supporting stem member, a support member therefor, power means for causing relative movement between said members, a plurality of switches supported in superposed relation by one of said members, and a trigger carried by the other of said members for actuating one of said switches for controlling said power means.

136. A device as defined by claim 135, including a control means interposed between said switches and said power means, whereby but one of said switches is conditioned for controlling said power means at a given time and wherein said trigger may engage said switches without controlling said power means until the control conditioned switch is engaged by the trigger.

137. In a hacking machine, the combination of an elongated trackway, a crane movably supported thereon, said crane including an elongated trackway positioned substantially transverse to the crane supporting trackway, a trolley movably supported upon said crane supported trackway, power means for said crane, power means for said trolley, and control means for both of said power means for automatically securing simultaneous step by step movement of said crane and trolley.

138. A device as defined by claim 137 characterized by an additional control for securing the simultaneous stoppage of both of said power means.

139. A device as defined by claim 137 characterized by an additional control for securing the simultaneous starting of both of said power means.

140. A device as defined by claim 137 characterized by an additional control for securing the simultaneous starting and stopping of both of said power means.

141. In a hacking machine, the combination of a plurality of relatively movable parts, a plurality of individual power means for securing the several relative movements between said parts, a switch point for each of said power means and connected thereto, an automatic control for each of the power means and having a switch point, a manual control for each of the power means and having a switch point, and a movable switch member for simultaneously connecting all the power connected switch points selectively

to the automatic and manual switch points.

142. In a hacking machine, the combination of a plurality of brick lifting devices, a plurality of supporting members therefor having several relative movements with respect to each other, individual power means for securing the respective relative movements, and control means for said power means automatically actuatable by said devices for conditioning all of said power means for operation.

143. In a hacking machine, the combination of a plurality of brick lifting devices, a plurality of supporting members therefor having several relative movements with respect to each other, individual power means for securing the respective relative movements, and control means for said power means automatically actuatable by said devices for simultaneously actuating a predetermined plurality of said power means.

144. The combination of brick receiving means, brick supporting and supplying elongated belt means, a pair of elongated trackways extending parallel to said elongated belt means, and a plurality of unitary mechanisms movably mounted upon said trackways for picking up brick from the belt means and depositing the picked up brick upon said brick receiving means, and an inter-control between said unitary mechanisms for securing predetermined and non-interfering operation thereof.

145. In a hacking machine, the combination of a support, a member supported thereby, said support and member having relative cyclic movement therebetween, and a rotary controller automatically and unidirectionally rotatable in the relative cyclic movement.

146. In a hacking machine, the combination of at least three severally relatively movable parts, a plurality of power means for securing the several relative movements, and an interlock between said power means preventing operation of one of said power means while another of said power means is operated.

147. In a hacking machine, the combination of three or more severally relatively movable parts, a plurality of power means for securing the several relative movements, travel limit means for indicating the amount of the relative movement between a plurality of parts, and means connecting said travel limit means to one of said power means, whereby a certain predetermined maximum relative movement must be obtained of another of said power means before the first mentioned power means is actuated to secure additional predetermined relative movement.

148. In a hacking machine, the combination of three or more severally relatively movable parts, a plurality of power means for securing the several relative movements, travel limit means for indicating the amount of relative movement between a plurality of parts, and means connecting said travel limit means to one of said power means, whereby the relative movement then in progress is caused to cease at a predetermined distance and a second relative movement by another of said power means is automatically initiated.

149. In a hacking machine the combination of a supporting framework, a support member movably supported thereby, brick supporting means, means for lowering said brick supporting means with respect to said support member, and travel limit means actuated in the relative movement of said support member with respect to said framework for controlling said lowering means to prevent lowering of said brick supporting means below a predetermined level until said support member is in a predetermined position relative to said framework.

150. In a hacking machine for removing brick from a brick support, the combination of a supporting framework, a support member supported thereon for movement angularly of the brick support, brick lifting means supported by said support member. means for lowering said brick lifting means with respect to the brick support, and travel limit means actuated by movement of said support member relative to said framework for preventing actuation of said lowering means for lowering said brick lifting means below a predetermined level when said brick lifting means is positioned over the brick support.

151. In a hacking machine for depositing brick in a brick receiver, the combination of a supporting framework, a support member supported thereon for movement to and from the brick receiver, brick supporting means supported by said support member, means for lowering said brick supporting means with respect to the brick receiver, and travel limit means actuated by movement of said support member relative to said framework for preventing actuation of said lowering means for lowering said brick supporting means below a predetermined level when said brick supporting means is not positioned over the brick receiver.

152. In a hacking machine, the combination of a supporting framework, a support member movably supported thereon, brick supporting means supported by said support member for movement from one level to another, power means for moving said support member with respect to said framework, and travel limit means actuated in said level to level movement for preventing the actuation of said power means unless said brick supporting means is above a predetermined level.

153. In a hacking machine for removing from a brick support the brick thereon, the combination of a supporting framework, a support member supported thereon for movement angularly of the brick support, brick lifting means supported by said support member for movement from one level to another with respect to the brick support, power means for moving said support member with respect to said framework, and travel limit means actuated in said level to movement for preventing actuation of said power means for movement of said support member toward the brick support unless said brick lifting means is above the level of the brick support and brick thereon.

154. In a hacking machine for depositing brick on a brick receiver, the combination of a supporting framework, a support member supported thereon for movement to and from the brick receiver, brick supporting means supported by said support member for movement from one level to another with respect to the brick receiver, power means for moving said support member with respect to said framework, and travel limit means actuated in said level to level movement for preventing actuation of said power means unless said brick lifting means is above the level of the brick receiver and any brick thereon.

155. In a hacking machine, the combination of brick supporting means, mechanism for moving said means with respect to each other, power means for actuating said mechanism, a support member supporting and moving said brick supporting means from one level to another, and travel limit means operable in said level to level movement for preventing the actuation of said power means unless said brick supporting means is above a predetermined level.

156. In a hacking machine for depositing brick on a brick receiver, the combination of brick supporting means, mechanism for moving said brick supporting means with respect to each other, power means for actuating said mechanism, a support member supporting and moving said brick supporting means from one level to another relatively of said brick receiver, and travel limit means preventing actuation of said power means unless said brick supporting means is above the level of the brick receiver and any brick thereon.

157. In a hacking machine, the combination of brick supporting means, mechanism for moving said brick supporting means with respect to the original axis thereof, power means for actuating said mechanism, a support member supporting and moving said brick supporting means from one level to another, and travel limit means operable in said level to level movement for preventing the actuation of said power means unless said brick supporting means is above a predetermined level.

158. In a hacking machine for depositing brick on a brick receiver, the combination of brick supporting means, mechanism for moving said brick supporting means with respect to the original axis thereof, power means for actuating said mechanism, a support member supporting and moving said brick supporting means from one level to another relatively of said brick receiver, and travel limit means for preventing actuation of said power means unless said brick supporting means is above the level of the brick receiver and any brick thereon.

159. In a hacking machine for removing from a brick support the brick thereon, the combination of brick supporting means, mechanism for moving said brick supporting means with respect to the orginal axis thereof, power means for actuating said mechanism, a support member supporting and moving said brick supporting means from one level to another relatively of said brick receiver, and travel limit means actuated in said level to level movement for preventing actuation of said power means for movement of said support member toward the belt unless said brick supporting means is above the level of the brick receiver and brick thereon.

160. The combination of a brick support, a brick receiver, and a machine for automatically and successively picking up brick from said support until the machine is substantially filled and subsequently depositing the picked up brick in said receiver.

161. The combination of a brick support, a stream of brick thereon in separated relation, and a machine for picking up brick in said relation and thereafter moving the brick into a relationship other than the initial relation.

162. The combination of a brick support, a stream of brick thereon in separated relation, and a machine for picking up brick in said relation and thereafter moving the brick into abuttable relationship.

163. The combination of a brick support, a stream of brick thereon in spaced relation, and a machine for picking up brick in separated but another spaced relation and thereafter moving the brick into a relationship other than either of spaced relationships.

164. The combination of a brick support, a stream of brick thereon in separated relation, and a machine for successively picking up the brick and moving the same into a relationship other than the initial relationship.

165. A device of the character defined by claim 7 characterized by the automatic segregation of the brick.

166. A device of the character defined by

claim 1 characterized by the depositing mechanism being automatically actuated upon completion of the picking up and segregation for automatic deposition of the brick.

167. A device of the character defined by claim 7 characterized by the automatic deposition of the brick.

168. A device of the character defined by claim 13 characterized by the automatic deposition of the brick.

169. A device of the character defined by claim 19 characterized by the automatic deposition of the brick.

170. A device of the character defined by claim 19 characterized by the automatic segregation of the brick.

171. A device of the character defined by claim 13 characterized by the automatic cross-hacking of the brick.

172. A device of the character defined by claim 19 characterized by the automatic cross-hacking of the brick.

173. A device of the character defined by claim 19 characterized by the automatic segregation of the brick, and the automatic cross hacking of the same.

174. In a device for moving brick from a support adapted to support a plurality of separated brick, the combination of a mechanism support, a plurality of brick grasping devices movably supported by said mechanism support, means for moving said devices with respect to said mechanism support, and a control actuated by the first actuated of a plurality of predetermined brick grasping devices for actuating said moving means.

In witness whereof, I have hereunto affixed my signature.

GRAFTON E. LUCE.

Approved J. W. Watson

Approved John R. Price

Approved L. E. A. Kelso

Date June 9, 1949