53-25

VALUE ANALYSIS SUGGESTION SHEETS

TELECHRON CLOCK

Compiled by:

Svein Hvamb
March 1953

Schenectady, March 30, 1953

Mr. L. A. Davis
Manager-Manufacturing
Telechron Department
Ashland, Massachusetts

Dear Pete:

As you know, because Bob Kane had a few things to finish before he could start his effective full-time Value Analysis operation, we have assisted him by some preliminary studies. His operation is now in full swing and we bring our activities to a close.

Value Analysis study consists of a quick but intensive search, a little into engineering, a little into manufacturing, and a lot into the vendor capability area. Accordingly, the attached suggestions will in some cases cover what we call "blasting" and in others "refining" in the fields of engineering and manufacturing.

Of course, during this brief period only a few items could be studied intensely. Accordingly, most of the job remains yet to be done. We hope that the suggestions made will be modified as needed and will result in more business for the Telechron Department at a better profit.

In making these studies, we have used all of the ideas given to us so generously by members of the various departments at Telechron and have tried, where possible, to add a supplementary idea or twist to help the projects further along.

Svein and I have truly enjoyed this interesting project and want you and your organization to feel free to call on us at any time when you feel our help on some specific point would substantially assist.

Sincerely,

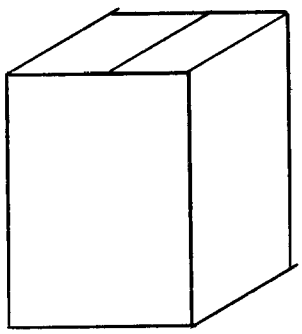
L. D. Miles, Manager
Value Analysis Unit

LDM:AEM

Unit Pack
Dwg. PS-752-1

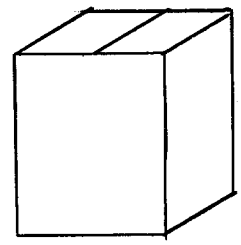
Present:

2-colors
print



Proposed:

2-colors
print



	Cost/Unit	
Present:		
Unit Pack	.04080	
Filler	.01855	
Total		.05935
Proposed:		
Unit Pack	.02150	
Filler	.01800	
		.03950
		.01985

Annual Savings -- ~~$19~~, 850.00
195,500.00

COMMENTS:

Proposed Unit Pack is printed in two colors. Finished with varnish. Glued seal end bottom and tuck-top. The tuck-top is self locking. High quality stock.

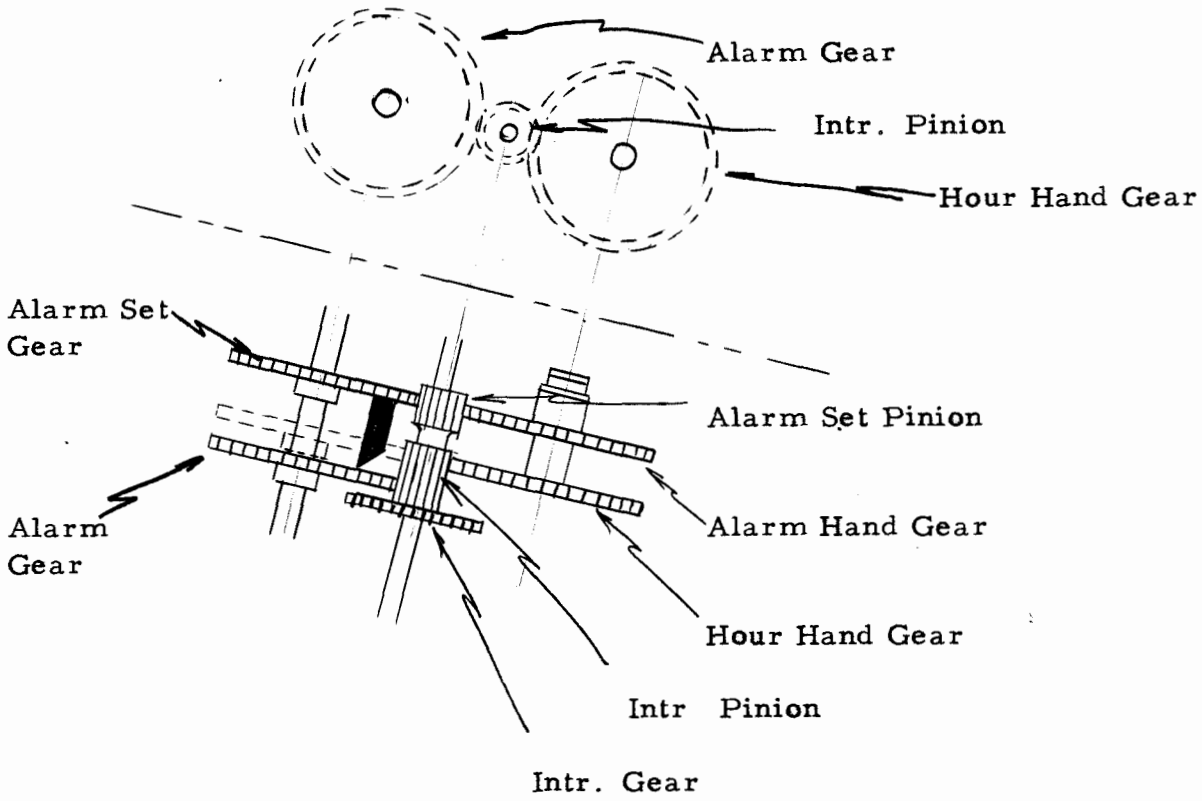
The proposed unit is made somewhat smaller than the present, and is made to pack the high production units only.

Print design proposals without cost.

Value Analysis Unit
Materials Services Dept.
March 1953

SH:AM

PROPOSED CHANGE IN CLOCK DRIVE



Proposed Change:

Move the Inter-Pinion in such position as to drive the Hour Hand Gear and the Alarm Gear directly. The Alarm Gear will now turn in opposite direction of the present system. In similar manner, the Alarm Set Pinion will drive the Alarm Hand Gear and the Alarm Set Gear in opposite direction. It will be necessary to reverse the slope of the interlock projection on the Alarm Set Gear and also the lip on the Alarm Gear. The relative position of the gears will be the same as before.

The Alarm Gear that at present is free to slide on the molded plastic gear can, in the new design, slide freely on the Inter. Pinion and consequently the molded plastic gear can be replaced by a stamped aluminum or brass gear or zinc die cast gear.

Present:
Dwg. CM-1310-17-G1

	Material	Dir. Labor
H.H. Gr. - Phen.	$.00145	$.00235
O.H. (130% D.L.)		.00306
Dir. Labor / O.H.		.00541
		.00145
Shop Cost		$.00686

Proposed:

H.H. Gr. Brs.	$.00239	$.00030
O.H. (130% D.L.)		.00049
Dir. Labor / O.H.		.00069
		.00239
Shop Cost		$.00308
Cost Difference	.00686	
	.00308	
	.00378	

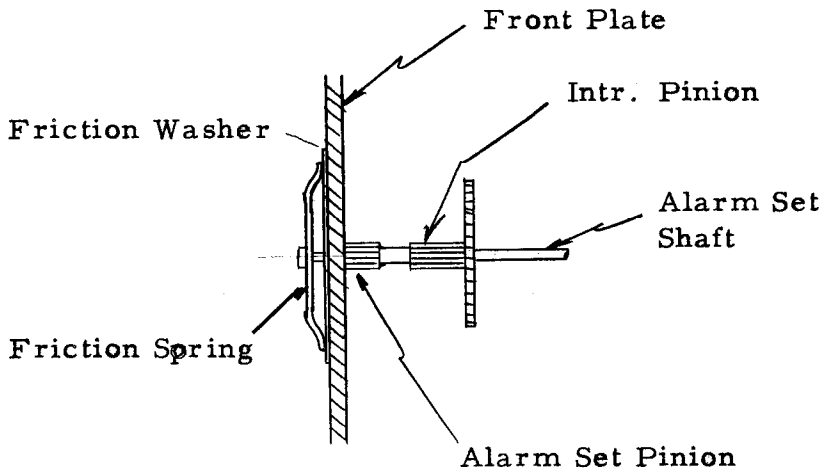
Annual Saving -- $37,800.00

Value Analysis Unit
Materials Services Dept.
March 1953

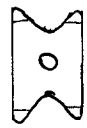
SH:AM

PROPOSED CHANGE IN CLOCK DRIVE

a)



b)



Friction
Spring

Place the Alarm Set Friction Spring on the Alarm Set Shaft as shown in the above drawing. The friction or spring action thus becomes less critical and a simpler less expensive friction spring may be used. It should be apparent that the Alarm Set Gear sees about 6 times (gear ratio opp. 6/1) the actual friction exerted by the spring in the new design.

The new design has also the advantage that less heavy gears are needed in the alarm set system as the gears do not carry the friction load at any time.

Dwg. CM - 1007 - 19

Present: Phos. Br.

	Material	Dir. Labor
Alarm Set friction spring	.00347	.00070
O. H.		.00091
		.00161
	.00347	
	.00161	
Shop Cost	.00508	

Proposed Change in Clock Drive (Cont.)

Proposal 1)

Reducing spring size 1/3 shaped as in dwg. b).

	Material	Dir. Labor
Friction Spring	$.00116	.00070
		.00091
		.00161
	.00116	
	.00161	
Shop Cost	.00277	

Difference: .00508
.00277

.00231

Annual Savings -- $23,100.00

Proposal 2)

Reduce spring size 1/3 using spring steel

Friction Spring	$.0004	.00070
O. H.		.00091
		.00161
Shop Cost	$.00201	

Difference: .00508
.00201
.00307

Annual Savings -- $30,700.00

Further saving may be made in reducing the size of the gears (less heavy) and also by using less expensive material.

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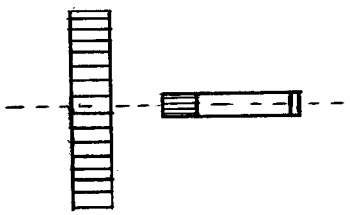
March 1953

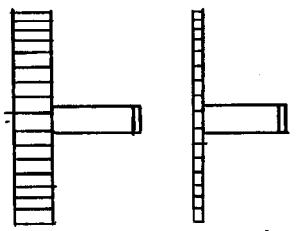
SH:AM

Hour Hand Gear & Sleeve
CM-1007-88 G3

Present



Proposed



	Cost/piece		
	Material	Dir. Labor	Shop Cost
Present:			
Gear Phen.	.00145	.00235	
Sleeve Brs.	.00304	.00080	
Asm.		.00310	
TOTAL	.00449	.00625	.01886

Proposed:

a) Zinc Die Casting - $.01000
b) Zinc Die Casting - . 0075

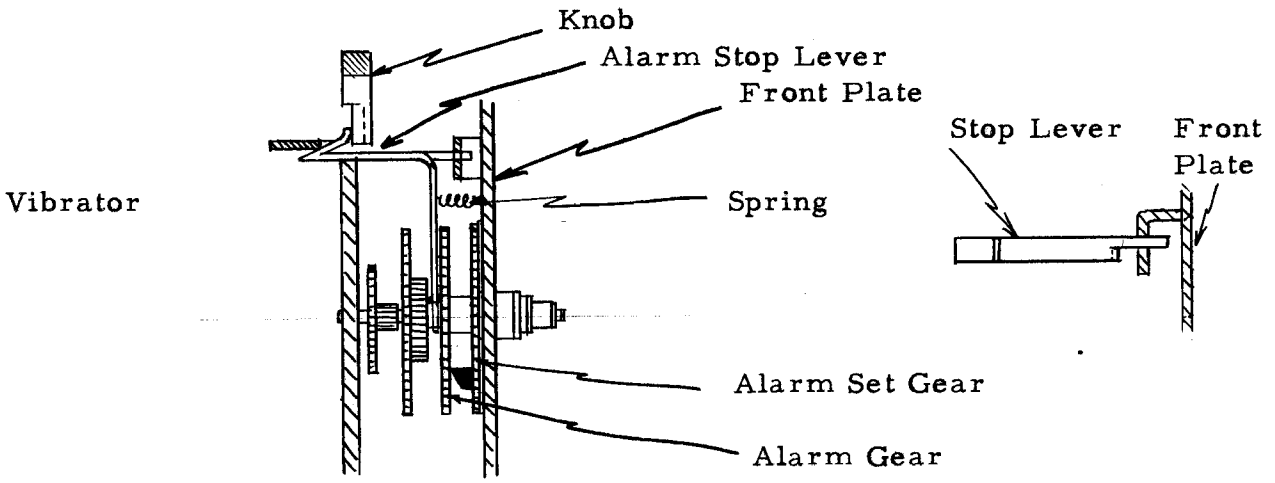
Annual Savings a) $88,000.00 - b) $110,000.00

Comments: Zinc die casting has good wearability (91 Brinell) and high precision is obtainable.

Value Analysis Unit
Materials Services Dept.
March 1953

SH/f

PROPOSED CHANGE IN CLOCK DRIVE



The above is a drawing of the main clock drive in which the alarm release mechanism is designed so as to work on the hour hand gear directly. It has been experimentally determined the vibrator action of the vibrator can be completely stopped by inserting a wedge-formed stop lever as shown above. The movement of the stop lever to perform the necessary wedge action does not have to exceed 1/8". This, however, means that the hour hand gear and sleeve should be able to move freely in the axial direction about 1/8", and adjustments have to be made on the present sleeves to allow for this. The hour hand would be in normal position at all times except when the alarm goes off upon which the gear, sleeve and hand will pop 1/8".

The alarm stop lever has to be redesigned as indicated and may extend outside the case as at present or the entire stop mechanism may be redesigned as shown on the following page (proposed appearance design).

The present hour hand gear and alarm hand gear will be replaced by the cam shaft gear and the alarm set gear respectively.

The proposed design allows elimination of the following parts:

	Material	Dir. Labor
Stop Lever Bracket (est.)	.00050	.00030
Hub - Cam Shaft	.00103	.00082
Disc - Cam Sft. Al	.00114	.00058
Cam Shaft	.00'47	.00080
Cam Shaft Asm.		.00530
Washer - Cam Sft.	.00127	
Alarm Hand Gear Al	.00448	.00050
Hour Hand Gear Phen.	.00145	.00235
Total	.01134	.01065

Proposed Change in Clock Drive (Cont.)

Overhead	.01385
	.02450
_	.01134
Shop Cost	.03584

Annual Savings app. $350,000.00

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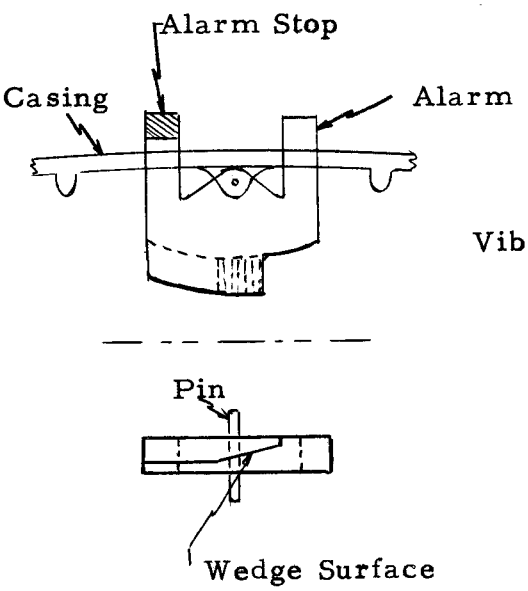
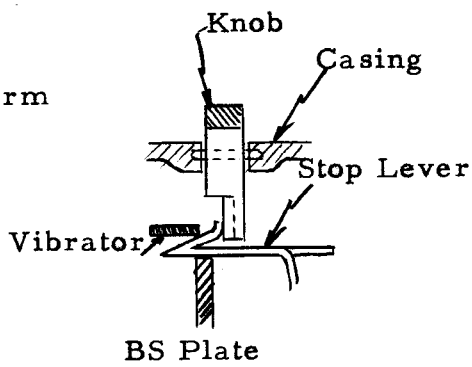
Materials Services Dept.
March 1953

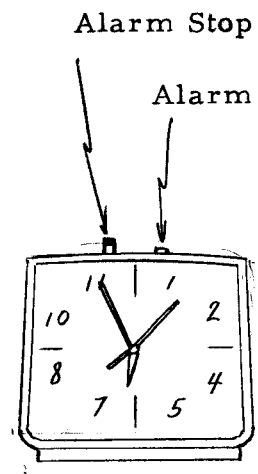
SH:AM

PROPOSED APPEARANCE DESIGN

The following redesign of the alarm stop devices was made in connection with the previous proposed change in the general clock drive. The general idea is to stop the alarm by depressing a button on the top of the clock case; however, in the proposed design a two button system is introduced and arranged as shown.







The Alarm Stop Button should be coated with a self-illuminating material.

When either button is depressed, the top surface of the other is even with the case surface.

As the Alarm Stop Button is depressed, the wedge surface locks the Alarm Stop Lever in such position as to wedge the vibrator.

When the Alarm Button is depressed, the Alarm Stop Lever is released and resting against the hour hand gear.

During assembly of the case and clock movement, the alarm button should be depressed so as not to distort the alarm stop lever.

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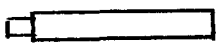
Materials Services Dept.
March 1953

SH:AM

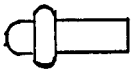
Field Spacer Stud Al. and Field Spacer
Dwg. CM-671-96, CM-548-184G1

Present



Screw Machine parts

Proposed



Bead Chain Product

	Cost/Unit		
	Material	Direct Labor	Shop Cost
Present:			
Field Stud Al.	.00089	.00082	.002776
Field Spacer Al.	.00043	.00075	.002155
Estimated Assm. Labor			.001000
		Total	.005931

Proposed:
Spacer-Guide Brs. -- $3.00/M

Annual Savings -- $29,000.00

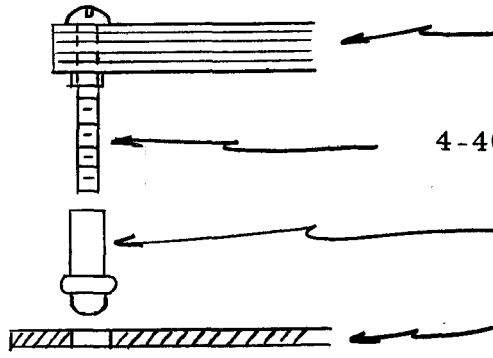
COMMENTS:

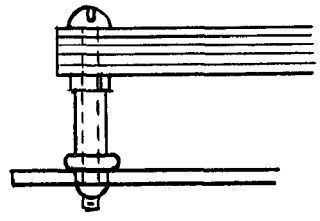
The proposed spacer has been experimentally tried in the present clock. It serves as a guide for the field screw and at the same time provides as a field spacer.

Value Analysis Unit
Materials Services Dept.
March 1953

SH:AM

ASSEMBLY DRAWING





Assembly

A smaller diameter spacer will lower cost considerably.

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March 1953

SH:AM

Base Plate Assembly
Dwg. CM-1310-13G1

Present:	Proposed:
Fabricated	Zinc Die Casted

Present:

	Cost/unit		
	Material	Dir. Labor	Shop Cost
Base Plate Assembly	.01753	.01593	.05417
2 Spreader Posts			.00462
2 - 4-40 x 1-1/8 Screws			.00348
Vibrator material reduced by			.00350
2 Rivets (Vibrator)			.00176
			.06713

Proposed:

B.P. zinc die casting	.05500
	.01213

Annual Savings: $121,300.00

COMMENTS:

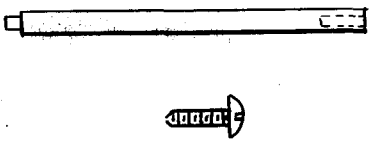
Zinc die-castings have been used in many similar applications successfully.

Value Analysis Unit
Materials Services Dept.
March 1953

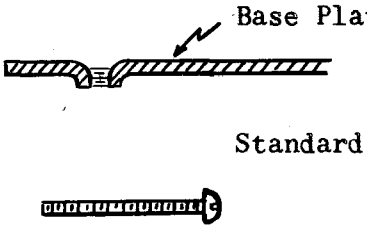
SH/f

Front Plate Studs & Screws
Dwg. CM-582-97G6, CM-1074G22

Present



Proposed



	Cost/unit (2)		
Present:	Material	Dir. Labor	Shop Cost
Studs Al.	.00370	.00258	.00964
Screws Br.	.00358	.00048	.00467
			.01431

Proposed:

Standard Screws - plated steel			
$2.25/M -	.00225	per unit	.00450
			.00981

Annual Savings - $90,000.00

Comments: In the above proposal the base plate is extended to provide material for extruded threaded hole.

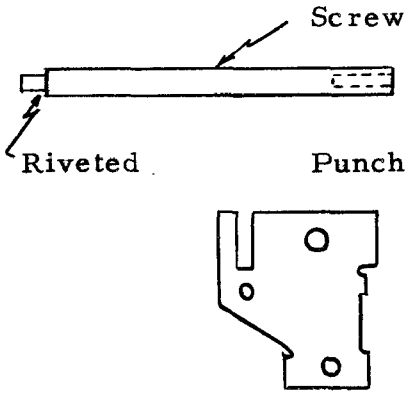
The extrusion is made such as also to provide a guide for the screw.

Value Analysis Unit
Materials Services Dept.
March 1953

SH/f

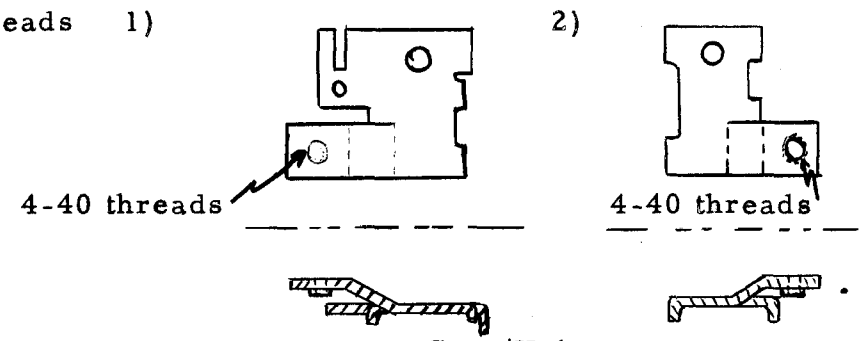
Front Plate Studs
Dwg. CM-582-97G6
Alarm Stop Lever Bracket
Dwg. 835-42G1

Present:



Proposed: Punched and threaded in one operation.

Punch Press Parts



Present:

	Cost/Unit		
	Material	Labor	Shop Cost
Stud Al.	.00370	.00258	.00964
Bracket St.	.00057	.00040	.00149
Total			.01113

Proposed:

Bracket 1). St. (Vendor)	.00347		
Bracket 2). St. (Vendor)	.00331		
Total	.00678		.00678
			.00435

Annual Savings -- $43,500.00

COMMENTS:

The proposed brackets are fastened in similar manner as the present Alarm Stop Bracket and will replace the long aluminum studs which are used to fasten the clock casing.

Value Analysis Unit
Materials Services Dept.
March 1953

SH:AM

Field Spacer
CM-548-184 G1

Present

Proposed

	Cost/piece		
	Material	Dir. Labor	Shop Cost
Present:			
Spacer Al.	.00043	.00075	
Asm.		.00050	
TOTAL	.00043	.00125	.003248

Proposed:
Spacer extruded from base plate

Estimated Annual Savings - $30,000.00

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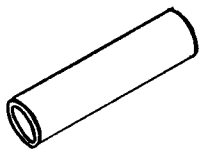
Materials Services Dept.
March 1953

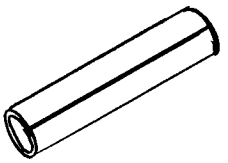
SH/f

Al. Set Spacer
CM-1340-24 G10

Present



Proposed



	Cost/piece		
	Material	Dir. Labor	Shop Cost
Present:			
Material	.00029		
Al. tube			
Cut to length		.00172	.00425
Vendor Quotation:			
Split Spacer (Al)	$2.50/M		
Difference:	0 .00425		
	0.00250		
	.00175		

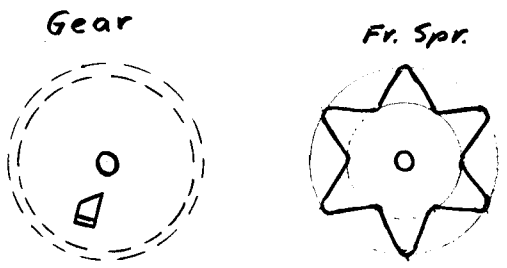
Annual Saving: -- $17,500.00

Value Analysis Unit
Materials Services Dept.
March 1953

SH:AM

Alarm Set Gear Asm.
CM-1007--86 G1

Present



Proposed

	Cost/piece		
	Material	Dir. Labor	Shop Cost
Present:			
Friction Spring Ph. Br.	.00347	.00070	
Gear Brs.	.00400	.00031	
TOTAL	.00747	.00101	.00978
Proposed:			
Spring & Gear	.00400	.00070	.00561
			.00417

Estimated Annual Savings - $40,000.00

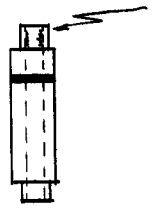
Comments: Proposed gear and spring as one stamping. Material Ph. Bronze.

Value Analysis Unit
Materials Services Dept.
March 1953

SH/f

Plate Spacers (Studs)
Dwg. CM-736-104 G2
CM-736-102 G2

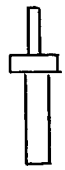
Present



Threaded

Screw Machine
Al.

Proposed



Cold Headed Stl.

	Cost/Unit		
	Material	Direct Labor	Shop Cost
Present			
1 stud (CM-736-104)	.00165	.00063	.00310
2 studs (CM-736-102)	.00330	.00248	.01000
TOTAL			.01310
Proposed:			
Cold Headed Steel	$.60/M Unit		.00180
			.01130

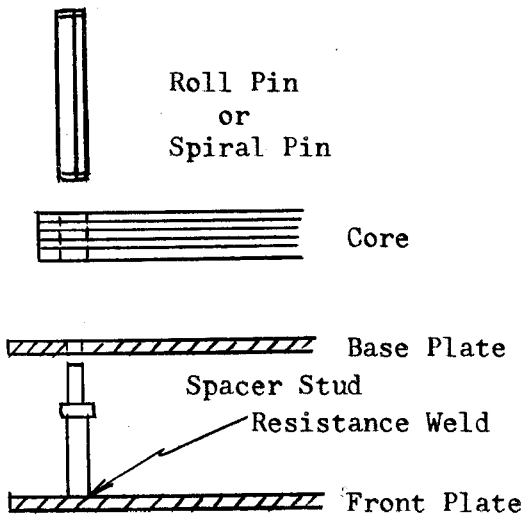
Annual Savings -- $113,000.00

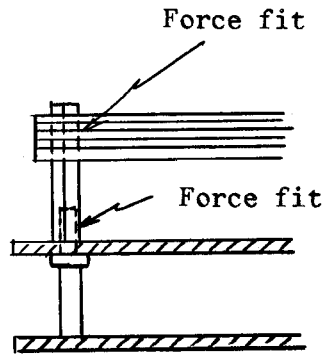
See assembly drawing.

Value Analysis Unit
Materials Services Dept.
March 1953

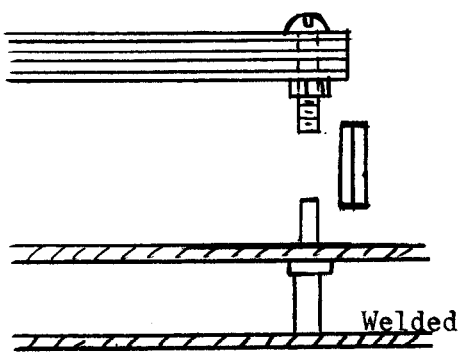
SH:AM

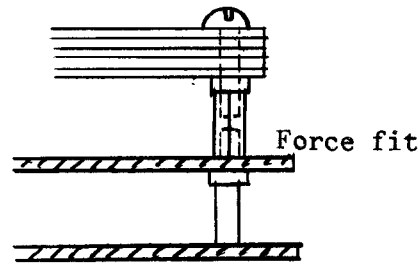
Assembly Drawing





The pin type fastener is forced through the laminated core and on the end of the cold headed spacer stud.





The core screw rests inside the pin now acting as a spacer and fastener.

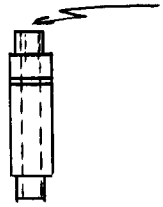
NOTE: The spacer studs are resistance welded to the front plate. The tolerance from the stud shoulder to front plate are held within $\pm$ .001

Value Analysis Unit
Materials Services Dept.
March 1953

SH/f

Plate Spacer Stud
Dwg. CM-736-104 G2
CM-736-102 G2

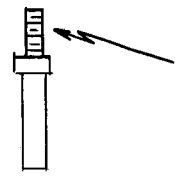
Present



Threaded

Screw Machine
Al.

Proposed



Rolled Threads
Cold-headed
Stud.
Stl.

	Cost/Unit		
Present:	Material	Direct Labor	Shop Cost
1 stud (CM-736-104)	.00165	.00063	.00310
2 studs (CM-736-102)	.00330	.00248	.01000
TOTAL			.01310
Proposed:			
Cold headed stud with rolled threads	$.94/M per unit		.00282
			.01028

Annual Savings -- $102,280.00

See assembly drawing.

Value Analysis Unit
Materials Services Dept.
March 1953

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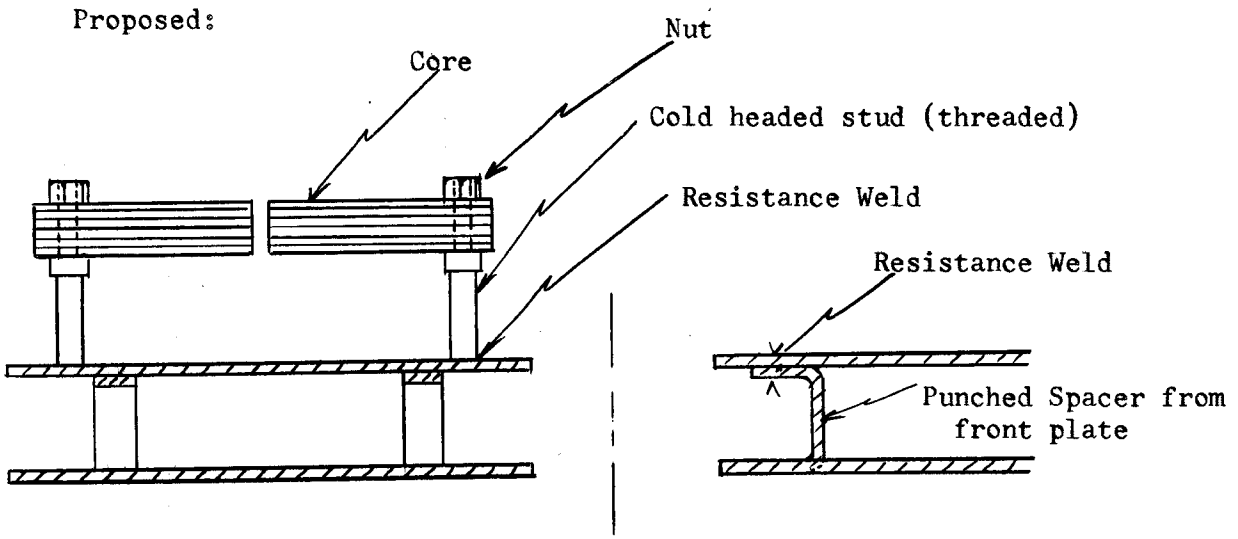
Clock Assembly

Proposed:



Present:	Cost/unit Material	Dir. Labor	Shop Cost
1- Stud (CM-736-104)	.00165	.00063	.00310
2- Studs (CM-736-102)	.00330	.00248	.01000
2- Spreader Posts (Al.)			.00462
2- 4-40 x 1-1/8 Screws (Stl.)	.00278	.00032	.00352
TOTAL			.02124

Proposed:

2- Cold-headed studs		.00188	
2- Palnut-locknut (4M40)		.00059	
TOTAL			.00247
			.01877

Annual Savings: $187,700.00

COMMENTS:

The plate spacer is punched out of the front plate. Small projection in base plate and punched spacer may serve to position the base plate.

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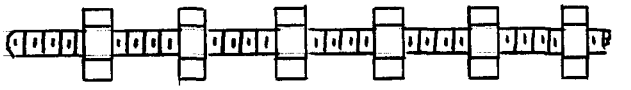
Head Screw
2CM-1074
4-40 x $\frac{1}{4}$ Brs.

Present

Special Screw

Proposed



Screwstick

	Cost/piece		
	Material	Dir. Labor	Shop Cost
Present:			
Screw Brs.	.00179	.00048	.00289
Proposed:			
Screwstick	$2.88/M		.00288

Comments: The use of screwsticks can cut the assembly cost up to 50%.

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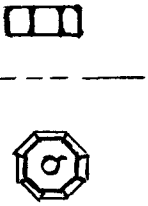
Stator Steel Hex Nut
4-40 x 3/32

Present:

Proposed:



Present:

4-40 hex nut (stl.)	@	$.00124

Proposed:

4M40 Palnut-Locknut	@	$.00059
		$.00065

Annual Savings: $6,500.00

COMMENTS: The proposed type of fastener has good holding ability and self locking characteristic.

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Vibrator Rivets
Dwg. 2-CM-1152 G71

Present		Proposed	
Tubular Rivet		Eyelet	

Present:
From outside supplier ~~$.80~~ .88/M

Proposed:
From outside supplier $.50/M

Annual Savings --~~$6,000.00~~ 7,600.00

COMMENTS:

The riveting cost is reduced considerably by the use of eyelets, as a spinning tool does the job in place of a riveting operation and is much faster.

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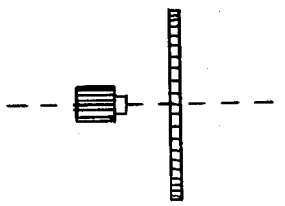
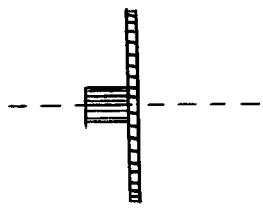
Inter. Gear & Pinion
CM-1007-95 G1

Present



Proposed



	Cost/piece		
	Material	Dir. Labor	Shop Cost
Present:			
Pinion Brs.	.00159	.00075	
Gear Brs.	.00239	.00030	
Asm.		.00310	
	.00398	.00415	.01353

Proposed:
Zinc die casting - $.00675

Annual Savings - $67,000.00

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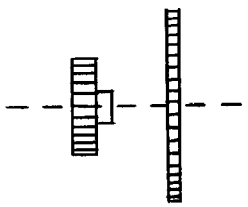
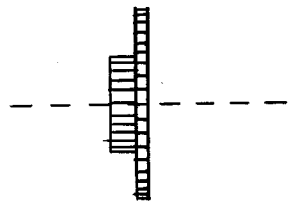
Minute Hand Gear & Pinion
CM-1310-9 G1

Present



Proposed



	Cost/piece		
	Material	Dir. Labor	Shop Cost
Present:			
Pinion Brs.	.00595	.00114	
Gear Brs.	.00309	.00028	
Asm.		.00322	
TOTAL	.00904	.00464	.01970
Proposed:			
Zinc Die Casting - $6.75/M			.00675
			.01295

Annual Savings - $120,000.00

Comments: Zinc has good wearability (Brinell 91) and can be die casted with high precision.

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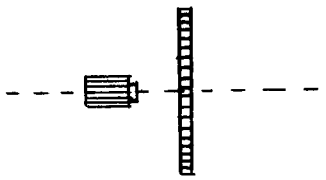
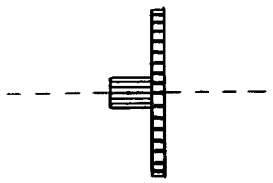
Second Hand Gear & Pinion
CM-582-1 G6

Present



Proposed



	Cost/piece		
	Material	Dir. Labor	Shop Cost
Present:			
Pinion Brs.	.00101	.00138	
Gear Brs.	.00159	.00027	
Asm.		.00100	
	.00260	.00265	.008775
Proposed:			
Zinc die casting - $5.5/M			.005500
			.003275

Annual Savings - $32,000.00

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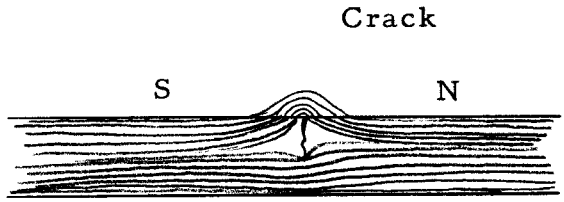
SH/jdf

PROPOSED LOW COST CLOCK MOTOR

Purpose: The purpose of this design is to create a low cost, low rpm. electric clock motr.

Discussion: The principle under which the motor operates is demonstrated in Figure I

Fig. I.



If magnetic flux is passed through a piece of steel having a surface defect such as a crack, part of the magnetic flux lines will tend to jump the air gap or crack, such as to create a north and a south pole across it.

Applying this principle to a circular magnetized steel ring in which radial slots are cut, Fig. II, the result is a set of north and south poles proportional to the number of slots. A 300 rpm motor has 24 slots.

Fig. II

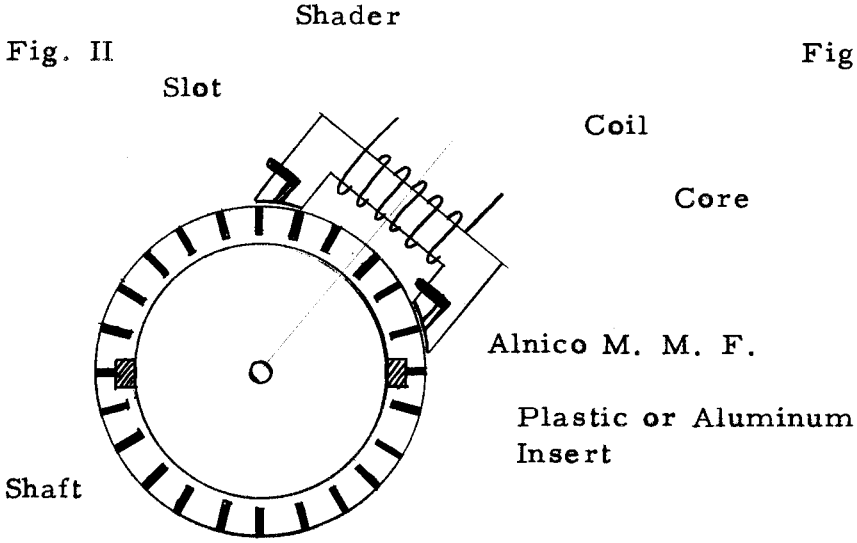
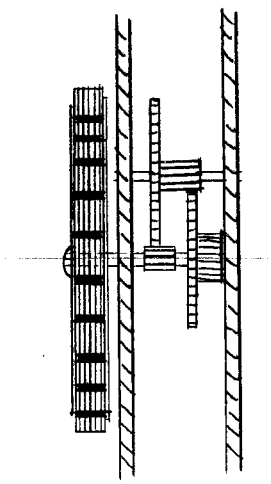
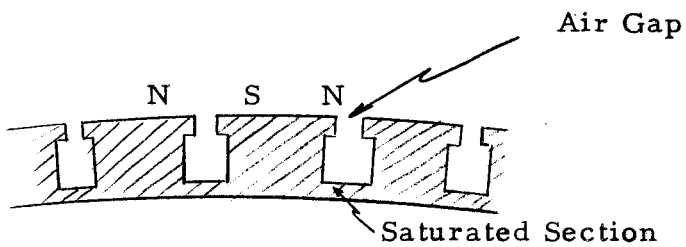


Fig. III



Since this motor operates on the leakage flux across the airgaps, it is of course desirable to make this leakage flux as strong as possible. This can be accomplished by cutting the slots so deep as to saturate the remaining steel under the slot. Preferably the slots may be made as indicated in Figure IV.



The following are three suggested methods for making the rotor.

1. Solid ring or laminated stampings of tungsten steel
2. Soft steel laminations with Alnico inserts (Fig. II & III)
3. Molded magnetic powder ring ("Hardyne" high H low B)

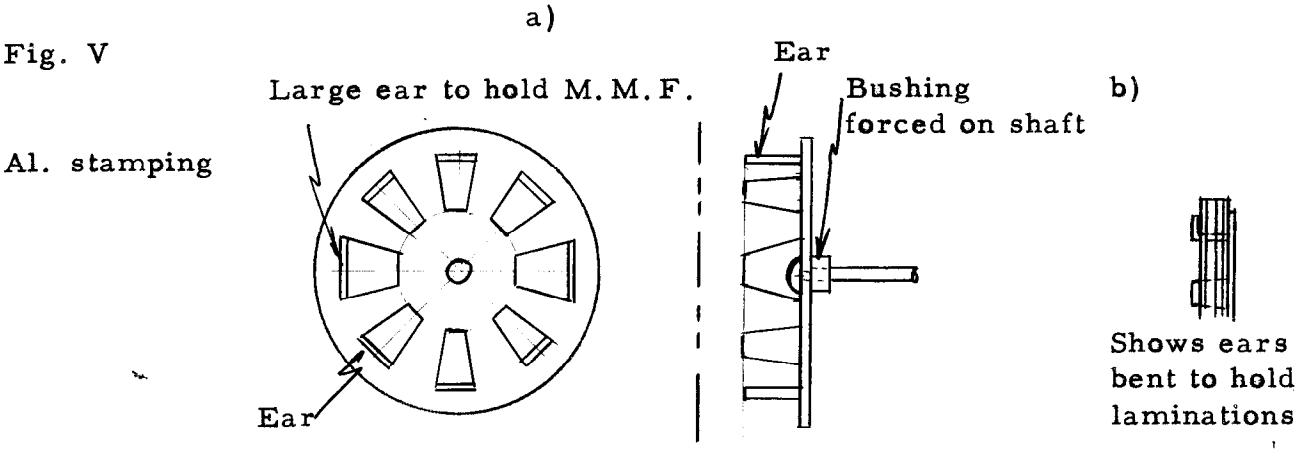
Method No. 1 is not likely to be practical. A solid ring with machined slots made of tungsten steel or other magnetic material would be quite expensive to make. Stampings of the same material could be made at lower cost but the changes are that such magnetic material would gradually lose its magnetism when used in this application.

Method No. 2 is recommended by consulted specialists and can be made at very low cost. Two Alnico inserts priced at $.0144 each are believed sufficient to supply the necessary magnetomotive force for this application. The Alnico inserts should be placed directly under an airgap as indicated in Fig. II. The ring may consist of one or more laminations of cold rolled steel.

Method No. 3 is also recommended due to the desirable characteristics of the Hardyne material. However, the cost is estimated to be somewhat higher than method 2.

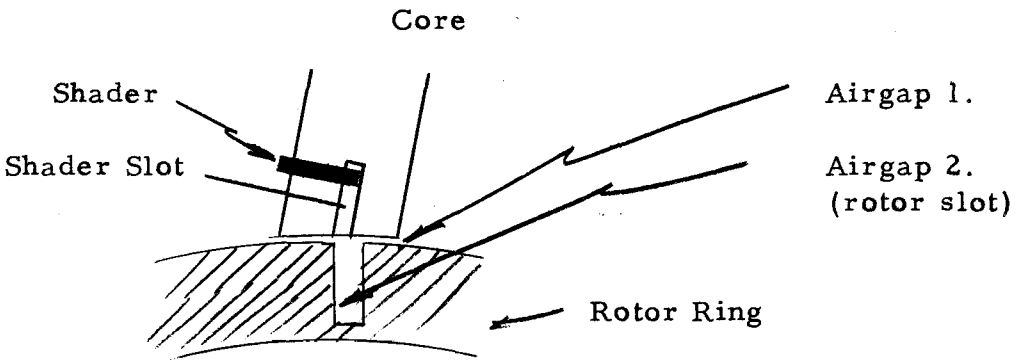
The ring insert or hub can be made of molded plastic, preferably molded directly in the laminations (ring) or as an aluminum stamping as shown in Fig. V.

Fig. V



The stator or field consists of a coil, core and shaders arranged as shown in Fig. II. The shape and size of the field shoe should be determined experimentally for best performance.

Fig. VI shows an enlarged sketch of the field shoe and rotor. The relative sizes of the rotor airgaps and the airgap between the field shoe and rotor should also be determined experimentally, although Airgap 2, Fig. VI should be made as small as possible within practical limits and also small compared to Airgap 1.



An experimental model of the above motor will have to be made in order to determine whether or not it will operate successfully. The scheme of operation of this motor is very similar to many present time motors. However, the general rotor design differs in the method of magnetization. It is felt that the design can easily be adopted for mass production and partial automatic assembly.

Cost Calculation

Present:

	Material	Labor
H3 Rotor Unit	$.07761	$.09002
6000T Coil and Field Asm	.12136	.05109
Total	.19897	.14111
	.14110	
	.34007	
Overhead 130% of total labor	.18344	
Shop Cost	$.52351 a piece	

Proposed: Estimated Shop Cost

Al lamination insert	$.0051
Al bushing	.0030
Steel Ring (4 laminations)	.0081
Shaft Brs.	.0046
Pinion Brs.	.0042
Alnico M.M.F. (at .0144)	.0288
Rotor	$.0538

Proposed Low Cost Clock Motor (Cont.)

Add reduction gears 300/1

Pinion Brs.	$.0042
2 Gears Brs.	.0060
Pin Brs.	.0030
	$.0132
	.0538
Total	$.0670
Assembly Cost App.	.0300
Rotor Shop Cost	$.0970
Coil and field Asm.	.2000
Motor	$.2970

Present	$.52351
Proposed	.29700
Diff.	$.22651

Annual Savings	$2,265,510.00
Approx. Savings	$2,200,000.00

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Proposed Clock Motor
(Vibrator type)

Fig. I

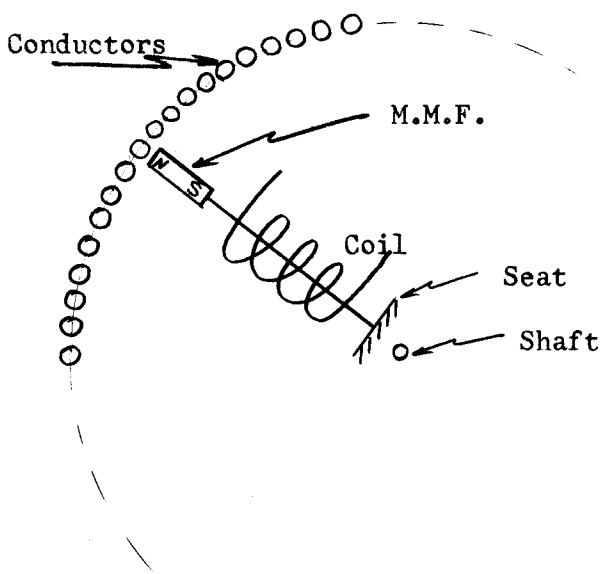
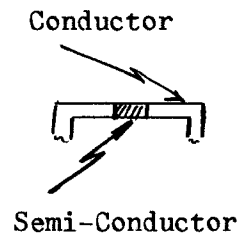


Fig. II



Purpose:

The purpose of this suggestion is to present a new principle of obtaining a low cost low rpm motor for timers.

Operation principle:

Moving a magnetomotive force perpendicular to the axis of a conductor will induce a current in this in such direction as to create a magnetic field around the conductor. This magnetic field will be such as to oppose the movement of the m.m.f. If the conductor was free to move it would tend to move with the movement of the m.m.f. By vibrating the m.m.f., an alternating current will be induced in the conductor.

Fig. I shows a vibrating m.m.f. located radially to a set of conductors arranged in a circle. If the m.m.f. is allowed to vibrate an alternating current will be induced in the conductor nearest the m.m.f. pole.

If a semi-conductor was placed in the conductor (Fig. II) the current would be allowed to flow in one direction only. The flux created by the induced current would thus oppose the vibrator in one direction only -- thus if the conductors are free to move they would move in one direction only.

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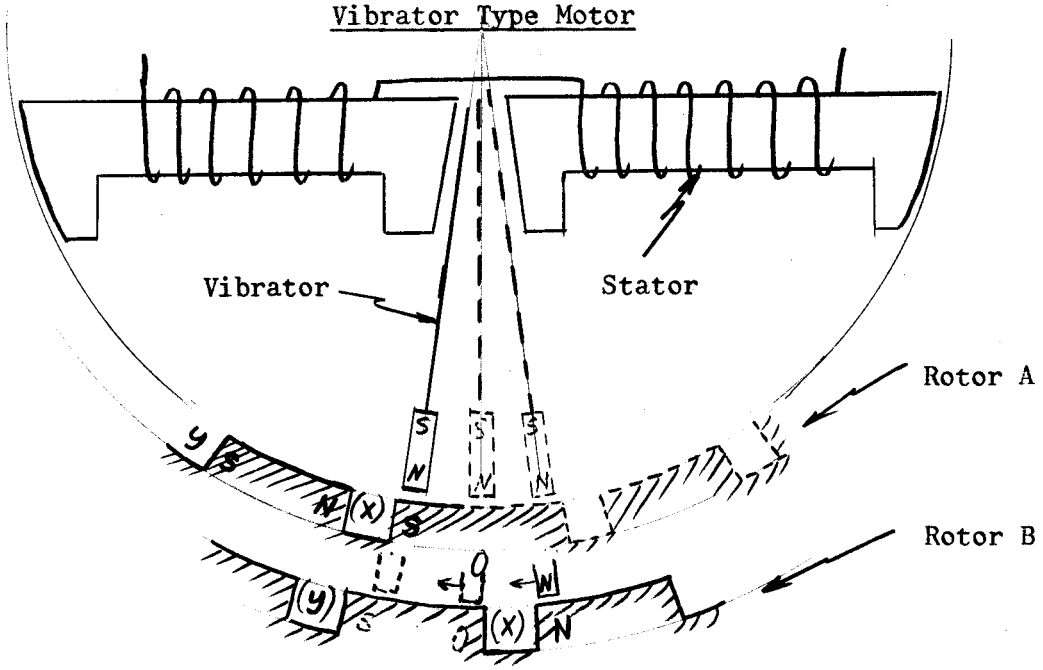
Vibrator Type Motor



The above drawing is an illustration of a magnetic type vibrator motor.

The stator consisting of a coil and laminated core operates the vibrator and also magnetizes the rotor. The vibrator consists of a magneto motive force and a steel spring. The rotor consists of a slotted laminated steel ring.

In the extreme left position of the vibrator let us assume that the rotor slot is in the position as shown (rotor a.) At that instant the rotor is magnetized so as to make the right side of slot (X) a South Pole. The vibrator m.m.f. will exert a pull on this pole and tend to pull it toward the right. As the vibrator passes through the mid position the pole will go toward zero and build up to a North Pole repelling the vibrator m.m.f. in the right position (rotor b). As the vibrator again goes through its mid position (rotor b) the left side of slot (X) will be zero, having no effect upon the vibrator, and as the vibrator goes toward the extreme left position the right side of slot (Y) will build up to a South Pole and the cycle will repeat itself.

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