

Magnesium Speech

Jacksonville Florida

May 2 (?) 1966

Thank you, Mr. Chairman.

I least expected to be at a Magnesium meeting a few months ago. My experience with magnesium was during the war, of course, where my emphasis was that of ~~in~~ in helping to perform tasks that magnesium would perform better. This morning I am going to put on an exact opposite hat, not because it is more important but because it is ~~more~~ my charter. Magnesium, like any other product, or material, has two fields: one the field where it performs better -- it gets its jobs because it does the job better.

However, experience has shown that to make a product a tremendous thing in the world of today, it ~~is~~ also has fields, large fields very often, where it gets the business because it will compete dollar for dollar on performance so I am making my first narrowing of the field, I will be talking exclusively to the important area where magnesium grow -- will do the job only if it accomplishes the function wanted, equally well and at lower cost.

And when I say that, I don't want to lose the friendship of any of you people who see the fine jobs in which magnesium excells. Thus another charter. Lets have two legs on this racer for this distance runner.

In 1947 the research started.--I was then with General Electric -- to determine a more efficient way to use resources of people and money and time ~~is~~ on this second job to provide proven performance, accepted performance in the market but at very much lower cost, and to utilize all known technologies, industrial engineering, work simplification, engineering skills, purchasing skills, management skills, and put them in one efficient package. This was the charter, this way we started.

Last month, 19 years later, 546 people paid \$70 to \$90 admission to attend a convention on Value Engineering. There were 60 presentations with three parallel meetings and these are the minutes on Value Analysis and Value Engineering. So you can see why I am enthusiastic about our growing knowledge on how to handle the factors in an efficient system to get ~~more~~ better cost oriented decisions.

I met there, men from all over the world, four from Britain and eight from Japan. This isn't just a United States effort. I expect to communicate to you this morning what this basic system is and what it might do for magnesium business and then some initial suggested steps that you might take.

I'll start with an example -- an electric cold control that was sold to refrigerator manufacturers. If performed very

well, then competition became very severe. Markets were being lost so the manager of the operation had complete cost reduction and engineering studies on it. He had engineering group, manufacturing group, purchasing group, each perform separate studies and then work together and they buttoned up the result.

They still had such ~~kg~~ high cost on this product that they could not sell it in competition. It was at this time that the three vice presidents of engineering, manufacturing and purchasing who authorized this research work said, "Let's have our research group look at it." The result was that in a few months - six months - it was being made for 25% less cost; two years later the functions provided for at least 25% less than that, and two years later the same or a little better performance for again about a reduction of about 1/3.

On the other end of the scale a very large machined forging-- it was only a forging and ~~machining~~ machining--the engineering manager had handled it himself for five years. He had had everything done because it represented half a million dollars of purchases. They needed money so it was handled and the result was five changes made and \$180,000 out of the \$500,000 saved. \$10,000 were taken from the basic winding cost or copper insulated and put into a large water wheel equipment. 80% of the cost removed from an important bulk chemical; 30% from a highly competitive control gear. This volume of castings expanded and increased from year to year. What caused it? A complete system of techniques and approaches which deals ~~with~~ as you fellows were discussing things this morning with the realities of life and deals not only with the technical factors but also with the people factors.

You will find that after I discuss the approaches that get us a clear view of what we are trying to do and get it into mind sized steps technically, then we have to put much time on dealing with the people factors or we just as well have saved our time.

There are two important factors in any product or service. One is its performance, the other is its cost. Again I am going to narrow the field. We do not use our techniques to provide better performance. That is an engineering task and technical people have fine measurements and systems and experience doing it.

Our techniques are based on/precisely ~~holding~~ ~~holding~~ holding ~~holding~~ the same performance but accomplishing it for lots lower cost, not 10% per cent less, very often for half; but we hold performance and lower cost. All of our techniques are in that line. What are they based on? We found that what we want to do is to learn to measure the quality of value decisions -- measure the cost decisions so that we know whether we are getting good cost decisions or not. In performance you know whether it is good or not. Either it meets the spec or it doesn't. It is ~~95~~ 92% efficient or 91%. In cost oriented decisions folks don't know. They do the best they can and they may be way off and they only find it out in the market place. ~~So searching for something~~

So, searching for something fundamental, we started with the customer is fundamental. The customer decides what he is going to buy. He decides what he wants. He wants a refrigerator, perhaps. But he doesn't want a refrigerator, he wants something that will perform a use -- a function -- so we start with him. Precisely what function does he want? Or can he be taught to want. I am using this in a broad sense.

Then, let's look at those functions group by group and one by one and determine what the minimum cost is to reliably provide those functions. So all of our thinking took a change. Never did we list anything on the piece of paper studying it except function. We would not say a wheel; we would not say a shaft; we always, after studying it, put that function there.

Let me go a little more on function. Our techniques divided function into two classes and only two: use function and aesthetic function. The customer only buys something to perform a use for him or to please him. The manufacturer must contribute in a proper proportion what he wants; they both represent value.

We found much extra cost in cost that did not add use the customer wanted, did not please him and cause him to buy; and it is the cost that comes under the heading of tradition -- of doing it the way we are used to doing it -- the way that looks good to us -- that we think is right -- and all this becomes complete waste.

Take the example of a tie here. Perhaps I paid \$2 for the tie. Why do I do it? Does it have a use function? And I'm going to cut some of these awfully short -- No, it doesn't. but I buy it so it has an aesthetic function and I want it and I paid \$2 for it regardless of whether it has use or not. And it is fine business; no problem. Does the tie clasp have a function? Yes. What is it? Two functions: it does a certain amount of holding -- that is a use function. It also presents a certain appearance; that is its aesthetic function.

In the Value Engineering step by step approaches we strictly divide the two functions, use and aesthetic. Now, in this system we have added a few new techniques; one is learning how to associate a value for a proper cost with a well defined function. What is the use value of this -- well to hold the tie. What would be the dollar and cents maximum cost of it? Well, the cost of something else to hold it equally well. What would hold it equally well? Name something. Pin, paper clip, something like that. What would that cost? One cent -- less than a cent, let's say. So, we now know that the use function of this clasp cannot have an appropriate cost of more than one cent.

But I paid \$2. for it. It doesn't mean that it's wrong.

It means that all of our money except the 1¢ is going to pay for the aesthetic function. So let's think of it only in terms of aesthetic function and let's prepare alternatives to create aesthetic function for perhaps half of the cost instead of what it is costing.

Certain products, like a nail in a wall is all use function. Products like ear rings on the girls ears, I would say, are all aesthetic function, altho' I had the opportunity of talking to an engineers club and their wives once and I used the president's wife's ear ring as an exhibit and the women stood up in acclaim and said "They have a use function!" I asked, "What is the use?" They said, "To get a husband!" I lost but I said, "Who you kidding? There's no body here who doesn't have a husband." And they said, "well, we have to keep them."

So, in a product, we divide them and then we put a dollar sign on them, no matter what it is. As an example, on a television set, I had a group of about half this size who invited me to talk about some of these and see if I could help/~~tax~~ decisions and give them some encouragement, sharpen I guess. I found as soon as we started talking about this, a little private argument. Well, they said, this fellow here just made a decision to change the switch on the TV and it costs \$28,000/year more. And I say it's a mistake; it is wasting the money.

I said, alright, now wait a minute. Let's look at it. That is a real situation. Who are you who made the decision? He said, I am in marketing.

Who did you work with?

I worked with ~~another~~ fellow in engineering. Another man held up his hand and said, I'm in engineering and its my job to work with them and we decide what should go in and we put it on.

OK. So everything was done right. Now let's look and see if we could have set the problem up so as to help them. What do we know? We know we are spending \$28,000. Do we know what we are getting for it? Somebody said NO'. Not the fellows who made the decision but everybody else.

There are only two things we can get; one is better use for the customer and the other is more sales. The only reason for spending that money is to get the customer to buy this one. So I said, let's look at it. Maybe this switch works better. I asked the engineers and they said no; it is the same switch with a different kind of a mounting and arrangement so they agreed that there was no change in the use function; it was just the same/ from the customer's viewpoint.

~~Now~~ Then, I said, we are paying this \$28,000 to cause the

customer to buy the set with the new switch. Does it do it? We don't know but most folks said, we doubt it. That was enough of that. The marketing man ~~xxx~~ said, "I get the point~~xx~~ I am going to set up some controlled tests and we will set up three or four in different places and we will watch that thing close enough to know." Two or three months later he called back and said, "I want you to know that we ~~didxxx~~ found that not one TV set was picked in all of the tests because of the changed switch. The \$28,000 is back in the bank which

What we want to do here is to find a way to frame our thinking in sensible packages and put it in decision sized and workable sized chunks. We will see that as we roll along.

In order to do this, we have to take several different looks. For example, if you want to go from here to Atlanta, a small scale map doesn't do any good. First you need a big map that shows the general picture; then you need ~~xx~~ a smaller map and then you need a precise map to how to get from Jacksonville to Atlanta. In this kind of work we found this just as important but it does not exist. Very often people will be working on a map that is either too big or too small but they don't have them all.

You can take any product - let's take a garbage disposal. It now breaks all down into parcels. First we decide how much cost we need in order to sell on the market and compete; get the orders you need. This might be \$15.

whole

The next thing is to divide the/disposal into functions--function groups. One is (mount ?) and enclose; one is control electrically; one is shred; another is provide power. And the naming of these is very important. If we said a motor used a name instead of a function, that would restrict our thinking from many things that may be tomorrow's product. Maybe there shouldn't be any motor in a disposal. We just need something to provide power so every group is put together this way and the dollars are assigned by function needed and then we look at them and see what they are now.

Now we have clean, clearcut precise problems to work on and I'll give you a little run down on the Value Analysis System for that. Among other things there is a Job Plan that allows any question to use his time and do all that needs to be done. It starts with an information phase: What is it that needs to be done? There are dozens -- hundreds of things that need to be known and I'll skip it quickly here.

Next is the analysis phase. We do this one at a time. What does that information mean? What kind of costs do we need? What are the problem areas? What are the opportunity

areas? How far do we need to go?

Then comes the creative phase. This is, as you are hearing around, withholding of judgment and doing an intense creative job.

Then comes the judgment phase -- picking something and making it better; then the development phase.

People trained in this probably get equivalent of three or four days of training on this problem solving system itself/ in order to get the answers you need. But it was found that that is not enough; it doesn't do the job. We have to deal in the people phase. Without the problem solving we have nothing to offer. That can be done. But without the people solving it amounts to nothing. I was interested in your discussions here which show the same thing.

Now I am going to take those same examples and let's see what the whole factors were -- the people factors. First the control. the one I spoke of where the 25% was reduced. On this, as soon as functions were studied, it was seen that \$310,000/year went into a box -- an enclosure to put it in. This was nothing that the customer precisely wants. It was seen that \$40,000 went into just a cover. Arrangements were made to get the box for \$70,000 less; the cover from \$40,000 down to \$15,000 by covering just as well but in a different way. And a few other things.

Now what happened? The manager of this operation came to our boxx, the vice president, and requested that this work be ended; that it be taken out. I would fail today if I don't communicate to you in believable terms what technical and management people do which prevent accomplishing functions for very much lower cost and I am going to bring up those examples in order to endeavor to communicate. He requested that it be taken out. We will talk about why when we have some other similar examples.

One of the cases on this is ~~xxxxxxxxxxxxxxxx~~ the springs. There were half a dozen springs in there. A man, the sales-manager of a spring company was asked to look at it. "You see the applications, Here's all the specifications for the application. You tell us what springs should go in there." He leaned back and said, "Oh no, not me." "Why not?" "Why", he said, "I sell springs to your people for a wide range of applications. You have specialists who know a lot about springs and they design them; their names are on the drawings. If I did a thing like that, I'd put my name on the blacklist all through the company."

Now we are starting to get at something that is real. Fortunately at that time one of my bosses was the vice president of purchasing. So, I said, well now I have an

interesting opportunity here. I'm going to tell you, right now, you are either going to get in bad with purchasing or engineering. one or the other -- right now. You make the decision.

He said, "In that I have no choice. If I can't get the orders out of purchasing, I'm licked."

Here again we have the people ~~xxxx~~ thing to deal with. The result of that was that he made up, working with engineers, five samples of each of the springs, springs you could make up on a set-up machine. He presented the samples and a page of test data. The engineer looked at it and said "My God why can't I have that kind of test data to make all of my decisions on." Everybody was happy but we had to go through the human barrier to get there and the springs, incidentally, cost only 25% of what they had before.

The next case was the large machine forgings. The manager of engineering, as a part of the president's staff, saw that profit was deteriorating and they wanted Value Analysis. They came to me. These things are not all General Electric -- some are some are in other companies. Four companies are represented here.

This next one is not. And I don't want you to think GE engineers are any different. I just don't want you to think I am picking on one company. The president said "We think this will help." Engineering vice president and technical people said we think so too. Let's get something. I helped them to get a couple of qualified men. They had this as a seminar project. The vice president called the men and said "I handled this myself for five years and I'm sure there is not a penny that can be saved on that. We'll be wasting our time. I suggest that you take it out of the study."

The V. A. men said "I hope you don't give us a definite order to because we have a half dozen projects and we'd like to have one of this type and one of the other types and unless you order us directly to take it out, we will leave it in as a study project during this two weeks of teaching. The vice pres. did not open his mouth to say you can't do it so ran the seminar. They found that there were nine suggestions of which five were immediately put in and took out \$160,000 from \$500,000.

What happened? That was three years ago. This vice president has prevented the value analysts from having any raise during the three year period. They are unwelcome in his office.

Then the windings story. This was a company that got this on a very tight bid and it was an order for something like a dozen large water wheel equipments. They bid in the world market on it and they had to get good quality and get some cost out.

They had a couple of good value analysts look at it. I'll tell you one case--there were many like that looked like a large copper buss of basically raw material that is wound and used in this large water wheel generator. It came in 300 ft. lengths. It had to be braised. Braising alone cost much more than winding the whole thing, that is, each joint.

So, using the functional techniques, the braise adds cost, ~~XXXXXXXXXXXX~~ it did not add function the customer wants. They set it up as a problem and used this test and went to engineering and asked, "is there any reason why you wouldn't like to have it in one" and they said no. They went to manufacturing: "is there any reason why it would bother you? They said no; this is in the information phase. They said, no, but we can't get it that way. They went to purchasing and said, "We want to buy this in a 15,000 ft. length instead of five 300 ft. lengths. They said you can't do it. You have to do a little work so you don't shock people and purchasing got a copper book and they showed 300 ft. as the maximum length. We've never been able to. We have tried to several times.

Using the approach of getting to the guts of the real problem, the value analyst said I don't understand ~~ix~~ why, in a copper fabricating plant, they can't just coil up 15,000 ft. and put it on a skid and not cut it off. Would you make an appointment with Phelps Dodge for me. They hemmed and hawed a little and with a little pressure did. He went out to Phelps Dodge and saw the equipment that's doing it -- didn't accept stoppers that come all the way along. The result was that three weeks later, on the skids in the factory were a coil 15,000 ft. long that just went thru' like greased lightning. It was such an efficient way to do it that Phelps Dodge later decreased the base price of copper when taken in that form.

In this case what happened? The word went around that the value analyst had an organized system for fault finding. And they were persona non grata.

(changed tape here. Could not get the beginning)

Value engineering looked so good to his boss and others ~~xxxxx~~ that he said, well, we'll try it. He did something that I would never do and it's wrong but when you are dealing with people they learn better from making their own mistakes. You can't tell them. He said you take all this information and take two or three people who know these techniques and I'm going to pick two or three people in our engineering dept. who would do this kind of work and I don't want any cross communication. We will find out, once and for all, so at the end of 60 days that this ridiculous approach ran, the men from his organization added a few more functions and refinements of functions that were needed; their costs were up 3% from the start. The men who used this functional approach had also added that because the product needed it and their

costs were down 30%. The points had been proven in the laboratory so there was no question about it.

What was the result? We know we can accomplish the same kind of results in our own organization. We don't have to have value engineering technology.

In the cement setting experience, a young engineer was studying setting cement where two products are put together by cement. He was tapping and vibrating in order to speed up the process. The reason I know this one is that I happened to come along; I asked him what he was doing and he told me. He said, I have to find out whether it is impact or impulse and how much - what frequency, how much aptitude. I said there has been an awful lot of cement set. Let me take a look and search a little for a specialist for you which is one of the simple things. Of course I had for him in a couple of days a catalog, arrangements for an engineer from a company that sells the equipment to talk to him. There were all the answers; all he had to do was buy a small equipment.

The next day I came down to the factory he was gone. He had been fired. I felt sick.

I want to take one more little example here of this type and then we will talk about what happens here and what happens here is what holds the cost in the products.

Here is a little stud. It is just a little piece of steel ~~it~~ What does it do? It goes on an appliance - ~~xxxxxxx~~ it holds a 2 lb. timer on an electric dryer and it costs 8¢. It is made completely automatic. Now let's use this approach. Precisely does it have esteem value or use value or both? And here it is only use value. The customer doesn't see it. Allright, now precisely separate the functions. What does it do? It has a holding function; it has a spacing function here. Next, put a separate value on each function. What is the value or appropriate cost for the holding function? Compare it to a bolt or a little screw. You don't guess. And it would cost a half cent for a screw that would do that. The spacer for the spacing function would cost 1/4 cent but ~~xxxxxx~~ you have the problem of how could you fasten them together. We have in our system a way for doing that. If they are not interacting functions, we can add them directly. If they are interacting functions, we have a formula to do it. Here they are practically non-interacting, only interacting at the head so it works out to be ~~an~~ approximation of 3/4 ¢ of value for the functions within a first but a cost of 8¢. This information was given. Work was requested because the product needed help. It was given to the technical people and they ~~an~~ looked at the 3/4¢ and said that's ridiculous. It shows that the system is just an idle dream.

So it was necessary to carry it further and go and get one of their engineers and help him solve this problem, how do

we get this function for its value? Using the creativity and the judgment, the little thing that cracked this was "what can we compare it to ~~xx~~ that will have some of the functions"? and it worked out to be a nail with two heads. What does it cost? 1/10¢. Put one head in the middle, the other in a little ways, ~~xxx~~ threads on it, and what do you have?
roll

So we got in a supplier who makes this type of part and here it is -- it cost 8/10¢, not 8¢. And it was arrived at by a step by step logical process that will solve the large problems as well as the little ones.

What happened? The ~~xxxxxxx~~ manager of manufacturing who had requested this work then said, "What do we have in our design engineering group down there -- men or boys?" And Value Analysis was dead. Now I am telling you this because it is true and vital and I have never seen an exception. Why? Because the why is important to you.

I have now concluded that it is because management has engineers, managers, Their kit of tools, their large tool is their mental reputation; it is what people think of them. What does the boss believe? What does he think of me? What do my peers think of me? To him this is the monkey wrench the plumber carries. It is the solder & the pliers the electrician carries. And if you take the solder and the pliers away from an electrician, what's he going to make a living? Take the monkey wrench away from the plumber, how will he live? These professional people feel this to the very bottom of their hearts. So then, without them understanding why, they fear embarrassment. There is danger of embarrassment to professional people and that is a sword that is the cruelest sword to them.

On the control device, everyone knew this manager had had this completely studied and done all that could be done. If something more is done, it takes away; it could embarrass him. So Stop the work at the start so it won't happen.

large.
In the case of the/forging, everyone knew that the engineering mgr. had handled that item and if important money comes out of it, let's say he's dead. He isn't, but the feeling is that he will be dreadfully embarrassed and his tools of his trade will be weakened.

In the winding story, purchasing, engineering, and mfging. had worked together every way to get all the cost they could out of it; everybody knows it. So the whole group is embarrassed. when this is done.

In the case of the generator, of course this fine successful engineering manager now entire responsibility who had been responsible through the years for the design of this -- he knows that a part of his basic kit of tools is taken away if embarrassment

comes in his field through someone bringing something that doesn't cost very much but is just a new thinking process and showing that lots of money could have been eliminated before.

In the cement job the vice president of manufacturing had talked in the bosses office about learning how to settle the cement and speeding up his line and he had hired this young engineer -- he used that as his tool. Now if some thinking process shows that the answer is already evident, his reputation with his boss -- he is embarrassed.

Now I have indicated to you a technical system that will cut a problem up into what is really basic, with the customer, will divide it into steps that are the size of the individuals working on it, and will use creativity where it is needed, use search where it is needed, use specialists where they are needed, and use judgment where it is needed. And I have shown you that an enormous part of this problem is human factor.

part.

Now I would like to pull it closer to the Magnesium ~~part~~ part. Here was a with a foundry. A foundry sales manager was very critical of Value Engineering. It was in their papers and everything else. Finally, I ran into him somewhere and we had a professional conversation. I said, "Why don't you come for two days and see what goes on in a seminar?" He said, "I don't want to see it. I know it is just a crime because I see all the jobs that we have had for years and we are losing them."

I said alright, I'll invite you to come next week if you will come for two days. You'll get to see that much and see what is going on there. Well, he got his venom off so he said, I'll be there. He came. I jotted down his comments. At the end of the first day when he could talk with people on a basis of function, what function are we really trying to get? He came to me and he said, I believe I have found four jobs that we haven't had in castings that I can do. He said Now I see what the problem is. Others are here looking at things that are in castings and they are for showing ways to do it but I haven't been here looking at things done other ways that can better be done by castings and showing them how to accomplish those functions.

At the end of the second day he came back and said, Larry, being able to talk ~~the~~ eyeball to eyeball about the function without any bad relationships between engineering, purchasing, manufacturing, in a group like this is just like having a license to steal.

\$12

As a result of this, there was a/fabricated heavy flange put into an aluminum casting that went from \$12 to \$1.60 each. There was an arc chute that was a brass fabrication that went from \$5.80 to \$1.80 as a shell moulded part. There was a/control shaft
small

a high volume one, he couldn't do but someone else in the industry did and it was a quantity of half a million, went from 11¢ to 2¢. He saw how the functional picture can put business in the foundry instead of take it out.

So let's see what we are trying to do in Magnesium using Value Analysis. First of all, how will magnesium effect the operation of this product. What function can it perform? I'll divide the functions into groups; I'll classify them, named them and incidentally they are named half a dozen ways. because the naming of a function promotes thinking. Each situation will be surrounded with more facts. Nothing is taken for granted. Information is gathered, assumptions are gathered, then information is improved and assumptions must be improved. Recognize the human attitudes that prevent fact gathering and recognize and deal with the attitudes that prevent using the facts after they are gathered. Use the best/sources available and deal with the
re

human attitudes and factors that stop action.

Finally, for some suggested actions: Maybe I'm an optimist* but I have found that when a thinking process like this is applied to something vital, we are just startled by what is opened up. Some suggestions would be these:

First, do you have a material that could open large markets for economic reasons? I think you have. So I am making the assumption that you have and I believe most of you feel that way. Then, use (have used) this value analysis problem solving job plan to, with deep creativity. The results of this would not be just a list of suggestions but would be well described and defined suggestions, limited suggestions, with costs, so they would be ready to use, well jelled up.

Second, get the benefit of function thinking. Yours is a new industry. The world isn't always going to guess on the value of functions; right now there is research being done to assign proper cost to function. What is the proper cost for conducting 100 amperes a foot under certain conditions or certain vibration conditions? What is the lowest cost that will reliably do it? What is the proper cost for transmitting torque? And it goes in mathematically beautifully. You draw a curve where you have the amount of torque and the cost per foot and a real technical study, taking in catalog data, cost and technical data so that we know. So the second suggestion is what I'm going to call prepare an intensive list of functions, that is, you will have studied so intensively that the ones you list are defined so that any technical person can look at it and say, that is the conditions

under which I want to accomplish that function and here is the appropriate cost for it done in aluminum. Get this list into the trade.

Next, use the value analysis men who are around. Some are good and some are poor, of course; but they are getting better. You will then deal with them on a basis of specific products or specific systems and have a chance to use this license to steal, providing them the cost. for it.

You folks are thinking in the same line, I'm very glad to hear. Establish some very specific goals by the industries or product lines as you suggested this morning. Then believe those goals yourselves and decide that you will solve the necessary problems in order to achieve them. In each case that is done by the question of what stoppers what is stopping us from it? And then immediately comes the biggest stopper. Then use the problem solving job plan to attack that stopper and you will lick it - usually you'll lick it. And now what is stopping us? Adn then you get a new problem. Fight it specifically and lick it. Then you go at the task of overcoming attitudes. You work with them, recognizing them, recognizing the embarrassment that comes whenever a change of this type comes in. I rmemeber a 1952 Value Analysis seminar was written up to use teflon on cooking utensils. It came up in connection with this type of work where that was just a by product. Ittook ten years - it didn't come out -- it came from somewhere else. So we have to expect that the lag between what we can prove and what people use is at least ten years. We need to get on with it.

I want to close be relating an example, an experience that deals with the plan and deals with people. We had a call to an area that makes this overhead bus system for use in factories. It consists mainly of three bus bars plus a housing plus supports. Its a fine product but the market was creeping up. They were starting to fear losing some business. They said, come over and we'll give you engineering and manufacturing and some of our other people and let's see what you can do.

We had a group about half as big as a dozen people probably. I'll pick one thing. Of course the first step is to get it into function - functional groups. We put that into three functionalgroups. 1. current conducting element; 2. means of support; 3. insulation.

We had information studies and creative studies. In the creative study we wrote them out ona sheet of paper -- hang it with rope story--. (this was the concluding of the talk)

Comment of introducer at conclusion --"This is a most stimulating and interesting subject to me. I think I mentioned when I introduced you we have indulged in a rather unsophisticated fashion in value analysis but I believe that every operation, every company manager should investigate this particular area and become more sophisticated

if he can. The reason I believe that we should, in my company, really get into it deeper and more effectively for some time on long range planning. I used to be a complete negative on long range planning. Now I think its very important.