

Proceedings
of the

SECOND INDUSTRIAL ENGINEERING
INSTITUTE ON

Work Simplification

January 27, 28, 1950
University of California
Berkeley, California

Proceedings of the
*Second Industrial Engineering
Institute on Work Simplification*

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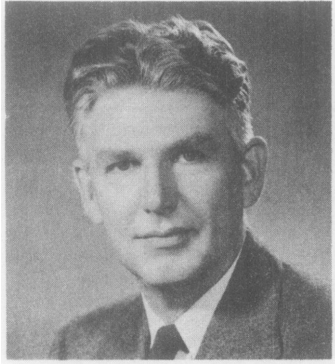
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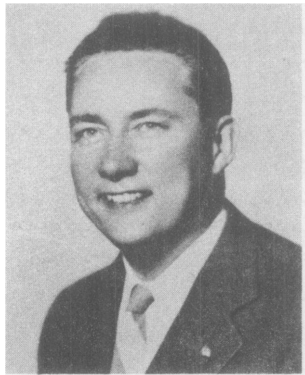
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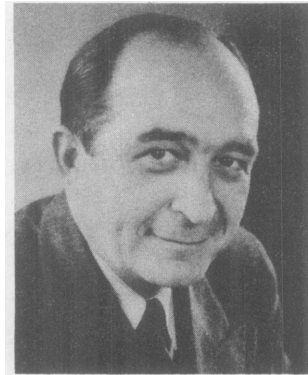
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FOREWORD

The proceedings of the Second Industrial Engineering Institute are given in summary form and do not represent the complete talks as given. Sincere thanks is given to the individuals and organizations which participated and made the meetings a success.

These Institutes have been conceived as a service to West Coast Industrial Engineering and future meetings will be planned in accordance with your desires as indicated by the Interest Questionnaire issued at the Institute. It is hoped that suggestions for future meetings will be received.

D. G. Malcolm
Institute Chairman

OPENING SESSION

ADDRESS OF WELCOME

M. P. O'Brien, Dean of the
College of Engineering,
University of California

The second Industrial Engineering Institute on Work Simplification was opened at 7:30 P.M. on Friday, January 27, 1950 with a welcoming address by M. P. O'Brien, Dean of the College of Engineering, University of California. He expressed gratitude for the growing interest in this important subject as indicated by the large attendance. The objective of the University in sponsoring these meetings, he said, is the broad dissemination of the recent developments and new techniques in this field for the aid and enlightenment of practicing engineers and industrial management personnel.

The engineering curricula at most engineering colleges has been held at the present level of four years, although it is realized that in many respects more time would be desirable. Many students are interested in carrying their formal academic studies beyond this period and about 25% of the graduating students are encouraged to engage in some post-graduate work. However, it is recognized that engineering is a practical science and the larger percentage of students, after graduation, enter a practical industrial world where their background of theoretical knowledge must normally be tempered with some years of practical experience before full responsibility in engineering activities can be assumed. The recent graduate finds that many details of his new interests were not covered in the courses that he studied, and that he needs review of various engineering subjects as time passes. In addition, new subjects, fields of interest, methods, and techniques are continuously being developed, which must be studied and understood if he is to maintain a good position in his field. It is in the sincere effort to aid the practicing engineer and those that they serve, that the University cooperates in sponsoring such programs as this one. By taking full advantage of these opportunities the individual engineer can develop the capabilities needed to produce greater return for a unit of effort. If this is accomplished, our purpose is well served.

INTRODUCTION OF A WORK SIMPLIFICATION PROGRAM

Harold Engstrom, Manager Industrial Engineering,
Sylvania Electric Products Inc.
New York

It is indeed a pleasure and a privilege to take part in your Industrial Engineering Institute. I am particularly happy to see so many interested in the subject which has made such a definite contribution to industrial progress.

I shall endeavor to cover the subject assigned me - "The Introduction of a Work Simplification Program" - by describing briefly:

1. What work simplification is and what it seeks to do.
2. Steps to be taken in introducing this subject in an organization.
3. How it may be made a continuing activity.
4. What it can do for a manufacturing organization.

We all know that Frank Gilbreth developed what we now know as "motion study." He proved to industry that all our procedures and all our ways of doing things depended, to a great extent, upon the quality and worthwhileness of the motion expended in performing them. He proved conclusively that we could analyze what we did by means of left and right hand charts, accounting for the delays and hesitations, and he further ably demonstrated that poor motions and the poor way of doing things were expensive, costly, and that they were also fatiguing. Industry immediately saw its benefits and today it is an important tool in good methods work. We owe much to Gilbreth's pioneering and development in this vital field of activity.

In the course of evolving the study of motions, Gilbreth developed the Process and Flow charts and also the Man-and-Machine chart. These techniques showed and proved our inefficiencies graphically. In almost every field of endeavor we have, by prudent and wise use of these techniques, made substantial

Recorder: Robert F. Schlirzkus, Mechanical Engineer, Merchant Calculating Machine Co., Oakland

savings in time and effort. In general, the field of motion study today has developed some interesting and, in some cases, complex techniques. It has been used by many practicing specialists and is part and parcel of the Industrial Engineer's tools of trade.

Around 1935 Professor Irwin Schell of M.I.T., together with Allan Mogenson coined the words "Work Simplification" - contending that motion study in itself was considered by many to be too technical in all of its aspects, and thus a phase of motion study, making use basically of Gilbreth's Flow and Process Charts together with Simo charts, became the basis for a program for the study of work procedures. By the proper use of this approach, it is extremely easy to prove that there are better and improved ways of doing things.

What is it supposed to do? Exactly what its name implies - to simplify work. Its purpose also is to eliminate negative thinking and to prove to those individuals who are so grooved and satisfied with the old way of doing things that there is always a better way of performing certain tasks. By teaching its simple technique, it can and does provide an outlet for those who have ideas on improving their own fields of work. Everyone has some ideas in this direction, but in many cases lack the opportunity to show how these things can be done. A work simplification program provides that outlet.

Permit me to illustrate what I mean by grooved and negative thinking. In a large electrical organization with which I was once associated, we had a man who for 15 years had been employed in rolling wire hoops as a part of his job in making electric fan guards. Because of an increase in orders, it was necessary to put another man on the job on the night shift. The man we selected for the work applied at the Personnel Department and said his only experience was that he had been a props man for the great, lamented Houdini. The first night he was on the job we really thought we had Houdini himself because the day man, the old vet, claimed that the new man did three day's work in one night and that he seriously doubted the man's honesty and integrity and assumed that he had stolen this particular amount of work. Much to his annoyance, the individual still continued to work at that pace. It wasn't until we investigated the high productivity and high earnings that we determined how motion economy minded he was and that he had honestly tripled the production on the job by a method which had been overlooked by the man who had been on the job for 15 years. His method was simple. Instead of catching the hoop with one hand and placing each hoop aside, he put his left hand at right angles to a surface plate of the machine and let the hoops bounce on his arm while feeding the machine with his right hand. In so doing, he also put a little brass plate on the face plate so that the wire would hit it when it came around and would bounce onto his arm. He would accumulate 100 or so and then set

them aside. Very interestingly, however, he would unscrew that little brass plate and stick it in his back pocket and take it home with him. By means of a suggestion award he helped redesign that machine and eventually we made the entire machine automatic. Yet, it took an idea thinking man to come in from the outside to teach us a new way of working and improving a very old job.

People, naturally, want a means for expressing their ideas. Training in work simplification helps to do this. In a plant, - and old established organization that made fire extinguishing equipment - a Foreman, after the second session of the training program, and who, incidentally, was particularly silent throughout the meetings, came to me and asked rather timidly if, as a personal favor, I would refrain from getting him involved in the class discussions. This I agreed to, but I did question his reasons. He informed me that he had been a foreman for a great many years and now the management was bringing in new blood, new college boys, and that he was on the shelf - on the way out, and so what! I made it a point to visit his department, and with his help made an analysis of his jobs and found that he had some very original ideas which he was more or less reticent to propose to the management. With his continued help and interest, we developed a method - a screw machine attachment - which increased the productivity at least twofold. Management didn't realize that he was capable of such original thinking and throughout the course I noticed his increased interest and delight with his own attainments. Furthermore, the management immediately thought more of him, his attitude toward his work and his fellow supervisors changed completely, and I know that he is now a general foreman in this organization - and this happened some 10 years ago.

So then, we have the opportunity to gain worthwhile ideas from people who are looking for some concrete way of expressing them, and in so doing we also have the opportunity to build up the morale of those who believe that their thinking is of small importance. How to do this is largely dependent upon your own analysis of the situation, but before discussing the steps to take, I would like to cite one other example, an experience of mine last summer where I was conducting a work simplification program. It seems that this plant had had two programs with just ordinary results. The President of the company called me one day and asked me where he could get someone to conduct a series of meetings which would enliven the thinking of his organization. He was in the manufacture of jewelry and one of his biggest items, a very competitive product by the way, was to manufacture wristbands for watches. I suggested several good men with whom I am associated at the University and then he asked me if I would consent to do it Saturday mornings or at some other odd hour convenient to me. His reason was, he said, he wanted more of a factory approach. I spent an afternoon there

and noticed several things which I knew should be improved. My first meeting with the supervisors was rather stereotyped. There were some 50 men in the group and I tried to make it as interesting and as practical as I could. The second meeting I had with them, I changed my technique. I promoted arguments within the group, something which I had never done before, but I immediately found them vociferous, interested, and wanting the opportunity to make themselves heard. It was one of the most satisfactory experiences I have ever had and I would like to illustrate one type of problem which they solved.

The company has to assemble links in a fixture. These links are then put together in a press. Each bracelet contains 30 to 50 links, depending upon the size. These links are assembled by hand into a fixture. Two fixtures were then put together and pressed and we had our bracelet. I immediately pointed out something through our process chart analysis which I thought could be improved. I did have an idea how to do the whole job, but I thought I would do it step by step. I suggested changing the assembly fixtures so that the positioning would be easier and so that the links could be simultaneously placed with both hands. The tool designer said it could never be done. He was immediately challenged by the foreman of the department and in that controlled discussion we eventually came out with a fixture made of Lucite which eliminated machining because the embossed portions were made by pressure under heat. Naturally, it reduced the machining costs in a manner which I had never seen before. Immediately it showed a big daily saving. We assembled those links manually, and when I asked, "should we be assembling them by hand," I was immediately questioned as to how we could do it otherwise. This, of course, is an old trick in the electrical business and eventually, with group participation, we devised a machine that assembled 3 fixtures at one time by means of a vibrator table inside a rotating hopper so that where we had 5 girls on a team assembling these fixtures by hand, we now had only 2. The next step, of course, is to make the press automatic and they are working on that. That saved a great many thousand dollars for that organization and the ideas came from the men themselves. At the conclusion of the sessions, one of the foremen came up to me and said, "You know, when you came over for this job, I had made up my mind that I would be darned if I would let that fellow teach me anything, and despite that - you did!" He didn't realize that we hadn't taught him anything, we had simply kindled his interest. We had given him the opportunity of jumping the groove, to play another record.

So, then, we have the purposes of making work easier, maintaining our alert thinking and supervisory-employee morale. How then, should we introduce a program of this sort? Regardless of whether the program is put on by the home organization or by outside individuals, there are 3 steps that are very

important to consider before we launch a program of this nature. First, we must study the existing situation in regard to the over-all plant efficiency. Is the company losing money on a particular item? Is the problem one of materials handling? Do we have a problem of disinterested supervision? And most likely we might have all the problems, but the point is to pick out the major ones. Here is a case example: In a canning industry manufacturing baby food products where the production was very high, plant productivity was handicapped by the warehousing and shipping facilities because they could not properly store and handle daily production which was some 500,000 jars daily. The management seemed to think that the holdup in productivity was due to low employee efficiency, but the truth of the matter was that the entire plant paced itself by the warehouse efficiency. Naturally, we concentrated our work simplification efforts on improving methods of warehousing and order filling and, magically, the production of the canning machines and food processes increased considerably.

In a large drug plant, where the cardinal principle was that only one job may be performed at a time in a department, so that there would be no possibility of mixing labels and products, productivity was very low simply because no one had ever thought that it was ethical and proper to pre-plan and schedule work, on the basis of time, in a drug plant. This was overcome by proving the lost time on our process charts. Incidentally, the man who controlled the distribution of labels eventually became the production scheduling man.

These cases are cited because there are any number of such situations that must be predetermined before a work simplification program is started. The important thing, then, is to find and start the program with the No. 1 headache.

The next step is to study the people with whom you are to work - and that applies to us within our organization and to outsiders as well. It is not often that we sit down and analyze just what are the strong points and the weak points of those we work with. We should, of course, do that to ourselves, but we are never quite objective enough. It is perhaps the most important thing in the introduction of a work simplification program to really know the people with whom you are working. In this aforementioned drug plant, the personnel was composed of graduate pharmacists, bio-chemists, physiologists and doctors. We felt that we knew them pretty well until we went over the entire list with the Manager of the plant and he pointed out their interests, their labor attitude, their management attitude, their cooperativeness, their length of service, and their manufacturing backgrounds. This is so important when dealing with a group, particularly in presentation of material. If the individual is simply research minded and yet has a production job, the problem of changing his thinking is somewhat difficult, but you do have to point out that the research activity, to a great degree, is dependent upon the

number of bottles and pills necessary, in that case, to be sold to maintain the research program. To those who have difficulty in getting along with people, the importance of good, healthful, happy industrial relations must be stressed when presenting the subject material. All such problems must be thoroughly thought out by the instructor or the committee which intends to introduce a profitable and successful course.

The next item is to plan our program along with the key factors of people and problems. As I mentioned before, if the problem in the plant is materials handling, pattern your subject material along that line. Although the basic material in work simplification is rather uniform, the subject, nevertheless, must be portrayed to the individuals partaking in the program concerning the company's own manufacturing problems and products. If the company is manufacturing television tubes, illustrations from a machine shop or metal working plant are not very satisfactory.

While getting this material together and planning it carefully, we should be careful not to overlook certain people in management in regard to acquiring their support and cooperation. By way of illustration - in a cosmetic plant where it is extremely important, because of a low profit margin on the manufacturing side, to utilize methods, time and effort efficiently, we met with resistance from one section of the management and, in tracing it down, we found that it came from the Controller who had not been informed of the program except in general terms and he looked askance at overtime payments made for the maintenance of and participation in this course. When we went over the material with him, he became most enthused and pointed out certain phases of our work which would be most helpful to him and which would show results quickly in the cost books. It is extremely important to sell and explain what you plan to do to all members of the organization. Even if they are not class participants, they can add greatly to the results if their interest is properly cultivated.

In the practical working operation of the program, it is well to have at least 12 men, but not less than 6, and to combine people with like interests if possible. They don't necessarily have to be working in the same department. It is surprising how the foreman of the Plating Department can suggest improved ways of doing things in the Shipping Room and vice versa. These meetings should not last more than 2 hours at a time, with a 5 minute rest interval in between and should be held weekly. As the course is being presented, there should be one or two live projects going along with it so that at the end of the third session you have one or two projects already completed with savings and improvements already listed. This stimulates the group and creates a great deal of interest. From then on the ideas come quickly.

Now the third step - the consideration of ideas for

continuing activity. It is not satisfactory to have a program of this sort immediately dwindle at the conclusion of the class sessions. If you can, by committee arrangement, set up long-term projects and monthly meetings, it will pay good dividends. Always train one or two carefully selected individuals as class leaders in this subject to carry on the work. Whenever possible, it is wise to make full use of motion pictures and it is always stimulating, from time to time, to introduce a motion picture taken at some other plant (from another industry) to let them know that others are also thinking and planning.

In our own company, we maintain a profit improvement program which keeps alive work simplification. A bogey is set up for savings. Assignments are given to certain individuals who are associated with these particular problems and weekly meetings are held as to the progress of these assignments. At the end of 6 months, another program may be started with a different approach. For instance, we might take another group in the field of office methods for here is a field where a great deal of work simplification can be done which, unfortunately, has been overlooked by many.

Now then, what can it do for a manufacturing organization? Our problems today are as acute cost-wise as they ever were. Every organization is compelled to fight for its competitive position in the field. We cannot afford to let go untapped, the idea resources available to us. Somebody said that ideas are funny things - they don't do anything unless you do. Work simplification then affords the opportunity for exploring our ways of doing things and drawing upon all in the organization to contribute towards the progress and prosperity of the organization with which they are associated. Even large industries with big staffs of industrial engineers cannot hope to cover all the possibilities for improving work methods. One large chemical industry employs over 300 staff industrial engineers and yet it has a continuous work simplification program.

In New York I am associated with the New York University Round Table - Work Simplification Program. We have representatives from industries all over the East continuously taking courses in this work, and it is interesting to note that many of the utility organizations are following up work simplification. Many participants are from small companies. The approach and handling of the subject material is the same whether the company is large or small.

I have attempted to describe work simplification in that it is a part of Gilbreth's original motion economy contribution to industry, and that its intent is to do what the name implies, and that we have a problem in management to alert lackadaisical minds, minds that can think - if given the proper auspices and opportunity; that in considering the installation of a program of this sort we must plan according to

our own individual situations and problems, study the people with whom we are to work in the program and plan such a course along lines suggested by the key factors of people and problems. In so doing, we raise the morale of our management and our people, we reduce our costs, we become competitive and assure ourselves that we have an alive and alert organization.

Discussion following the subject:

Question: Can you elaborate on the methods of obtaining the artisan or operator support in the program, and how important is it that this be obtained? Answer: You must have the artisan's support and cooperation and it has to be obtained through the efforts of the supervisors. A suggestion system, when established, will stimulate cooperation; and, in order to maintain a good attitude, pay-off should be very prompt.

Question: Is it more desirable for company or outside personnel to lead the course? Answer: The leader must be technically good and a person commanding respect of the people attending the course; aside from this, it does not matter where he comes from.

Question: When a Suggestion System is in operation, is it always necessary to provide a monetary reward? Does the system ever work without it? Answer: I am only familiar with systems involving a monetary pay-off, which is normally on the basis of 10%.

Question: On exactly what is the 10% pay-off based? Answer: The 10% is based on the first year's savings of direct labor. 10% should not be regarded as a rigid figure; sometimes it may not be sufficient.

Question: Would it be worthwhile to put an engineer in just one department for a trial effort with the idea of planting the seed of thought to get a program started? Answer: You would have to deal with the problem cautiously. Once the idea catches on the system will develop fast. In some cases it may be very wise to start in only one department and then expand to other departments or divisions.

Question: Do you encourage supervisor participation in a Suggestion System? Answer: No. This is assumed to be part of his job. A man is ordinarily regarded as not eligible for pay-off if he has the authority to influence accomplishment of an idea suggested. In some companies a bonus or other recognition may be given to supervisory personnel, provided this decision is made by top management.

Question: Can you give us some details on the round-table program which is mentioned?

Answer: Various subjects are dealt with and leading authorities in various fields attend. Professor Dave Porter and Prof. Mullee, for example, as well as Harold Finlay, of Metropolitan Life Ins. Co. were present for participation. A ten day program was introduced on office methods and for each topic a specialist was introduced. The discussion was not, however, confined to one subject and results have been very gratifying. Fine savings have been effected in the fields of rubber, electrical and steel manufacturing.

Question: Is the primary objective of the suggestion plan for gain financially or personnel morale? Answer: Primary objective should be regarded as improvement in personnel morale, naturally actual financial savings are important objective.

Question: Is it more desirable that the industrial relations department or the industrial engineer handle a work simplification course? Answer: Industrial Relations should handle the course. The industrial engineers can give it if necessary.

Question: What length of time is recommended for consideration of an idea before pay-off under a suggestion plan? Answer: Pay-off should always be as prompt as possible. Many companies pay-off in about two months, some more quickly.

Question: Are shop stewards ever invited to participate in a work simplification course? Answer: No; since they are automatically not willing to attend and in some unions the policy is against their participation.

Question: Statistical figures for this area show that from 70 to 80 of the manufacturing is conducted in companies of 20 employees or less. How practical is the introduction of a work simplification program in small plants such as these? Answer: It can be very effective if strong leadership is provided.

Question: On what basis may the proper selection of a leader for such a program be judged? Answer: On the basis of high integrity technical ability, and character; he must be an individual who gains the respect of the people with whom he will deal.

Question: Is it better for the leader to be a person of much higher management level than the persons attending the course? Answer: Ordinarily this is not so good because some of the

people in attendance may be reluctant to talk freely and express ideas which they feel could be contrary to the opinion of the high management leadership.

Question: If, under a suggestion system, an idea is considered unacceptable, do we explain why to the person who submitted the idea? Answer: In order to maintain the morale of the people involved, a written answer must always be provided, whether the idea is accepted or not.

Question: How far down in organizational level do you go in selecting individuals to attend a work simplification course? Answer: Ordinarily not below group leader.

Question: When introducing these programs, how do you convince the employee that improved methods will not cause loss of jobs? Answer: At the introduction of a program the company should have lots of work ahead so that improvement of methods merely means improved production and not reduction of force. There is an optimum psychological time to start a program.

Question: Are nebulous and undefined ideas considered acceptable if they are worthy of development? Answer: Yes. Any good idea is acceptable although some companies modify the pay-off according to the amount of development which will have to be done to put the idea into effect.

Question: Is any award system provided for the group attending the work simplification course? Answer: No.

Question: How then is the group attitude kept alert and active? Answer: Individuals of this group are normally proud of their ability and have a sincere interest in accomplishing gains for their company.

Question: Under a suggestion system, what percentage of ideas submitted are worthy of receiving a pay-off? Answer: Experience shows that the average pay-off is between 20 and 30 percent of total suggestions received.

Question: Are suggestions submitted ordinarily received from a small group of employees or is there a general spread through the employment of the plant? Answer: There are those who will never make suggestions and those who put in several suggestions during a year. The spread is limited to some extent and it has been shown that the average number of suggestions received per participating employees is four (4) suggestions per year.

Question: Is the operator told what will be done with a suggestion submitted? Answer: Yes.

This is necessary to create and hold employees' interest.

Question: In the mechanical manufacturing field, where is the greatest gain by application of the program? Answer: Dave Porter describes big savings as "steam-shovel savings." The best examples of this type of improvement have been observed in new methods of materials handling and improvement of assembly operations.

Question: Are there set rules to determine whether or not a program will be good for a company? Answer: Not exactly. It requires an examination of present methods and organization to make this decision.

Question: What do Industrial Engineers do during a recession period? Answer: Industrial Engineers are effected no worse than other fields of endeavor or business in general. If these programs are not warranted, there still remains organization activities, production control, plant lay-out, etc.

Question: Are there times when introduction of a work simplification program may be critical for small companies? Answer: Yes. The introduction of a program is sometimes capable of saving a small business from failure.

Question: Is it desirable to mix foremen and engineers in a group attending a program? Answer: This depends on circumstances, but ordinarily it is better to separate the groups.

Question: If they are separated, what is done to correlate the activities of the two groups? Answer: The correlation comes naturally, since ultimate objectives are similar and it shows in the results of the efforts.

Question: When extremely large savings are made through a suggestion, is the 10% pay-off actually made? Answer: This is a matter of management policy which should be clearly established in advance. Some companies have established \$200.00 top limit and in special cases pay-offs of several thousand dollars have been made.

Question: When calculating the base amount of savings for a pay-off, is the development expense considered to be amortized in one year and the pay-off based on savings beyond this amount? Answer: Yes.

Question: If the savings from an idea equals the development and installation cost, what pay-off is made? Answer: It may not be desirable to make the installation, or the expense can be amortized over several years and a proportional amount of one year's savings used as basis for pay-off.

Question: Is it likely that there will be a difference of attitude between workers on incentive plan and hourly rates? **Answer:** In general you may expect less resistance to the introduction of a program from day workers.

Question: What can be done about the award if an idea submitted is not of a direct money saving type? **Answer:** Sometimes the man is given a raise, or other definite recognition for his service if the idea is worthwhile.

Question: In one local company, as result of two year's efforts toward improvement of methods and organization, some departments were combined and plant reduced from 60 to 50, and the hours required for manufacturing of one unit of the product reduced from 30 to 20. In a case like this, how can you now sell management on a work simplification program? **Answer:** A very good job has been done and I would perhaps wait another year or so before making the effort to introduce a new program. However, the campaign for better methods is an unceasing one.

SECOND SESSION

MOTION STUDY AND METHODS DEVELOPMENT

Ralph M. Barnes

Professor of Engineering and

Production Management

University of California, Los Angeles

Our present standard of living is far below the level that we should have and can have. If all industry and business used the best management methods and techniques available, we could attain a level of output of goods and services now undreamed of by most people. We all want more and better things at the lowest possible cost but to get them we must have greater Productivity per man hour. It does not mean that people will have to work harder physically. It does mean that management and labor both will have to use their imagination, ingenuity and inventive ability to eliminate all useless and unnecessary work and to find the easiest and most efficient way for each person to do his job.

Of course, the amount of goods and services produced could be increased by employing children and older people past retirement age or by asking for a longer work week. However, in peace time, these do not seem to be practical suggestions. Rather, we must look for ways of increasing the productivity of those now working.

This matter of increasing productivity is, in my opinion, one of the country's greatest problems today. If we ever hope to halt inflation, provide for our foreign commitments, maintain our national defense, and support the large federal, state and local budgets, we must become more productive. In fact, our survival as a nation may depend upon it.

Now for a definition of our term - increasing productivity means getting more units of production per man hour worked; thus if a farm tractor plant employing 500 people increases its output by 25 percent, we mean that 25 percent more tractors per day will be produced with the same number of people working in the same plant. Along with this increased output, it is expected that there will be a reduction in the total cost of each tractor produced. This

should result because of the lower unit labor cost as well as lower overhead.

The engineer has played an important role in increasing productivity and reducing cost. In fact, it is often said that an engineer is a person who can do for one dollar what others do for two dollars.

There are a number of different ways of increasing output of the worker and reducing the cost of the product and I want to refer to some of these briefly.

1. The product should be designed so that it is economical to manufacture. An improved design may contain fewer parts, permit simpler machining or employ less expensive materials. For example, one manufacturer of arc welders was able to reduce the selling price of his product by over \$3,000,000 in one year because an improved design of his welder inherently required fewer man hours of labor to produce than the preceding model.

2. Tools, machines and equipment should be employed to relieve the operator of physical work and thus multiply his efforts. One rubber footwear manufacturer has increased the output of his plant by 40% by replacing handmaking methods by a mechanical process. Modern machinery in this plant has helped materially in converting a business on the verge of bankruptcy to a highly profitable one and the number of people employed has increased from around 300 to 1000.

3. Greater use of power should be employed to assist the worker in doing his job thus making his work easier and more satisfying. Power driven machines, power conveyors, and material handling devices multiply the efforts of the worker greatly and enable him to increase his output. One automobile manufacturer is working toward the objective of mechanizing its factories so completely that no employee will become so fatigued during the day that he will need to stop his work to rest. Electrical and mechanical power will merely have to be controlled by the worker.

4. Much greater attention should be given to the human factor. In many cases the operator is expected to work out his own method of doing his job and is left to determine for himself what should constitute a normal day's work. In most cases this is not the best solution. Management and the worker together should develop the easiest and most effective method. After the method has been standardized, and after the proper person has been selected for the job, and properly trained to do the job, then and only then should a time study of the operation be made to determine the time standard.

Recorder: T. L. Carroll, Chief Industrial Engineer, Columbia Steel Corporation, San Francisco
Introduced by E. P. DeGarmo, Assoc. Professor of Mechanical Engineering, University of California Berkeley

Work is largely a combination of mental and manual effort expended in a given period of time. Most factory work and much office work are largely manual, and manual work can be analyzed, improved and measured. Manual work consists of movements of members of the body and there are fairly definite and specific rules which, if followed, will enable a person to do a given task in an easier, faster and more satisfying manner. Thus, an increase in output results but no extra expenditure of energy on the part of the worker is required. Although motion study had its beginning over fifty years ago, it progressed slowly for a good many years. However, the rapidity with which motion study is being adopted by industry today presages a great future for it. The philosophy as well as the techniques and methods of motion study are of such wide scope and are so fundamental that I believe they will bring results as startling and as far reaching as the industrial revolution.

Through all of the centuries preceding the industrial revolution, man possessed the skill and with the aid of relatively simple tools, he produced the goods and products which he needed. The handicraftman had his day. In fact from ancient times until the latter part of the 18th century, production methods had changed very little. The number of man hours necessary to make an article was great. The standard of living was low. There was never quite enough food and clothing or shelter. Famines and epidemics were frequent, - man had not learned to cope with nature.

Then suddenly the machine age was born. The skill of the worker was transferred to the tool or machine, thus enabling men and women of little skill to produce more in a given time. The inventions in the textile industry were followed rapidly by similar inventions in many other fields. These inventions, together with the development of a practical steam engine marked the beginning of the great revolution in machines and production methods. Skill of every conceivable kind was transferred to the machine and production was increased a hundred-fold. Because of this, much thought and effort have been given to refining and perfecting the machine, - usually with little attention directed toward the person who operated or maintained it. In fact, the operator has been taken for granted so often that time and again the question has been asked, "Is the machine the master or the servant of man?"

With full cognizance of the great contribution the machine has brought, and with a definite and positive assurance that we would not want to consider for a moment living without the machine, I believe we are entering a new era in which greater emphasis will be placed on the individual. The man will come first in all of our plans.

No machine is entirely automatic. Human effort is required to build, adjust, service and maintain all of our equipment. Also much work at present cannot be done economically by the machine. Much

manual work is still required. The principles of motion economy have been tried and tested in so many different types of human activity that we can say without fear of contradiction that motion study can bring increases in output in any manual task whatever.

Fundamental principles underlying good work methods are just as simple and as easy to apply as the "transfer of skill." However, there is one basic difference. In transferring skill from the man to the machine, our every thought has been directed toward the machine. The design engineer, the inventor, and the machine builder held the key to successful manufacturing. We are now entering a period in which the emphasis is shifting from the machine to the man. When a manual operation is the subject for study, the situation is different. The individual who does the job can readily be taught the simple principles of good work methods and can apply them himself. The worker can design his own job. Job design can be learned and practiced by all.

Even though the man on the job never becomes as proficient in applying motion study principles to his work as the especially trained engineer and although he may have to rely on the methods department to make and install certain devices needed in simplifying the job, yet the worker can take the initiative in this matter. Thus by placing the tools of motion study in the hands of those who supervise, direct and manage, as well as those who actually do the work, we have a formula for increasing production, reducing fatigue, and increasing satisfaction on the job, the like of which we have never seen in the past.

There is a basic difference between the two areas of activity to which I have just referred. For example, in the design and construction of a factory building, it is a relatively simple matter for the engineer and the architect to lay out the lighting, heating and ventilation. The particular group of people who will occupy the building need not be consulted. However, when the operator in the factory is asked to change his work method, the matter is a personal one with him. Most people resist change. They often feel that a suggestion for a better method is a criticism of their present one. They do not want to leave the well worn groove. The most ingenious method of doing a job that can be devised is worthless unless the operator can be persuaded to use it. Therefore, a different approach must be used in a methods improvement program. It is necessary to lead or persuade the operator to want to adopt the method which will result in increased output and lower cost. One of the best ways of doing this is first to explain in simple terms the objectives and the techniques of motion study, and then organize things so that each individual will profit by cooperating and participating in the program. The worker must benefit in the short run as well as in the long run.

One criticism of industry today is that the worker is constantly confronted with changing conditions in the organizations which affect him and his job, but over which he has no control or part in creating. Moreover, he is often not consulted about contemplated changes and may not even be informed about them in advance unless he happens to hear about them through the grapevine.

The program for methods improvement which we are discussing here calls for the worker's cooperation, uses his personal knowledge of his job and his general "know-how." He gets added satisfaction from his job, feels that he is a member of the company team, gains recognition from his fellow workers and from management and receives extra money in his pay envelope. The workers productivity has increased and the cost of the product has been reduced.

I believe that an intelligent program of methods improvement and work simplification is consistent with the broad objectives of business and industry in this country today.

I now want to discuss briefly the approaches that are commonly used in improving methods, and cite a few examples of application of motion economy principles.

Figure 1 lists the management tools relating to the payment of wages. The goal of particular interest to this discussion is motion study, which aids in developing the easiest, safest and most efficient work method.

Motion study principles and techniques can be applied to three broad categories of activity for the purpose of effecting improved methods of production and reducing costs.

- a. Process analysis provides an understanding of the over-all production process - i.e., analysis is made through study of the broad aspects of the entire production process, its requirements and sequence of operations.
- b. Equipment utilization is improved through study and analysis of the relationship between men and equipment in the production operation.
- c. Operation study or analysis is applied to manual jobs and involves the study of hand and body movements toward the end of getting a job done in the easiest way with respect to effort requirements and reduced direct labor cost.

Figures, 2, 3, 4, and 5 are illustrative of process analysis as applied to a problem in a plant where buffing wheels are re-conditioned by recoating with emery dust. Briefly, the production cycle requires operations to coat worn wheel surfaces with glue, to roll freshly glued wheel surfaces in a trough containing emery dust, and to place resurfaced wheels in a drying oven. Figures 2 and 3 consist of a flow diagram and process chart illustrating the old method, and figures 4 and 5 display the same technique for presenting the new method. Comparison of the two methods discloses the improvement made. It should be noted that the analysis and resulting

over-all improvement involved consideration of all the process operations and work locations rather than study of a single production operation. Such over-all understanding was necessary to accomplish the improvement.

Figures 6 and 7 are illustrative of the application of motion study principles and techniques to a situation wherein improved equipment utilization and more effective usage of labor were required. These figures demonstrate the work and delay relationship existing between the machine, operator, and helper under both the old and new methods. The improvement was accomplished by analyzing the man-machine relationship to determine where, in the productive cycle, and how the man-machine productive potential could be further utilized by elimination of machine down time due to manual work elements and by rearrangement of the manual work elements.

Figures 8, 9, and 10 are illustrative of operation analysis where study is made of hand and body motions for the purpose of increasing productivity by making jobs easier.

Figure 8 demonstrates an efficient work place that was developed through motion study by: (1) designing and placing bins so as to permit simple and short simultaneous hand movement; (2) pre-positioning of tools; and (3) utilizing an assembly jig.

Figure 9 illustrates a case where the original machine arrangement was designed with little regard for the operator and consequently the required work method was cumbersome and inefficient. The new machine design is also shown. This improved arrangement made it possible for the operator to produce more with less effort and initial cost of the machine was reduced.

Figure 10 illustrates a left and right hand operation description of a productive method. Not only does this technique provide a valuable means of analyzing work with respect to right and left hand balance to affect methods improvements, but it is an excellent way of recording the facts regarding the method upon which standards are based. All too frequently this phase of performance standards development and incentive application is overlooked and consequently the maintenance of standards in current adjustment with changed conditions is difficult, if not impossible, of administration.

SUMMARY: To summarize, we want to find the most economical method of doing every task by eliminating all unnecessary elements of the job and by using the easiest and most effective means of accomplishing the objective.

Wherever feasible a standard time should be established for the job and the worker should be encouraged to meet and beat this standard. If a wage incentive plan seems desirable, the worker can be compensated in direct proportion to his output.

MANAGEMENT TOOLS RELATED TO THE PAYMENT OF WAGES.	
TOOL	PURPOSE
JOB EVALUATION	TO ESTABLISH THE RELATIVE WORTH OF JOBS IN AN ORGANIZATION.
MOTION STUDY	TO AID IN DEVELOPING THE EASIEST, SAFEST AND MOST EFFICIENT METHOD.
TIME STUDY	TO DETERMINE THE STANDARD TIME FOR A JOB.
WAGE INCENTIVE	TO PAY EACH WORKER IN PROPORTION TO HIS PRODUCTIVITY.

Figure 1

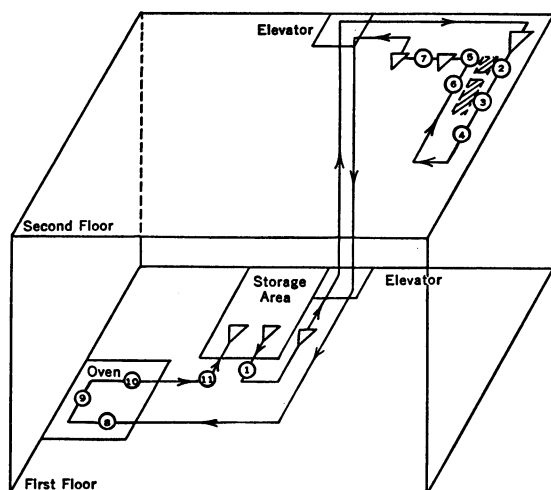


Figure 2

Flow diagram of old method of re-coating buffing wheels with emery.

PROCESS ANALYSIS

Re-coating Buffing Wheels with Emery
Old Method

Travel In Ft.	Symbol	Description
	▽	Worn wheels on floor (to be re-coated)
	1	Load wheels onto truck
40	H	To elevator
	▽	Wait for elevator
20	E	To second floor by elevator
35	H	To coating bench
	▽	At coating bench
	2	Coat with glue
	3	Coat with emery (1st coat)
	4	On floor to dry
	5	Coat with glue
	6	Coat with emery (2nd coat)
	▽	On floor at coating table
	7	Load onto truck
15	H	To elevator
	▽	Wait for elevator
20	E	To first floor by elevator
75	H	To drying oven
	8	Unload coated wheels onto racks in oven
	9	Dry in oven
	10	Load wheels onto truck
35	H	To storage area
	11	Unload wheels onto floor
	▽	Storage

Summary

Number of operations.....○	11
Number of storages and delays...▽	6
Number of inspections.....□	1
Number of transportations.....○	7
Total travel in feet.....	240

Figure 3

Process chart of old method of re-coating buffing wheels with emery.

Figures 2 and 3 reproduced by permission from Motion and Time Study, third edition, by R. M. Barnes, published by John Wiley & Sons, Inc., 1949.

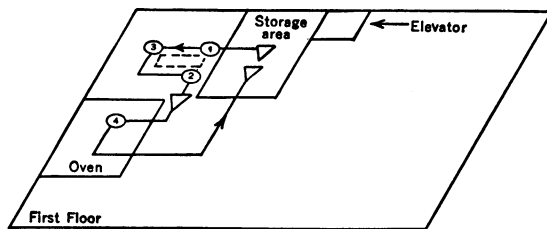


Figure 4

Flow diagram of improved method of re-coating buffing wheels with emery.

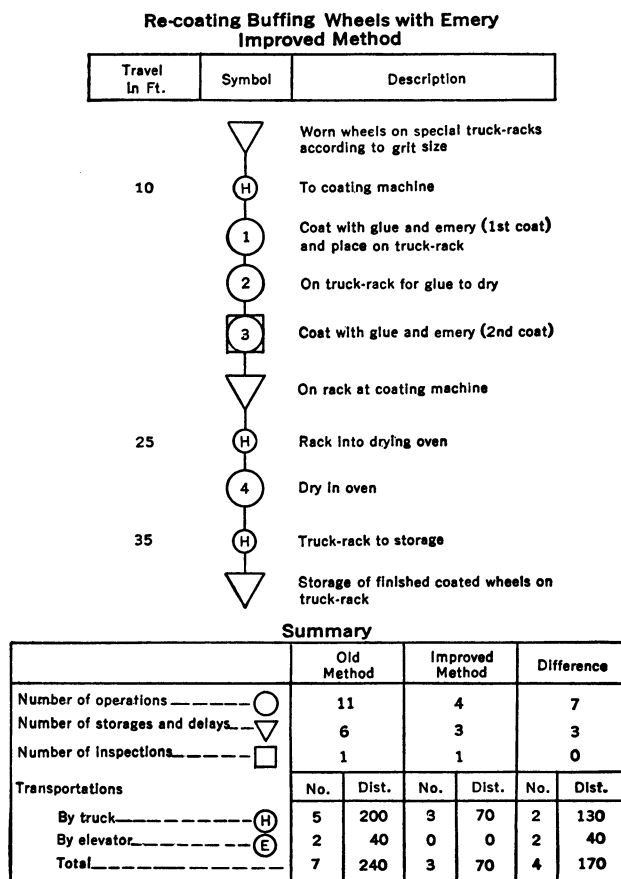


Figure 5

Process chart of improved method of re-coating buffing wheels with emery.

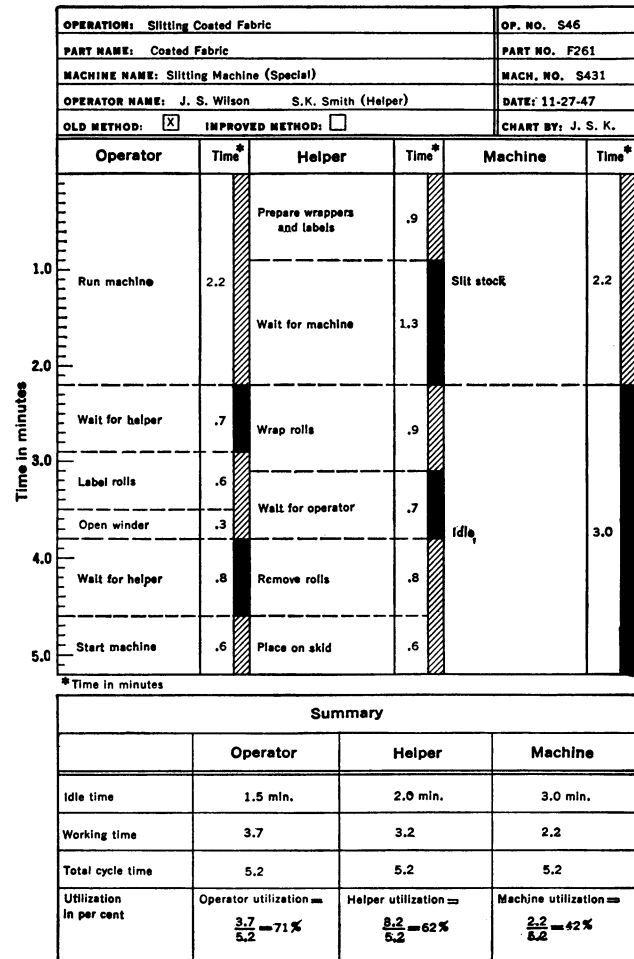


Figure 6

Man and machine chart for slitting coated fabric - old method. Total cycle time 5.2 minutes. Total number of cuts per hour = 11.5.

Figures 4, 5, and 6 reproduced by permission from Motion and Time Study, third edition, by R. M. Barnes, published by John Wiley & Sons, Inc., 1949.

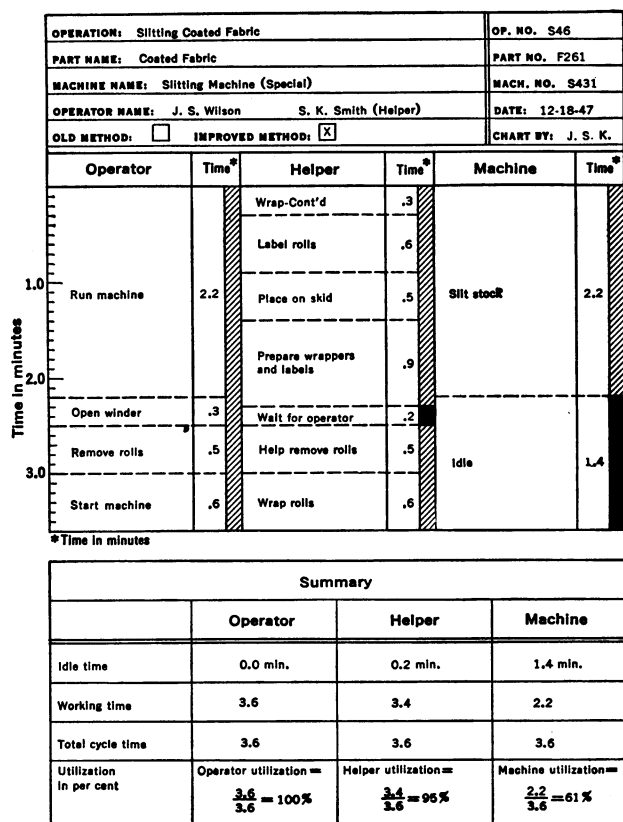


Figure 7

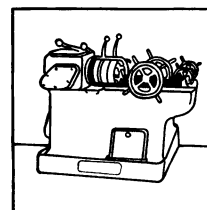
Man and machine chart for slitting coated fabric - improved method. Total cycle time 3.6 minutes. Total number of cuts per hour = 16.6.

Figure 8

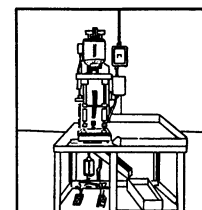
Standard work place equipment. A. Lip tray, length (from back to lip) 5-1/2 inches; width 2-1/8 inches, 4-1/4 inches, or 8-1/2 inches. B. Edge tray, length (from back to lip) 4-1/4 inches or 8-1/2 inches; width 5-1/2 inches. C. Open bin - bench type, length (from back to front) 8 inches; width 5 inches, 8 inches, or 10 inches; depth 8 inches. D. Open bin - rack type, length (from back to front) 8 inches; width at back 8-1/2 inches; width at front 5-1/2 inches; depth 3 inches. E. Curved rack to support trays, depth 5-3/8 inches; height 4-7/8 inches. F. Universal brackets for mounting fixtures. G. Tote box dolly designed to hold tote boxes of material or finished work.

Figures 7, 8, and 9 reproduced by permission from Motion and Time Study, third edition, by R. M. Barnes, published by John Wiley & Sons, Inc., 1949

PRODUCTION WAS INCREASED
COST WAS REDUCED



OLD MACHINE



NEW MACHINE

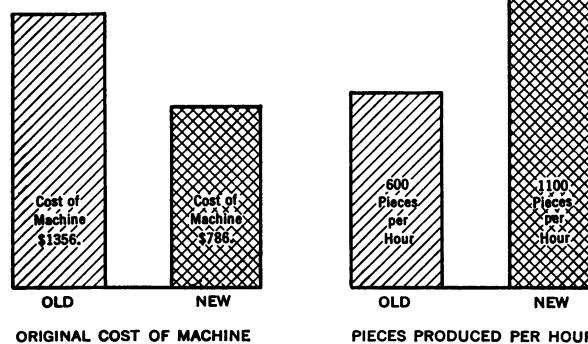
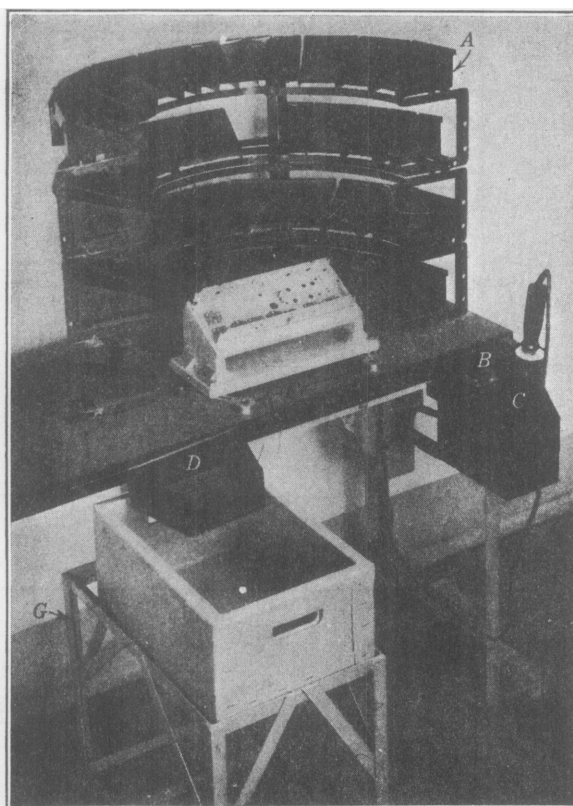


Figure 9

Chart showing comparison of original cost and hourly production capacity of a standard rethreading machine and a new machine employing the principles of motion economy in its design.



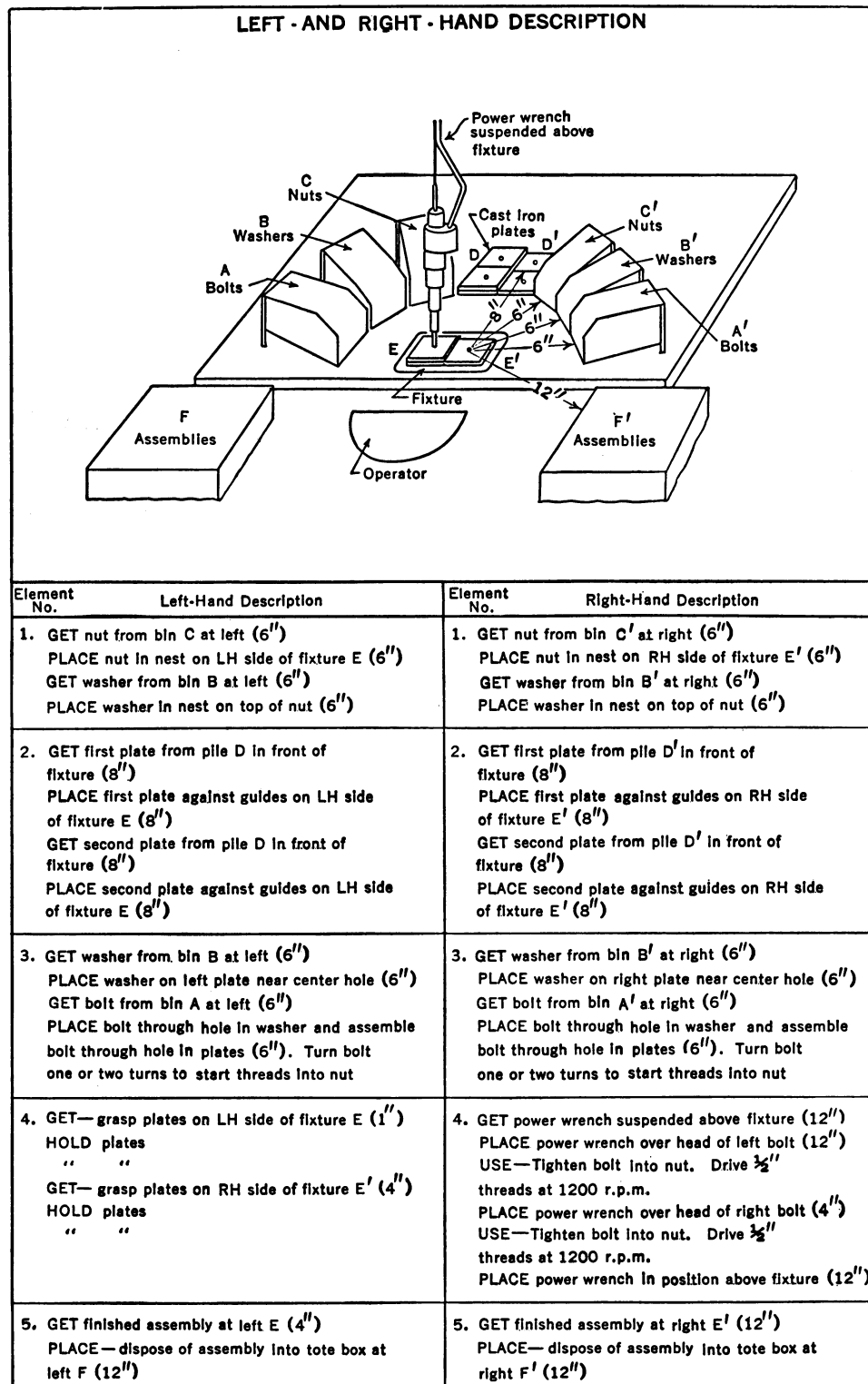


Figure 10

Left-and right-hand operation description for the assembly of cast-iron plates.

Reproduced by permission from Motion and Time Study, third edition, by R. M. Barnes, published by John Wiley & Sons, Inc., 1949.

It should be emphasized that methods, systems and techniques produce small effects unless the interest and cooperation of each individual worker are received and maintained.

Question: With regard to the slides illustrating the method of inspecting reels, would it not be advisable to develop a mechanical method of handling the reels and performing the inspection?

Answer: In the preliminary stages of development, several mechanical aids were tried but they were discarded because they were not satisfactory. With further refinements in the manufacturing process of the reel, it seems likely that certain elements or part of the inspection operation can be eliminated and other parts mechanized without too much difficulty.

Question: Please discuss the application of job analysis and methods study in job shops vs. production shops. **Answer:** The principles of motion economy can be applied in job shops as well as in production shops. Although in a job shop the total dollar saving on a given product or order may be smaller than in a production shop, the percentage of savings may be just as great. Frequently it is possible in a job shop to study a type of work rather than a specific job. Thus all welding or grinding or drill press operations might be analyzed and improvement developed and put into effect with profit to the organization.

Question: What is the best method for establishing allowed time for standards: average time, leveled time, selected minimum time, etc.? **Answer:** In setting a time standard for a specific job, the operation should be divided into elements and a sufficient number of elements should be timed to give a representative sample. At the same time the data are recorded, the operator should be rated for speed or pace. The average time for each element (average of the stop watch readings) is usually taken as the selected time or representative time for that element. This selected time is then multiplied by the performance or speed rating factor to give the normal time for the element. Allowances are added to this normal time to give the standard time for the job. I believe this procedure is pretty widely used throughout the country.

Question: The methods for accomplishing motion economy are well accepted and the benefits to be realized by methods improvement are generally appreciated but how, so you sell the management on the idea of adopting a program of motion economy and methods improvement? **Answer:** The boss in the front office must be sold on the methods program and must support the program in a

positive manner. To do this he must understand the methods and techniques and must continuously keep in touch with the program. Likewise all top management, middle management, and the foremen, group leaders and key operators must be convinced that a methods development program will be to their own advantage and to the advantage of the company and the employee.

I believe the industrial engineer should take the attitude that he is employed to give service to the line men in the organization, that is, to the foremen, superintendent, and factory manager. If the industrial engineer can get these men to suggest ideas for methods improvement, he often can aid materially in carrying the ideas out, but in each case, he should make certain that the line men receive full credit for the installation.

THE HUMAN FACTOR IN INDUSTRIAL ENGINEERING

Mason Haire, Department of Psychology and Institute of Industrial Relations,
University of California, Berkeley.

The psychologist has a proper role in talking to engineers because industrial production problems are partly mechanical, partly human. We have a technological machine, the like of which has never before been seen. However, the changes and improvements that are being made are barely keeping pace with the decrement in human productivity. The clear implication is that we need to know more and more about the people who operate these machines.

We know a lot, usually, about how to lubricate the machine, how fast to run it, the kind of power input required, and all the other technical knowledge to operate it successfully. Can we answer the same questions about the people who operate these machines? If we ran a machine with as little understanding of its characteristics as we have of humans, we would probably burn out bearings or otherwise ruin the machine and be out of jobs. We do know and understand machines up to the handle but there our knowledge dips sharply.

What can we say of human and technological change? Two big points:

1. When we introduce changes, we must do it with the nature of the people clearly in mind.
2. When we design changes, we must do it with the nature of the people clearly in mind.

Recorder: William Price, Industrial Relations Supervisor, General Electric Co., Oakland.

Introduced by: Ronald W. Haughton, Assistant Director, Institute of Industrial Relations, University of California, Berkeley.

People resist changes which are externally induced. This resistance to change is rooted in all humans and for two reasons:

1. Our world from birth is very confusing; very few things are simply organized or simply true. One of our big problems is to organize this chaos into a sensible pattern we can live with.
2. Because this problem of making sense of the world is so vital and close to us, changes mean insecurity. Trying to make sense out of a complex and confusing world results in rigidity.

You can't make people change their minds. You can often create situations where they are likely to see things differently. This is the way to induce change. Failing to realize this, we often introduce changes poorly and blame the result on the group. How many times have you heard the blame for a failure of a change put on the intractability of the people we were working with rather than on the way the change was handled?

The second point may be more important than the first. Changes should be designed with people affected clearly in mind. Don't try to take account of piddling psychological factors like the optimum length of a lever for exerting maximum pressure, or the optimum rate of manipulation to minimize fatigue and insure maximum production. All of these things are important - we must design our things to fit the visual acuity, the reaction time, the manual dexterity, the coordinative capacity, etc., but there are much bigger and important things:

Why do people work?

What do they get out of work?

What is the difference between the way the boss works and the way the worker works? Is it all the difference between the boss and the workers as people, or is some of the difference in the way each of them sees his job?

Why does the worker do a half-hearted job all day at the factory and go home and sweat blood to build a perfect boat in a bottle?

Can we use the answers to these things in designing the work situation? To cut down absenteeism - turnover - rejects - grievances? One factory tried; they gave the girls who did the inspecting direct control of the speed of the conveyor. The girls took advantage of it at first, got the resentment out of their systems and then settled down to doing an honest day's work. Thereafter, their slowest speed was higher than the average speed had been formerly. This illustrates an important factor in work. We all need expression for autonomy and independence.

How many times do we fail to utilize the many things for which we work:

1. Pay
2. Recognition
3. Feeling of accomplishment

Can we lay out production lines on the basis of the psychological characteristics of the people who are to run them, and then build machines to fit the people?

More research is needed in this area and more opportunities for research. When we begin to design our changes with the characteristics of the people concerned in mind, we may then be in a position to make increases in productivity per man-hour that will make all past performances look sick.

Question: Have any grocery stores ever made experiments in which the customers themselves made suggestions, such as the kind of baskets, the height the counter should be, etc.? Answer: Probably some informal experiments have been made along these lines, but there are no written reports in the literature.

Question: Do you feel you can get a more ready acceptance if workers were allowed to participate? Answer: Yes. Invite participation when you can, but bear in mind that you must follow such suggestions when forthcoming.

Question: Under an employees' suggestion plan, it is sometimes difficult to explain to one person why his idea was turned down while the guy next to him gets \$25.00 for an idea not nearly so good. Answer: I am leery of suggestion plans. It depends a great deal on the way they are handled. The kind of participation we want is not solicited suggestion system; it takes much time on the part of management. It is sometimes hard to explain why certain ideas are rejected. It is best to encourage participation at the grass root level.

Question: You expressed regret that the average industrial employee does not work as assiduously at his job as he might at building a ship model in a bottle. Do you not think that he might lose his enthusiasm for even that task if it were his job? We are all aware of many influences which operate constantly and deliberately - whether through strikes over trumped up or confused issues, or to subtle innuendo in radio and movie scripts to cause dissatisfaction with the American system and hostility toward "the boss" as its most proximate representative. Do you not believe these forces are a much greater psychological hazard than, for instance, a lack of employee participation in planning? What suggestion have you as to how this sort of influence may be counteracted? Answer: (by Ronald Haughton) General Motors and General Electric Companies have plans for reaching employees. They realize that sympathies will be with the Union on many issues, but loyalties can be with both, and the companies hope to establish good working relationships. It's well established that people in group operations can establish a sense of participation. Lockheed Aircraft actually put certain assembly problems up to groups of workers and they worked out time savings methods which resulted in almost 50% savings.

LUNCHEON 12:00 - 2:00

INTERNATIONAL HOUSE, BERKELEY

Luncheon Speaker:

Mr. Frank E. Marsh

Executive Vice President of the San Francisco Bay Area Council, Inc.

"Industrial Development in the Area - Prospects for 1950"

WORK SIMPLIFICATION APPLIED TO MANAGEMENT PROBLEMS IN THE U.S. ARMY

Lt. Colonel R. E. Vanderberg, U. S. Army Chief,
Management Division,
San Francisco Port of Embarkation

It will no doubt come as a surprise to most of you to learn that an Army installation such as the San Francisco Port of Embarkation has developed a management program, and is actively engaged in applying the latest scientific management techniques to military operations. This program covers all phases of scientific management engineering and has been extended from the highest Army offices in Washington, D. C. to the smallest field operations in various parts of the world.

The military services certainly provide a fertile field for the application of management engineering principles. As an aftermath of the world's greatest war, stupendous problems have been created for the Armed Forces - problems which the Army is attacking with the same thoroughness of preparation and vigorous effort with which it solved its logistics problems during the war. We, as management engineers, know that the end result of management techniques is never static. Conditions change, methods become obsolete, and there is always a better way of doing the job. Thus the management program must be extended indefinitely, amended to meet changing conditions, and re-designed to accomplish the desired results in effecting greater economy and obtaining maximum efficiency.

Of all the many applied techniques of management engineering, I consider work simplification techniques to be of paramount importance. It is these techniques which produce real savings in both manhours and money. At the San Francisco Port of Embarkation, we have pursued vigorously a program of work simplification which has resulted in considerable savings to the Government. One example of this is the

Reports Control activities. During the war the Reports Control Branch of the Management Division, San Francisco Port of Embarkation, reviewed all reports of a recurring nature with the aim of eliminating duplications and superfluous reports. Upon the cessation of hostilities, however, many of the specialists in the Branch returned to civilian life, and as a result control over the reports program diminished. By June 1948 many voluminous and superfluous reports developed, with no proper authority or sound justification. To solve this problem, Reports Control officers were appointed within Divisions; the Management Division made a thorough analysis of all reports, redesigning forms and establishing more efficient routing procedures; and conferences were held for the purpose of developing an effective Reports Control Manual. The Reports Control Manual clearly defines all phases and responsibilities of the reports control program, and requires submission of all requests for new or additional reports to the Reports Control Officer, Management Division, for approval.

As a result of the control thus established, many reports were eliminated through combination and consolidation. Internal recurring reports were reduced in number from 255 to 50. It is estimated that the savings to the Government between July 1948 and January 1950 total 14,130 manhours and approximately \$23,000 per year. Still further savings can be effected - but the survey work cannot be allowed to reach a point of inertia. To be effective, such a program must be pursued vigorously by follow-up surveys and analyses to maintain the volume of reports at a minimum level; and, equally important, the program must have the backing and authority to act for top management, for obvious reasons.

Another problem we encountered was the necessity of reducing the time required for processing civilian personnel returning from overseas through the San Francisco Port of Embarkation. Processing averaged $2\frac{1}{2}$ days for each individual, whose salary and per diem allowance continued until return to the point of original hire. The Port processed an average of 5000 such people each year and employed 24 clerks to handle the workload. Week-end arrivals caused still further delay, since clerks were not worked overtime; and in many cases debarkees managed to disappear before being processed. Discharge of baggage required

Recorder: Owen S. Reinold, Office Manager National Automotive Fibres Inc., Oakland
Introduced by: W. L. Barnes, President of the Society of Industrial Engineers & Chief Industrial Engineer Cutter Laboratories, Berkeley.

24 to 26 hours, and many times a vessel was totally discharged before baggage could be assembled.

This problem was solved by placing processing clerks on a production line basis; by obtaining authority from higher headquarters to pay overtime for Saturday work when necessary; by furnishing transportation to debarkees from the gangplank to the processing center; and by requesting through the Chief of Transportation to overseas ports for top stowage of baggage to expedite unloading. The net result of this work simplification was a reduction in processing time from $2\frac{1}{2}$ days to one day, and an estimated saving to the Government of approximately \$140,000 per year - not to mention the beneficial effect on passenger morale.

I can cite many more examples of work simplification techniques applied to Army problems, each solution resulting in considerable manhour and dollar savings to the Government. Total savings to the United States Government as a result of the overall work simplification program at the San Francisco Port of Embarkation alone for the period 1 July 48 to 1 October 49 amounted to more than \$235,000. Total savings as a result of the over-all management program at this Port for the period 1 July 48 to Dec. 31, 49 was more than \$2,500,000.

We have learned from these and other similar, yet totally different, problems that there is always a better way to operate. And by the same reasoning, there is always a better way to perform work simplification surveys. Management specialists cannot set up a standard technique which will be entirely applicable in each situation due to the constantly varying circumstances and situations surrounding each case. Process flow charts are effective but are not always the solution; neither is wholesale reorganization always the solution. But one thing is certain - examiners must be constantly on the alert for organizational weaknesses. And by "organization" I mean the grouping of like functions and activities within those functions; clearly stated missions; carefully defined responsibilities; and precisely delegated authorities. Even though an operation appears efficient and has been practical for a long period of time from an operator's point of view, often it will not hold up under close scrutiny and thorough analysis by top management examiners. Many valuable time-saving suggestions are received from people who are on the spot, performing the actual operation. An Employee Suggestions and Awards program is another management technique which the Army has adopted with a high degree of success in furthering its work simplification program.

Development of work methods and procedures effected in field agencies often produce positive results in effecting amendments or complete changes in work methods or procedures promulgated by the "home office." To obtain the maximum benefit from a work simplification program, it requires more than just forwarding copies of surveys from field agencies to the home office for information. The

management office from "top side" must be staffed with qualified and experienced personnel who are alert and receptive to suggested changes by the field agencies. There is always a "better way" of doing a job, and who is more qualified to discover an improved method than the man in the field who is actually performing the job? This factor in management thinking cannot be overemphasized.

Work simplification techniques are an all out, common sense attack on present work methods. The heart of any management program lies in work simplification techniques. Without the constant pulse beat of new and improved methods being pumped to all extremities of the organizational system, the system will become stagnant. Work simplification techniques will revitalize the entire system by eliminating waste and increasing efficiency, making it a healthy growing and living thing. It will sparkle with success - with money in the bank. It has been the applied techniques of management engineering from the primitive methods of early man to our scientific methods of the atomic age which has created this great civilization we are enjoying today.

All through this period of human endeavor the military has played an important part in developing new methods and applying the techniques of what we now call scientific management engineering. There has been a constant interchange of ideas between the military and civilian agencies. An idea, method or invention devised by one agency has often been adopted by the other, with modifications where appropriate.

Since 1946 the Army has implemented a program of assigning selected officers for duty with American industries for periods ranging from a few weeks to one and two years. Military personnel selected for this type of duty are charged with the mission of learning everything they can about the methods and techniques employed by industry with a view to applying those techniques to military operations wherever applicable. The Army has initiated an intensive program of post graduate training at leading universities for the educational development of selected officers. Military personnel are pursuing extensive courses of instruction at these universities and are majoring in subjects which will familiarize them with the latest developments in such fields as applied sciences, engineering, business administration, psychology, personnel management and human relations - to mention a few. A similar program has been initiated by the Army whereby the Army acts as host to members of industry. This whole program has been of inestimable value in the interchange of ideas and the development of greater understanding and appreciation of the problems of these agencies. Benefits are accruing to both of these activities for the betterment and preservation of our American way of life and to the continued effectiveness of our National Security.

Should it come as a surprise, then, that the

United States Army is actively participating in a management engineering program? Along with many other governmental agencies, the Management Division of the San Francisco Port of Embarkation is an active member of the American Management Association and the Society for the Advancement of Management. Full use is being made of the many services offered by membership in these associations. The latest techniques and developments in the management engineering field are carefully analyzed and energetically applied to military operations wherever applicable.

The success of the Armed Forces in accomplishing the assigned mission in the face of the present grave world situation depends upon many things. One of the most important today is how we spend your dollars. Never before in the history of our country have our military forces been challenged to do so much with so little. Through the application of scientific management techniques, the Army is meeting this challenge on every front, in every theater of operation, and in every installation here at home. The work simplification techniques presented today are but a few of many being implemented throughout the Army. They are typical of our effort at the San Francisco Port of Embarkation to: "find a better way," increase our efficiency, effect greater economies, eliminate waste, and make every dollar invested buy more National Security.

EMPLOYEE SUGGESTIONS IN A WORK SIMPLIFICATION PROGRAM

E. C. Keachie

Associate Professor of Mechanical Engineering,
University of California

Both suggestions and work simplification involve the idea of doing work in the most effective way. Thus, both involve, basically, technological change, a fundamental of today's industrial progress.

In turn, technological change involves, in the individual:

1. Inventiveness and ability to have a new idea
2. Willingness to have a new idea
3. Initiative to do something about it - management-mindedness
4. Some knowledge of techniques of attack (suggesters often need help in this)

Again both employee suggestion and work simplification involve a knowledge of job conditions, for example:

1. Familiarity with methods used on this job
2. Familiarity with methods used on related jobs
3. Familiarity with conditions of use of the product
4. Understanding of people involved in any suggested change.

Important in both suggestions and work simplification is the idea of making changes; people usually

don't like to do that, but if both the employees who suggest and the work simplification people do agree on something, through the investigation of suggestions, that much more backing is available for proposed improvements.

I have made the assumption that you all know what employee suggestions are, as well as work simplification, certainly a very modest assumption in view of today's roster of conferees. For the present, let us take our cue from the psychologists, who define intelligence as that which the intelligence test measures, and just say that a suggestion is anything that a suggester puts on a suggestion blank. Later on we can eliminate the types of suggestions that do not apply to work simplification.

On the Relationship Between Employee Suggestions and Work Simplification

We are interested in getting a better idea of what the optimum relationship of these two important, related, and yet often independent functions might be. Certainly, if work simplification is but a subordinate tool of the suggestion plan, then it is not doing its job. If on the other hand, the suggestion plan is a minor cog wheel wholly within the gears of the work simplification department, it may fail of its highest service to the organization.

Secondly, we are also interested in getting a better idea of the actual relationship between the two existing today, in our own plant, and in other organizations. One group working in this field stresses very strongly the idea that suggestions and work simplification are not only similar, but to some extent competitive and that the chief value of suggesters' suggestions is - "Undoubtedly, a bigger value to the company than the actual saving in cost is the material help given by the suggestion system in keeping everybody in the organization on his toes and mentally alert. This is particularly true of such persons as design and manufacturing engineers, time and motion study analysts and the entire supervisory staff in general. Nobody likes to have his mistake or oversight put into the limelight through a suggestion turned in by a shop employee. After one or two such experiences, he will do everything in his power to avoid a future repetition."* I would like to point out that this may be true in many cases but is a negative (painful) approach. The reaction of a person in this situation may be destructive of the very system we are trying to build up to get ideas. Therefore, I regard this thought chiefly as something to be noted as a possible danger signal to be kept in mind in the organization and day-to-day functioning of the suggestion plan.

Introduced by: R. G. Folsom, Chairman of the Division of Mechanical Engineering, University of California, Berkeley

*Suggestion Systems, National Association of Suggestion Systems, Chicago, 1944, p. 5

Some Basic Concepts on the Nature of Suggestions

The mention of employee suggestions is likely to conjure up many and varying pictures in the minds of even such a fairly homogeneous group as we who are here today. Based on one's own experience, suggestions may be looked upon as anything from more or less necessary evils to the cheapest panacea for the ills of an increasingly mechanized industrial society. In ultimate function, the work simplification suggestions of the individual employee may be regarded as located anywhere within the gamut from being the last stand of the individual so-called "inventor" to being a part of the most modern flowering of an organized and controlled system of scientific management and engineering. Some industrial engineers have nothing to do with employee suggestions and get along quite well. On the other hand, some are in responsible charge of the suggestion plan and work with employee suggestions every day in the year.

I have spent these minutes on this aspect of suggestions because it points up two facts: First, workers do have ideas on work improvement. Second, these ideas will die somewhere between the first vague flicker in the worker's mind and even up to the point of fairly decent development of better methods if a favorable environment is not provided for their development and incorporation into the company's operation.

At this point another widely used idea will assist us in orienting ourselves to the place of suggesting in work simplification: This is the exception principle, developed by Frederick W. Taylor. For our purposes, the exception principle means simply that when the worker has an idea that pertains to job improvement, but that is beyond what would ordinarily be expected of him, and which he does not have authority to inaugurate into practice, this constitutes an exception to routine that should be brought to the attention of management, usually, to the man's immediate superior or foreman. When this is done, it of course constitutes a communication upward which is the kind of communication that is very desirable and yet often hard to get.

Values of Suggestion Plans

What are the values of suggestions in work simplification? How real are they?

1. First, the obvious value - or ostensible value - of new methods developed. Usually figures are available on this, although sometimes convenience alone justifies a proposed change. These figures usually justify the cost of suggestion systems. Savings range from \$200 - \$400 per year on the average; individual suggestion awards run from \$1 to \$12,000. No more 67 cent awards. This type of return from suggestions interests conservative management, but a system based on these savings alone, even though the savings are real, won't work. We shall see why in a minute.

2. Secondly in regard to work simplification is that value gained from helping to make the organiza-

tion "methods conscious" - a real help in getting cooperation of all concerned, on all work simplification projects, not just those involving suggestions.

3. Thirdly, suggestions are a positive indicator of job knowledge - we can only suggest what we both know about and think about. Seen in this light, suggestions help show up promotable or transferable men - important in view of prevalence of technological change - help develop men, even, for example, in the practice they get in writing up ideas. Again since most of us are said to think with only part of our minds, suggestions may help "release the brakes," mentally.

4. Fourth, is that much talked of - often controversial - value which we have fallen into the habit of calling by the general name - "morale." There are many aspects of this and many factors underlying morale. A recent survey shows that persons in charge of suggestion systems think this is the greatest contribution, with dollar values of savings second, in the ratio of two to one.

The key word here is participation. We all know why this is an issue - too often the employee is at the end of the line of command - the receiving end for orders - at least it looks that way to him. He doesn't realize that the boss is on his own private receiving end too.

The need for participation by all in getting full productivity is the reason why suggestion plans based too heavily on dollar considerations alone won't work, as I mentioned earlier. In fact, if we use employee suggestions, we are already in the area of employee participation in production problems and should recognize the implications accordingly (for example, "industrial democracy").

5. The fifth value of suggestion systems is in their aid in developing communication within the organization, especially in the kind of communication hardest to get, namely communication upwards. Both staff and line people can be the beneficiaries of this improved communication and each should see to it that they are. If the employee has no chance to tell management of a better way to do something, and must sit by watching what at least to him seems a stupid way, then his opinion of management, his morale, and his productivity are all likely to go down.

6. Sixth, the suggestion system may be a good indicator of the success of other activities, such as personnel and industrial engineering work - for example, selection, placement, training, job evaluation, work simplification, or cost control. This whole subject of evaluation and control of staff or functional activities is currently receiving more attention and will probably continue to do so. We should be alert for indications of value in our own work, if for no other reason than to place ourselves in a better position to "sell" that work.

Nature and Scope of Employee Suggestions

Let us briefly review the nature and scope of

employee suggestions with special attention to those related to work simplification. One plan, for example, requires that suggestions to be eligible for award, conform to the following guide:

An Eligible Suggestion Must

Minimum Award

\$10	1. Conserve material, energy, or time
10	2. Eliminate or improve an existing method
10	3. Eliminate or improve a tool, jig, or fixture
3	4. Eliminate an existing safety hazard
15	5. Increase present output of a machine
5	6. Improve the quality of our product
5	7. Improve protection of property
2	8. Convenience - suggestions to expedite action on projects that have been unduly delayed.

On the following types of suggestions, no award is paid, even though the idea may be adopted:

1. No definite proposal for improvement
2. Concerns a routine function
3. Covered by existing standards
4. Suggestion previously received on same subject
5. Job still in development stage, but many companies do pay on this
6. Savings will not justify expenditure
7. Other reason

In another plan, a large manufacturing company* adopted during one year the following types of suggestions:

Types of suggestions adopted	Number	Percent
Apparatus and products	753	10
Shop methods, tools, jogs, fixtures, dies	2,244	29
Finishes, change or salvage of materials	366	5
Property and manufacturing equipment	1,513	19
Forms, orders, stock, prod. inf. and dwgs.	1,452	19
Safety	950	12
Testing, welfare and education and miscellaneous	490	6

It is thus evident that many suggestions lie in the field of work simplification.

Development of Suggestion Plans

Let us take a quick look at the history and development of suggestion plans, for they are far from new.

I like to think of Benjamin Franklin as an early suggester because he had so many fruitful ideas relating to every day work: for example, methods of making the most of his own time and talents. Formal suggestion plans include, beginning in 1880, the William Denny Shipbuilding Company, Glasgow, Scotland; Yale and Towne Manufacturing Company, Connecticut; 1884, National Cash Register; 1898, Eastman Kodak and soon thereafter, Bausch and Lomb, Westinghouse, Western Electric, and General Electric.

Suggestions then grew slowly through World War I. In World War II, the War Production Board's drive was important in spreading the benefits of suggestions as a significant part of labor-management cooperation. Over 10,000 plans were in effect and an extensive clearing house system was set up for work simplification ideas. Suggestion plans have gone, as well as down, up. So have other staff activities. The most recent report of a survey*, 1949, shows that one half of the companies are on an upward trend in the submission and adoption of suggestions, but one third of the 300 companies are in a downward trend.

The important thing is to analyze and find out why suggestions are trending as they are in our organizations. Like any other activity, this one should be analyzed in light of its objectives and results. In size, suggestion plans are fairly impressive. The survey just mentioned covered some 300 companies which have some 2.6 million employees:

Suggestions made - 520,457

Suggestion adopted - 134,000

Awards paid - \$2,337,337

Average award per suggestion adopted - \$17.50

This is far below the so-called "standard" of "one suggestion per employee per year" of ten used. Adoptions are about 25% whereas in the case of the La Pointe Machine Tool mentioned** in connection with the Scanlon plan of employee participation and savings-sharing, there were 380 acceptances out of 513 suggestions in 2 years by 350 employees, a rate of 70% which is very high. The Federal Government alone saved an estimated fifteen million dollars last year from suggestions of which the Navy accounted for about half. Government has approximately the same number of employees as in the survey of private companies. However, government has a special fund for awards, and possibly more personnel available to administer plans.

On the basis of roughly 2.3 million dollars of awards alone, if we assume the average, is based on 10% of savings to company, these 300 companies saved 23 million dollars or about \$75,000 per company. This is not large in comparison with the payroll but is worth saving especially if one concedes the other values of suggestions such as the

*Reproduced from Proof, Westinghouse Electric Corporation, 1947

*N.A.S.S., Chicago, October, 1949

**"Economics for Everyman," Fortune, January 1948

development of the individual, the improvement of morale and communication, and the development of "methods-consciousness" in the whole organization.

Administration

First, regarding administration, we find that often these plans are under the personnel department, but in some plants are under the work simplification function. In others, the investigators are from work simplification, while in some, the suggestions are merely routed to work simplification at the discretion of the investigator. Obviously, the administration will vary with the objectives of the plan. If work simplification is to profit, the organization should be framed accordingly, so that work simplification is adequately represented.

Basic Procedural Features

In a logical breakdown of suggestion systems procedures as related to work simplification, the following three general phases and ten specific chronological steps of suggestion plans seem apparent:

Development of The Idea

1. Some way of ensuring that employee has idea
2. Some way of ensuring that employee can work it up
3. Some way of submitting it in useable form

Processing of the Suggestion

4. Identification for all future processing
5. Check on essentials
 - (a) Objective of system
 - (b) Other suggestions submitted
 - (c) Eligibility of employee
6. Check on value of suggestion
 - (a) What it accomplishes
 - (b) Will it work
7. What does it save; calculation of award

Application of the Idea, the Pay-off

8. Installation of the suggestion
9. Payment of the award; publicity value to the suggestion system
10. Follow-up, what actually happened?
 - (a) Was idea used?
 - (b) Actual savings
 - (c) Actual cost
 - (d) Secondary awards

Steps 1, 6 and 10, the development of the idea the analysis, and the follow-up, are of special significance to us, because they point up the ways in which suggestions can be of value in work simplification.

Perhaps the most important and yet neglected issue is this business of seeing to it that the employee has an idea. It is much easier to solve a problem that is given to us than to see that a problem exists where none is pointed out. Yet we typically expect the employees to do the hardest job of all, to find the problem, and then we give them help on the easier job of solving it! Seeing problems is supposed to be man-

agement's job. However, many employees do see new problems, perhaps because they have a different viewpoint than anyone else about some problems that are concerning them directly, and others where their view is more detached than management's; this then constitutes a real contribution of employees' suggestions.

Sometimes we can help the employee to see problems by suggesting the end results desired such as more production, less waste, or greater safety; or we can ask department heads to pose current problems, as for example, production bottlenecks, for solution.

We can help the worker see and solve problems by giving him tools to think with in work simplifications, such as the general job improvement formula. Often booklets and cartoons illustrating the ideas of eliminating, combining or changing sequence are helpful to him. In some cases, we may effectively expose him to the flow process chart, right and left hand chart, and man and machine chart, but can hardly expect him to get into the refinements of motion study, such as micromotion analysis.

Perhaps the most effective general method of helping to make the worker methods conscious is to do it through his contact with his immediate boss, and this points up the need for training of the boss himself. Much valuable training of line supervisors in methods work has taken place, especially since the War and "Job Methods Training;" such training, effectively done, helps make the industrial engineer's job easier and more productive.

Specific Problems of Application

Variables between companies:

1. The first and obvious variable between companies is size. Obviously less "system" is needed in the smaller company, although the fundamentals are the same.

2. Second, is differences in the nature of processes and employees. Where a large number of people are working on a few standardized operations which are running continuously, work simplification can well be done by experts. Also, here, the type of production employee on the job may not generate ideas readily. These two things are usually found together. Therefore, while useful ideas are always welcome, the ratio of ideas to employees may not be high. Where, however, there is greater diversity of operations, there is usually more room for suggestions because:

- a. It is physically impossible for work simplification or even the supervisory staff to cover all the possible improvement, that is, to have all the ideas.
- b. The need for cooperation is such that it would be difficult if many changes per supervisor were to be introduced without active cooperation of line people.
- c. The workman is more apt to be of the calibre that has ideas.

3. Other factors of which the implications are more apparent to you in regard to your own organizations will be the type of organization, department structure, personalities, and rapidity of technological change in the industry.

Suggestion Plan Pitfalls

Turning now to malpractices, some of the more concrete errors noted in applying suggestions to work simplification are, for example:

1. The situation wherein the foreman or other person investigating the suggestion is either
 - a. a "good Joe" - approves nearly everything
 - b. hardboiled - perhaps takes suggestions as criticism - disapproves nearly everything
2. Closely related is the case where the foreman turns down the idea and later uses it himself or conversely, where the foreman has an idea and gives it to the worker to suggest.
3. Suggestions that are gripes or concern policy - a more appropriate method should exist for handling grievances.
4. Lack of tie-in of work simplification with suggestions - an obvious problem.
5. Instances where suggestions systems are looked on with suspicion exemplified by the idea, "\$1000 for management, \$50 for me."
6. Failure to process suggestions promptly - 30 days is usually considered good.
7. Failure to treat the employee as an individual, especially in handling turn downs - the employee may not realize how much extra effort would be required to make his idea work - this is part of a necessary and remunerative training process.
8. Failure to budget adequate amounts for awards and methods changes, based on logic and experience. The charge should not be an unfair burden on one cost item. At the other extreme, for example, the Federal Government budgets award money separately; it is not charged against a specific organization.
9. Failure to check actual results (lack of control).

Areas where we need more facts:

1. We should know the cost of getting and using ideas in this way. This should be fairly straightforward in terms of the time of those employees most concerned, space, materials used, and so forth.
2. We definitely need to know more about the returns from suggestion activity - are we being too generous, or perhaps too niggardly? Some of the methods used in computing so-called savings can be called little more than haphazard. Some plans are vague and invite favoritism in awards. What relation if any should there be between returns to a worker under an incentive wage system for physical exertion, and returns under a suggestion plan for mental exertion?
3. Who makes suggestions? Statistics on this seem especially meagre. All we usually get is

the average number of suggestions per employee on the payroll, practically a meaningless figure. What percent of employees suggest? 1%? 5%? 10%? If 5%, should we use a system that involves contacting the uninterested and perhaps even antagonistic 95%? Perhaps the values are such that we should.

4. What about suggestions found worthwhile and adopted? Perhaps even in the group of those who suggest, the figures will follow the patterns of typical automobile accident statistics - 15% of the drivers have 85% of the accidents. Perhaps not. We should know. We should check to see that we are properly following up on such facts.
5. Finally, what about the employees themselves; how do they think up ideas? Like you and me? How can we best help them? Maybe we only think we know.

Conclusion

In summary: if we find that it is true that typical suggestions do concern matters readily discovered only from day to day contact, that often are not economically susceptible to normal engineering study - if we find that the suggester needs the help of people in work simplification in thinking up, modifying, and putting ideas into effect - if we recognize the many common objectives and common elements in suggestions and work simplification - if we see that work simplification people need to know what is happening in suggestion - need to see that changes made are in the best interest of all - need to see that awards are in line with recognized practice in engineering economy - which probably govern the other expenditures of the organization - including work simplification - if work simplification needs to get the benefit of all the ideas available - to get the cooperation that methods-mindedness generates - then, and only then, we shall be in a position to see the possibilities of using employee suggestions in our own work simplification program.

PANEL DISCUSSION

Questions from the floor were answered by the speakers at the Institute

Question: (directed to Ralph M. Barnes) What is the best selling point for work simplification during a very slack work period? Answer: It is desirable in slack work periods to get ready for a boom period. The methods and techniques can be taught to the foremen and supervisors and new and better ways can be developed for

Recorder: F. Theodore Malm, Institute of Industrial Relations and School of Business Administration, University of California, Berkeley

use when production is resumed. This, of course, is the practice in seasonal industries such as canning and food processing. In any methods improvement program it is necessary to have the cooperation of the workers: therefore, no steps should be taken that will not benefit this group. If you can demonstrate that a cost reduction program will improve the company's competitive position and make for more business and steadier employment you will, of course, be benefiting the employee as well as management.

Question: (directed to Harold Engstrom) In the man-machine type of analysis, what percentage might be considered "normal" as an allowance for down time caused by machine jams, etc., assuming that the machine is considered to be in good condition? Answer: We have made it a practice to allow from 5 to 8 per cent - that is, on lamp machines that are in good condition.

Question: (directed to Lt. Col. R. E. Vandenberg) Have any studies been made to find out how many suggestions come from workers and how many come from supervisors? Is there any evidence that those submitting suggestions have contacts with members of the awards committee? Answer: In our suggestion system, almost no suggestions come from supervisors. In our opinion supervisors are already paid for designing management improvements as part of their regular jobs, and should not be eligible for additional awards. However, suggestions received from a supervisor will be considered when that supervisor has offered a management improvement in an activity other than his own. All our employees are civil service "workers," - therefore, all suggestions come from "workers."

As to the second point, in the Fort Mason suggestion and awards system the awards committee assigns a code number to each suggestion received so as to conceal the identity of the person submitting it. This suggestion, bearing only a code number, is then circulated to all interested agencies for analysis, appraisal and comment. Based upon the comments received from those agencies, the awards committee then determines the actual award to be made, if any. The committee's actions are reviewed by the Commanding General. It is very unlikely that those turning in suggestions could contact the committee and influence its decision.

It may be added that the Fort Mason adoption ratio shows that 17-23 percent of the suggestions submitted are adopted. Actually, many come in proposing procedures that have been established for some time.

Question: (directed to E. C. Keachie) Is it advisable for a company that employs no industrial engineers to adopt a suggestion system? Answer: Certainly

there are such companies that have successfully adopted suggestion systems. Where it isn't possible to have a complete program of work simplification, it certainly is desirable to use other available means of improving work methods.

Question: (directed to Ralph M. Barnes) What in your opinion is the best incentive bonus pay curve? Answer: For direct labor on operations that can be measured, I think the incentive should be 100%. That is, for every 5% increase in the worker's output above standard, there should be a 5% increase in his pay. I think this is fair both to the worker and to management.

On process jobs or on operations where an incentive is placed on increased yield or utilization of materials, reduction in scrap, etc., the amount of incentive must be tailored to fit the particular conditions.

Question: (directed to Ronald Haughton) Mr. Haire expressed regret that the average industrial employee does not work as assiduously at his job as he might at building a ship model in a bottle. Do you not think that he might lose his enthusiasm for even that task if it were his job? We are all aware of many influences which operate constantly and deliberately to cause dissatisfaction with the American system and hostility to "The Boss." Do you not believe that these forces are a much greater psychological hazard than a lack of employee participation in planning? What suggestions have you as to how this sort of influence may be counteracted? Answer: Concerning the counteracting of the "influences" which you mention, two large companies (General Electric and General Motors) have recently launched large scale programs of reaching their employees to build their loyalties toward the company as well as toward the union. It is recognized that it is not possible to break the loyalties of workers away from the union, but these companies believe that a man can be loyal both to the union and to the company. Except in this sense, I think it's impossible to speak of "counteracting" the union influence.

In addition, I believe that giving participation to employees works effectively in building better feelings toward the job. At the recent American Management Association conference in San Francisco, H. E. Ryker (Vice President of Lockheed) told how a work group, handed the problem of improving work methods, was able to cut the time required on a job from 790 man hours to about half of that.

Question: (directed to Harold Engstrom) Can you suggest means of keeping up morale and avoiding excessive boredom with women operators on highly repetitive conveyor-paced assembly? Answer: I'm not convinced that women are really bored with such jobs. If they are, such things as rest

periods, opportunity for promotion, and extra activities (such as a bowling league, etc.) can help to offset boredom.

Question: (directed to E. C. Keachie) Does a suggestion system need money rewards? Answer: Yes - most suggestion systems do find it necessary to pay awards.

However, many employees would turn in suggestions even if there were no money rewards, because of a desire for participation. For example, the discussion of the Scanlon plan in Fortune (January, 1950) points out that suggestions have been submitted although there is no direct payment of them. Thus, although monetary awards are most common, other rewards such as personal recognition or the use of award pins could do the job in many cases.

Question: (directed to Ralph M. Barnes) Where are work simplification films available? Answer: Perhaps the largest collection of such films (films available for loan) is the one at the Bureau of Visual Instruction, University of Iowa, Iowa City. Films pertaining especially to farm work simplification are available from Cornell, Purdue, Minnesota and other state universities. The film I showed today, "Machine Tools and Motions" and a few other similar films were made by General Motors and may be purchased or borrowed from them, or borrowed from the University of Iowa.

Question: (directed to Harold Engstrom) What do you feel about industrial engineers moving directly into positions as production foremen, superintendents, or managers? Answer: I think that industrial engineering is fine training for managerial work, although you can move up the management ladder without it. I believe that more executive development programs should be designed to include industrial engineering experience.

Question: (directed to Ralph M. Barnes) Will you discuss briefly the progress made in work simplification in the office? Answer: Although in the past most motion study applications have been made in the shop and factory, there are great opportunities in the office. The methods and techniques may be applied just as successfully to office work as to other manual activities. The analysis of office procedures, design of forms, arrangement and balancing of load of office personnel are producing worth-while savings in some offices. Mail order houses, insurance companies, and banks are among companies that have been working in this field over a long period of time.

Question: (directed to Lt. Col. R. E. Vandenberg)

When you speak of saving so many man hours and so many dollars, is the value of the man hours included in dollars saved? Answer: Yes, it is. Every effort is made to express the savings effected as the result of a work simplification technique in a dollar value. In addition to other factors, the man hours saved are converted into dollars. We use the over-all dollar value as a means of measuring the success of the program - the breakout of man hours is normally included in every instance for the purpose of further workload analysis and possible reduction in force action.

Question: (directed to all) What do you recommend that individual plant management do to offset labor's chief objections to work simplification - eventual unemployment? Answer: (by Ralph M. Barnes) Our objective is to increase the worker's output per hour and reduce costs. With lower costs, volume is expected to increase and more rather than fewer, workers will be needed to supply the demand for the product. Many companies have a long record of doing just this and every opportunity should be used to point this trend out to the employees. Eastman Kodak Company, for example, has published data in its annual report showing the trend with regard to "increase in number of employees," "increase in annual wages," "increase in annual real wages," etc.

Management should demonstrate by its actions that persons displaced by method changes are given equivalent jobs elsewhere in the plant at a wage rate as good or better than they were formerly paid. The move you ask the employee to make must be to his advantage if you want to maintain his cooperation.

I think the problem of satisfactory transfer of workers is just as important as the problem of developing a new method or the designing of a new machine that will displace the workers and make the transfer necessary. As much thought and care should go into the solutions of the first problem as go into the others. Answer: (by Harold Engstrom) Companies with good work simplification programs haven't had to lay off people. These are the companies with progressive ideas - and are the companies which are expanding because of that.

In my own company, Sylvania tries to give workers displaced by methods changes equal or better jobs.

**RESULTS OF INTEREST QUESTIONNAIRE
ISSUED TO THOSE ATTENDING
2ND INDUSTRIAL ENGINEERING INSTITUTE
January 28, 1950**

Total Number in Attendance.....312
Number of Questionnaires Received....218

Tally of Questionnaires Received

- | | | | |
|----|---|-----------|------------|
| 1. | Did this Institute cover your area of interest? | Yes | <u>198</u> |
| | | No | <u>4</u> |
| | | Partially | <u>16</u> |
| 2. | If provided by the University, which of the following services would you be interested in and/or use? | | |

	<u>Interested In</u>	<u>Use</u>
a) Time Study Rating Films	85	52
b) Printed Rating Forms	62	32
c) I. E. Newsletter	107	71
d) Work Simplification Films	136	87

3. When should next, if any, institute be held?

<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Jan.</u>	<u>No Answer</u>
25	36	29	15	19	26	7	0	20	21

4. *What topic would you prefer (2 sets of questionnaires used)

<u>Questionnaire A</u>	<u>Weighted by Pref. Order</u>	<u>Questionnaire B</u>	<u>Weighted by Pref. Order</u>
Work Simplification Techniques	234	Plant Layout	147
Introducing Work Simplification	165	Motion Study	98
Time Study Rating (participational)	88	WI JE	151
Time Study Procedure	98	Work Simplification	162
New Techniques in Time Study	193	Production Engineering	184
Suggestion Systems	33	Time Study	77
Wage Incentives	137		
Job Evaluation	178		
Quality Control	91		
Plant Lay Out and Maintenance	137		

- | | | | | | | | | |
|----|--|----|------------------|------------|----|-----------|-------|----------|
| 5. | a) How long should institutes last? | 1 | 1-1/2 | 2 | 3 | 4 | 5 | Days |
| | No replies | 50 | 80 | 60 | 9 | 0 | 5 | |
| | b) Will your company allow you time off to attend? | | Yes | <u>149</u> | No | <u>26</u> | Maybe | <u>5</u> |
| | c) Did your company pay for your registration fee? | | Yes | <u>133</u> | No | <u>55</u> | | |
| | d) How often should institutes be held? | | Annually | 37 | | | | |
| | | | Semi-Annually | 117 | | | | |
| | | | Quarter-Annually | 53 | | | | |

*Two different questionnaires were distributed in an attempt to test the effect of different wording and order of the check list. Roughly 65% received Questionnaire A and 35% received Questionnaire B.