

Proceedings of the
**FIRST SOUTHERN CALIFORNIA
MANAGEMENT CONFERENCE**

*Manning and Managing
Our Arsenal*

Held at
CALIFORNIA INSTITUTE OF TECHNOLOGY
May 2, 1942

CONFERENCE SPONSORS

Foremen's Club of Los Angeles

Los Angeles Chapter
Society for the Advancement of Management

U.C.L.A. Student Chapter
Society for the Advancement of Management

in co-operation with

College of Business Administration
University of California at Los Angeles

College of Commerce and Business Administration
University of Southern California

Industrial Relations Section
California Institute of Technology

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PREFACE

The papers included in these Proceedings of the First Southern California Management Conference were presented under the general theme of "Manning and Managing Our Arsenal." Although this Conference was precipitated by the unusual demands on management arising out of the war effort, careful examination of the papers will reveal that many of them deal with fundamental concepts of management. This is to be expected, since the pressure of war activities merely increases the need for a widespread understanding of the fundamentals of management.

This Conference, held at the California Institute of Technology on May 2, 1942, was a joint enterprise which originated from two sources. The Los Angeles Chapter and the U.C.L.A. Student Chapter of the Society for the Advancement of Management had held two Spring Conferences at the University of California at Los Angeles in 1940 and 1941. Early in 1942, these organizations requested permission from the California Institute of Technology to hold their Spring Conference on the Cal. Tech. campus. About the same time, the Foremen's Club of Los Angeles made a similar request. When both groups were told of the request made by the other organization, it seemed logical to them to combine their efforts by holding a joint conference. This action was deemed especially appropriate at a time when the major problem of management is production.

In order to expand the scope of the Conference, the Los Angeles Chapter and the U.C.L.A. Student Chapter of the Society for the Advancement of Management and the Foremen's Club of Los Angeles also invited the College of Business Administration of the University of California at Los Angeles, the College of Commerce and Business Administration of the University of Southern California, and the Industrial Relations Section of the California Institute of Technology to join in sponsoring the Conference.

This development is unique in the field of management. For the first time a number of organizations interested in various aspects of management's problems joined in presenting a united front. Such action proved to be of great value locally. Through the common efforts of these six organizations it was possible to present a much broader program than would have resulted from a conference sponsored by any one group. That the co-operative nature of the Conference was of value to industry in southern California is attested by the registration of over 700 and by the large delegations sent by many of the leading companies in this area.

This response from local industries, which resulted in the Conference on May 2 being oversubscribed, dictated the decision of the Conference Committee to plan another conference. Late in May 1942, this group formed the Southern California Management Conference and adopted the name First Southern California Management Conference for the meeting held May 2.

Plans were also started for the Second Southern California Management Conference to be held at the University of Southern California in October 1942. Other organizations interested in managerial problems are being invited to participate in this next conference in order that the scope of the meeting can be broadened still further.

Arrangements for the Conference on "Manning and Managing Our Arsenal" were under the general direction of the Conference Committee composed of representatives of each of the co-operating organizations. The members of the Conference Committee, individually and collectively, are deeply appreciative of the contributions made by all of those who participated in the program. Every chairman and speaker and almost every person scheduled for panel discussions was present to carry out his assignment. The widespread demands for a similar conference in the future are tributes to the work of these individuals and indicate their success in presenting essential information and valuable comments.

The Conference Committee acknowledges the work contributed by the Student Committee of the U.C.L.A. Student Chapter of the Society for the Advancement of Management. These students acted as aides at the general meetings and at the seminars and helped in the general conduct of the Conference.

The Committee is also appreciative of the hospitality extended to the Conference by the California Institute of Technology. The staff of the Industrial Relations Section carried out the large volume of clerical work involved in arranging the program. Many other departments of the California Institute made special arrangements to provide a period of relaxation: the Geology Department opened its Museum, and Professor Chester Stock showed his film on "Hunting Dinosaurs in California"; the Observatory Council opened its Optical Shop to display the 200-inch mirror, and Mr. Marcus H. Brown described some of the problems involved in polishing the world's largest telescope reflector in preparation for its installation in the observatory on Palomar Mountain; the Electrical Engineering Department demonstrated its high-volts exhibit; and the Industrial Design Section displayed some of the work of its students. To these and many others the Conference Committee voices the thanks and appreciation of those who attended the Conference.

The Conference Committee

C. T. Gilliam
Vernon D. Keeler
Reid L. McClung
Reg Nickerson
Howard S. Noble
Donald E. Reysa
James E. Tackett
Robert D. Gray, Chairman

SPONSORS

FOREMEN'S CLUB OF LOS ANGELES

President: Hugh F. Scott, Frazier Wright Co.
Vice-President: G. Ross Bernard, Fluor Corp., Ltd.
Secretary: Reg Nickerson, Downtown Los Angeles
Y.M.C.A.

The Foremen's Club of the Los Angeles Y.M.C.A. has successfully provided for several hundred foremen and supervisors in Los Angeles industry an opportunity to fraternize through a club membership in much the same manner that other professional groups of artisans have done for years.

The monthly club program is designed around the interests and problems of the membership, recent developments in industrial production methods, and the part of the foreman in the present war effort. Social and recreational events are incorporated to make a well-rounded club program.

Membership is limited to men who are in supervisory positions in industry. A nominal annual membership fee is charged to cover the business and operating expenses.

THE SOCIETY FOR THE ADVANCEMENT OF MANAGEMENT

The Society for the Advancement of Management was formed in February 1936 by a merger of the Taylor Society, Inc., founded in 1912, and the Society of Industrial Engineers, Inc., founded in 1917.

The purposes of this Society are, through research, discussion, publication, and other appropriate means:

1. To forward the elimination of waste and the development of efficiency through the study and application of scientific principles and methods of management.

2. To bring about a better understanding of the mutual interests of government, management, investors, labor, and the public in improved management.

3. To provide means whereby executives, engineers, teachers, public officials, and others concerned, who apply scientific methods to management problems, may promote this common interest.

4. To inspire in labor, manager, and employer a constant adherence to the highest ethical conception of individual and collective social responsibility.

The Society functions both through its national office and through local chapters and student branches in cities and universities in the United States and abroad.

The local chapters and student branches enjoy substantial autonomy in their organization and conduct.

Membership in the national organization carries with it the privilege of affiliation with a local group.

Los Angeles Chapter

President: C. T. Gilliam, C. T. Gilliam and Associates

Vice-President and Chairman, Program Committee: Fred E. Wagner, Manager, Labor Standards Department, United States Rubber Co.

Executive Secretary: Dr. Vernon D. Keeler, Assistant Professor of Management and Industry, College of Business Administration, University of California at Los Angeles.

The Los Angeles Chapter of the Society for the Advancement of Management was organized in 1939. Its activities have included two conferences held in 1940 and 1941 and a series of regular monthly meetings. In planning its program, the Chapter has consistently recognized the broad aspects of management as well as many of the specific problems in the fields of production, marketing, finance, and control. The speakers at its dinner meetings have included many men well known to management both locally and nationally.

U.C.L.A. Student Chapter

President: Donald E. Reysa

Vice-President: Robert M. Carrasco

Secretary: Dean A. Harrington

The U.C.L.A. Student Chapter was organized in 1937 for the purpose of promoting scientific study and discussion of the principles governing organized effort in industrial and economic life, including labor and management, by students in institutions of higher learning. It attempts to ascertain and promote those administrative policies and managerial methods which tend to make business operations and other organized relationships more serviceable, stable, economical, and profitable. This chapter serves its members through educational meetings and through business contacts which it makes possible by planned programs of activities.

The Chapter meetings, in addition to keeping members informed as to new industrial methods and trends, offer opportunity for invaluable personal contacts with industrial executives and engineers.

The requisites for membership are the student's interest in management, his enrollment in a school of business administration, and a recommendation of the faculty adviser of the Chapter.

COLLEGE OF BUSINESS ADMINISTRATION
UNIVERSITY OF CALIFORNIA AT LOS ANGELES

Howard S. Noble, Dean

The College of Business Administration is a professional college of the University offering majors in accounting, banking and finance, marketing, management and industry, and in general business.

The purpose of the College is to give students a well-balanced introduction to professional careers in business through the study of business subjects and the solution of illustrative problems. Such an introduction should assist them to adapt themselves more easily to the requirements of business, and to understand the place that business fills in modern economic life. Through the study of practical problems and actual cases, the student is given an appreciation of business realities, and through the opportunity afforded him to visit various types of organizations, he gets firsthand information about going concerns. Opportunity for further practical contacts with alumni of the University and business leaders of the community is provided through student organizations.

COLLEGE OF COMMERCE AND BUSINESS
ADMINISTRATION
UNIVERSITY OF SOUTHERN CALIFORNIA

Reid L. McClung, Dean

The College of Commerce and Business Administration of the University of Southern California was established in 1920. It comprises eight different departments and a School of Merchandising which has three separate departments of specialization. Approximately two hundred courses of instruction are offered in the College. The Bureau of Business Research of the College issues periodically a publication which is mailed to all parts of the country.

The enrollment in the College of Commerce is approximately eleven hundred students. The faculty consists of fifty-two members especially trained in their fields of instruction. The College of Commerce is the second largest division of the University.

INDUSTRIAL RELATIONS SECTION
CALIFORNIA INSTITUTE OF TECHNOLOGY

Robert D. Gray, Director

The Industrial Relations Section of the California Institute was established in 1939 for the purpose of contributing to the improvement of relations between employers and employees in southern California. Sponsors of the undertaking include more than sixty individual, company, foundation, and trade-union contributors who have underwritten the project for a five-year period.

Originally, the activities of the Section called for four types of work:

1. Instruction of Cal. Tech. students.
2. Research studies in the field of industrial relations.
3. Maintenance of a library of current materials in industrial relations for the use of students, sponsors, and research workers.
4. Periodic conferences to focus interest and attention on special problems.

In response to the need for wartime training, the Industrial Relations Section has undertaken the supervision of courses in Production Engineering under the Engineering Science and Management Defense Training program sponsored by the United States Office of Education. At present more than five hundred night students are enrolled in twenty-four classes.

CONTENTS

	Page
PREFACE	iii
SPONSORS	iv
CURRENT PRODUCTION PROBLEMS Dillon Stevens	1
INDUSTRIAL RELATIONS AND THE FOREMAN Arthur H. Young	5
INVENTORY CONTROL Robert D. Sheehan	11
METHODS STUDY FOR THE WORKER Trevor Gardner	13
CO-OPERATIVE SUBCONTRACTING Aubry Miller	17
TESTING PROGRAM OF THE LOCKHEED AND VEGA AIRCRAFT CORPORATIONS R. Randall Irwin	21
PRODUCTION CONTROL Howard G. Benedict	23
RETOOLING FOR WAR WORK Thomas W. Kendall	29
THE INDUSTRIAL SUPERVISOR'S RESPONSIBILITY IN ACCIDENT PREVENTION R. E. Donovan	31
WOMEN IN WAR INDUSTRIES W. Gerard Tuttle	35
HOW CAN A FOREMAN MEET THE CHALLENGE OF ALL-OUT DEFENSE PRODUCTION? F. A. Olmsted	43
ALL-OUT MOBILIZATION OF MAN POWER Lawrence A. Appley	45

CURRENT PRODUCTION PROBLEMS

DILLON STEVENS
*Chairman, Board of Directors,
Plomb Tool Company*

The California Institute of Technology is to be commended for taking the leadership in co-ordinating the very fine work of the sponsoring organizations and for managing and providing a meeting place for this conference. The California Institute of Technology has, in its long and honored history, sponsored many activities and projects for the advancement of knowledge. This conference marks a new departure in the activities of Cal. Tech. It initiates a move along a new and vital channel. It is an activity, less scientific, than much of the work that has characterized the Institute's past history. It is closer to the soil—closer to the man on the street and closer to business enterprise. It is dynamic!

This conference falls neither in the category of pure science nor of research and experiment, nor yet can it be classified as a teaching session in the older sense of university activities. I feel that it takes up where the others leave off and brings something to industrial society which has long been needed. This conference brings men who are in the front lines of production together for a concentrated session devoted to the study of business in action. And here, as the day unfolds, the guests of this conference will have the opportunity of hearing firsthand of the ideas and processes of going businesses. Factories use and are a combination of applied natural sciences—of accounting, of finance, of psychology, plus just plain horse sense—put together in varying but, we hope, proper proportions.

California Institute of Technology, by holding this conference, is doing a great service to the business of this area and to the nation.

The request to talk to you on "Current Production Problems" seemed easy. My thought was, "Production Problems! We've got lots of them, so I'll just talk about our own." We've enough to last for hours. Only forty or fifty minutes! said I to myself—a pipe, a cinch, just a breeze. So I said "Yes." I should have said, "No! No! No!" like the girl in the song.

Then I got to thinking about you. You are not apt to be interested in our production problems. You have lots of production problems of your own, maybe even bigger and better ones than ours. So again it looked easy, and I said to myself, "I'll just talk about other people's production problems." It is always easier to talk about things you do not know than about things you do.

Up to this point I was going fine. Just talk about the other fellow's problem about which I know very little and all will be well.

But then I made a mistake. I asked the Chairman for suggestions. He said, "Oh, don't go to a lot of

trouble. Just cover production control, methods improvement, retooling, subcontracting, union-management co-operation, inventory control, and women in industry."

When I regained consciousness, I put in for a week's leave of absence, went to Warner Hot Springs, and settled down to work and found that by talking fast I could probably tell the little I know plus a great deal I would dig up on these subjects in four or five hours and leave no one else the wiser. That did not look so good. There kept hammering in my subconscious the thought that there must be some way of treating this subject more broadly than detailing our production problems, guessing about your production problems, or trying to do an encyclopedia act and cover the field as outlined and suggested by my helpful and well-wishing friend and your Conference Chairman, Bob Gray.

Before starting to talk on that broader field as it finally cleared itself in my thinking, I want to tell you of a very early production problem I encountered. It illustrates many facets of the subject; and while inconclusive and unconcluded and ultimately unfinished, I think many of you will recognize its aptness to the problem in hand and also the warning it conveys.

Thirty-five or so years ago kids did not have all the mechanical "savvy" of the youngsters of today. We were pioneers in a way. There were no salvage lots full of delectable mechanical junk to pick from.

My brother (who is now plant engineer of Bell Aircraft Company) and I had bought a motor boat—a 20-footer, for \$150.00. We'd wangled the money from a loving grandmother. Very shortly after acquiring it, we developed a production problem. We wanted to produce more speed.

That, we decided, was simple. We noticed that the boats with more speed than ours had bigger propellers than we had; so we set out to search the boat yards along the muddy Mississippi for a propeller that was larger than ours and yet within our very limited financial means to purchase. We finally found a dandy; it was an old bronze wheel, about a 20x20, plenty dented and corroded, but after a lot of work had been expended on it, it looked pretty good. The only trouble was that it was bored for a lot larger shaft than our old wheel; but we found a friendly mechanic who for about a dollar made us a bushing.

Our engine was an old Roberts two-cycle. Some of you may remember such engines. This one was pretty much the worse for having had a long career.

It wouldn't run slowly. It either went fast or it died. We also had what passed in those days for a clutch. It was an early cone clutch and it was either in or out—there wasn't any middle ground.

Well, after a lot of work we got our new wheel on the boat and we got on board prepared to split "Ole Mississippi" right up the middle.

We got the engine going. We slammed in the clutch and the shaft broke. It then became clear to us that we needed a larger shaft for our larger propeller, if we were going to produce more speed. Again the boat yards were combed and in due course we owned a shaft to fit the hole in the propeller without a bushing, and of course we had to buy a stuffing box to fit the new shaft. We had the hole in the clutch bored out to fit the new shaft and again we thought we were ready to produce more speed. This time the engine quit dead when the clutch grabbed hold. No amount of work on our part got any good results. The engine wouldn't run slowly and it just couldn't turn that noble old propeller fast; so we had a bottleneck.

We knew of a man who had an engine works; so we went to consult him about a bigger engine. We told him about our "20-footer," about our desire for speed, and about our 20x20 propeller. He asked something about where we got our money, and we mentioned our grandmother. She was known to be a pretty wealthy old lady; so I guess he took a lot for granted. Anyhow, he told us that he had just the engine we needed. It was a very special engine he'd been building for a Mr. Dobyne, intended for the Keokuk races, but Mr. Dobyne, it seems, had been killed in some recent tryouts and our friend the engine-builder was left with the engine.

Naturally, he wanted to see our boat at once. He did. He was a kindly man and spared us any ridicule and did not vent upon us any justified wrath and scorn. Instead he took the trouble to explain that we were moving in the right direction but that before we put the new power plant on the front end of our propeller and our shaft, we'd also need a new hull.

We did not know it then, but I know now that we had been through a great and deep experience in scientific production methods.

I might add, just in passing, that two years later I saw the engine of our friend in a hull designed by the great Walter Beauvais carrying a propeller specially designed for both engine and hull win the 20-foot championship of the Mississippi.

That you may know I also speak from more recent experience, may I be forgiven for mentioning another personal experience far more recent than the production problem which perplexed my brother and me. In this most recent experience, our company bought a plant in an Eastern city. This plant had been jogging along in the even tenor of its way for several years.

Within a space of fifteen months after buying it, we have increased production in that plant until now in each month we are producing a volume equal to their best whole year. We increased the net investment in the plant only about 15 per cent. We raised

average hourly rates about 25 per cent. We pay the plant manager more than his predecessor ever made. We make more net profit before taxes each month than our predecessor company made in their best year. In all of this, we have put in practice the very principles you will be discussing in this conference.

What do we mean when we say "production problem"? In plain English we mean the task of getting more production, getting production for less money, and usually faster. Production problems are always present. They are not war babies. The war just accentuates them. War brings them to the consciousness of a lot of manufacturers who may normally be too somnolent to be bothered. However, a production problem never creates itself. It is always either the love child of ambition or the unwelcome child of some outside condition involuntarily imposed; this is generally competition, though in the present time a war is both mother and father of production problems.

Production problems involve people, personnel, processes, programs, and progress. These are all components of production problems and all are concerned in the solution of most production problems. And the greatest of all of these is a "self-starting" desire for progress. By the way, that self-starter is something you can't buy or hire. You just must develop your own.

Now, assume that you have found a production problem and you want to move toward its solution. You have many means from which to choose. Each of these many means will be well explored this afternoon in the various seminar sessions to be conducted by men experienced and expert, each in his own particular field. I do not think it was intended that I should attempt to discuss in detail all of these methods of solving production problems, nor do I believe it was intended that I should even attempt to discuss any one of them in detail. However, no talk on current production problems would be useful unless it indicated the direction or directions which might be taken to arrive at a solution.

Let us assume that you are a manufacturer and that you have come face to face, either from your own desires or by the force of competition or through the drive of government, with the problem of what to do to get more production and possibly to lower the cost of your production. Now you've got your problem—so let us look at various procedures you may follow for a solution.

Modern business has developed an activity, call it an art or a science if you choose, which has been labeled "Production Control." Production control is a system which can be imposed upon the activities of manufacturing for the purpose and with the hope that the end objective of greater production will result. Like most remedies, the result attained will be dependent largely upon the

accuracy of the diagnosis and the soundness of the prescription and the consistency with which the prescription is followed. Production control is a system that is about half accounting and half engineering. It is a system involving a great deal of paper work. It combines the tabulation of much historical data with a lot of imagination, for the ultimate purpose of anticipating and foreseeing difficulties that may arise in the flow of work before the difficulties arise.

The purpose of production control is to control the flow of materials and semi-finished goods through a plant in such a manner that there will be a minimum of interruption and loss of time. It contemplates as an ideal the maximum use of every machine at all times. It aims at the greatest velocity of flow of material between and through machines. If the diagnosis has been properly made and the prescription accurately written, there will be fewer idle machines. There will be a decrease in the amount of work-in-process and an increase in finished production.

This is a great and important subject and it will be given the attention it deserves during the afternoon session.

Closely related to production control—in fact, almost inseparable from it—is what is termed “Methods Improvement.” The name of this activity is so apt that it needs little explanation by me as one of the activities to follow in the solution of a production problem. However, methods improvement is not simple, for it involves some of the deepest studies ever conducted regarding both men and machines. The whole science of time and motion study is but a part of this important subject. Volumes have been written on simple phases of it. It is a subject which is never completed. It involves time and motion study, flow charts, machine arrangement, and many other subjects. Each step leads to another and the challenge of it will ever be worthy of the mettle of the best production brains.

This subject of Methods Improvement will be given most careful treatment and presentation this afternoon. I am happy and proud to say that it will be handled by one of my own colleagues whose daily work keeps him right in the firing line in this important phase of manufacturing.

Now let us assume that in solving your production problem you have found it advantageous to create and install a system of production control and that you have gone farther than this and embarked upon and carried through a real program of methods improvement. Then you may find that you have embarked upon a progressive chain of events. In fact, I will say that if your plant is an average good plant which had been moving along without specific development of production control and methods improvement—then it is almost certain that the adoption of these will lead you into another field.

Your production control and your methods improvement may bring you unavoidably face to face with the necessity of retooling. Retooling opens up a whole vista

of new problems. These problems in many cases go far beyond just engineering. They involve delicate financial decisions and sometimes almost financial reorganizations; because retooling may mean anything from the addition of a few jigs and fixtures up to the development and installation of co-ordinated production machinery including intricate conveyor belts, the whole to be controlled by the most intricate of electrical timing machinery. Retooling is a never-ending and inexhaustible subject which only reaches its ultimate perfection when you throw away the whole plant and rebuild from scratch. Then when the new plant is done and ready for use, it's time again to start retooling, because even as you are building, some chap may be working in his basement or in a laboratory here at Cal. Tech. and making a better machine than the one you are installing.

At the present time, it is the belief of a great many manufacturers that the demand for their product is at a height which is abnormal and which will not continue when the period of the war is closed. A manufacturer in this position faces a very serious production problem. If he equips his plant to take care of the present demand, he fears he will find himself overexpanded, overbuilt, and ruined when the current demand is lessened. To such a manufacturer the solution of his current production problem can often be found in the practice of subcontracting—that is, of having various parts of his process carried on in plants other than his own.

Subcontracting is not new. It has been widely practiced in all industry. In fact, it was the beginning of industry. The so-called cottage industries of the old country are the root and beginning of subcontracting. As time went on, industry grew away from that method and tended toward centralization of all phases of any given production under one roof or at least in the hands of a single concern. Then some years ago it began to swing back, not to the cottage industry of earlier times but to the specialized plant performing a few highly developed operations or making some integral part later to be assembled as a unit into the completed whole.

The automobile industry was probably foremost in the development of modern subcontracting although it has existed in almost every field. Today there is a tremendous urge toward more subcontracting. It affords the ideal solution for many manufacturers today. This, too, will be treated further in a special session of the afternoon seminar by two men who are amply qualified by experience and current practice to highlight this very important phase of production methods.

If you are a busy, harassed manufacturer with a backlog so high you can't see over it and production problems all about you; if you have gone as far in practice to solve your problems as I have in

this presentation of mine; if you have adopted production control, delved into methods improvement, retooled your plant to the pitch of perfection, and subcontracted in all directions; then, my friends, unless you have unlimited financial resources you will find yourself face to face with another problem which has grown out of the very ones you have already solved. I refer to "Inventory Control." Unless you can accomplish a solution of this problem, you may well find yourself literally buried under the products of the foregoing solutions which you have accomplished. Yes, unless you can install a good inventory control and then operate and control with an iron hand the results of your production capacity, you are very likely to find yourself marching toward the bankruptcy court with your banker riding straddle of your neck and the board of directors raising hell from all directions.

The last of the subjects is "Women in Industry." Here again I prefer to leave the detailed treatment of this subject to one better informed and more experienced than I am. You have often heard the remark made about women, "You can't get along with them and you can't get along without them." From our own experience, we must paraphrase this to read, "You most certainly can get along with them, and it's going to be mighty hard, if not impossible, to get along without them."

As I have now touched practically every subject involved in the solution of your production problems, I will close with a few parting generalities and leave

you with the sincere hope that you will be able to get much more from the speakers who follow me than I have been able to give you.

If you and those connected with you are satisfied with things as they are, you have no production problems. And you will soon be a candidate for the industrial scrap-pile. If you have within you, or can create within you, a deep dissatisfaction with things as they are, then you will have production problems all about you.

Sell yourself that the way it's being done is not per se correct just because it's being done. Sell yourself the idea that, however it is being done, there is somehow some way to do it better, quicker, or less expensively. Then and then only will you find the need for the things we are discussing at this conference. When you get yourself into this frame of mind, you'll need no one to sell you the merits of production control, methods improvement, including time and motion study, retooling, and all the other means to the end you desire.

When you've created in yourself a constructive dissatisfaction with things as they are and a set purpose to seek a better way, then and then only are you ready for these studies. And if you can get into such a frame of mind and stay that way and drive untiringly and unceasingly for the solution, then you are a true disciple of progress and you and your firm will prosper and be a benefit to your community and to your fellow man.

INDUSTRIAL RELATIONS AND THE FOREMAN

ARTHUR H. YOUNG
*Lecturer on Industrial Relations,
California Institute of Technology*

The participation of so many supervisors, educators, and managers in this conference amply demonstrates the many new approaches to our man-power problems presented by an all-out war effort.

The changes that have occurred, and the greater changes still impending in the social, economic, and industrial status of individuals and groups, are difficult to analyze, and still more difficult to anticipate and control.

Many of the techniques of industrial relations procedure that have been so painstakingly developed, and have served so well in the past, will have to be abandoned, altered, or supplemented almost beyond recognition to meet the stark necessities of our current needs. Some indications of the revolutionary character of these changes may well cause us much concern as to whether they are to be of only temporary expediency or are to become permanently incorporated into a new labor relations pattern of the future. Alluring for discussion as is this particular subject, it has a far lower priority rating than the subject we are here gathered to discuss. It will be less difficult to plan our postwar adjustments after we prove who is the victor. In the strict military sense, our victory exists only in potentialities. The translation of those potentialities into realities is the prime requisite to win.

Never before in history has the factory played so important a role in war, and the changing of potentialities into realities, actually the winning of this war, is even more the responsibility of you men in industry than it is at this time of our soldiers and sailors and marines. It is betraying no military secret to say that, by present forecasts, the calendar year 1942 will require an increase of 2,200,000 persons in the armed forces, and 10,500,000 among civilian employees of the war industries. That is a shift in occupations of nearly thirteen million people and a probable shift in geographic location of most of them.

Where will we get 12,700,000 persons for new occupational status? The estimates are:

By reduction of persons engaged in agriculture	600,000
By reduction of persons now unemployed	1,900,000
By conversion from nondefense employment	7,400,000
By new additions to the labor force (mostly women)	2,800,000

Any single item in this summary presents staggering problems in sociology, economics, and other

realms, as well as in our indicated sphere of interest, industrial relations.

At the present time we continue to have what is called a free labor market. Under this system, which is the normal situation in peacetime, every employer is permitted to follow his own devices in recruiting labor. Every worker is free in his choice of a job. Controls are beginning to be exercised, but it is obvious that the 1942 war production program cannot be manned by this voluntary basis of employment. We are obliged to organize the labor market and exercise direction of its processes if we are to secure the 10,500,000 new persons for civilian employment.

And it is equally obvious that the selection of 2,200,000 men for the armed forces must be done in consonance with the civilian recruitment if each individual is to be so placed that he shall make his maximum contribution of skill and service.

One need only to note the nationalization of the United States Employment Service in December, the occupational questionnaire now being utilized for inventorying the skill of Selective Service Registrants, and the recent appointment of the McNutt Man Power Commission to deduce that selection, transfer, placement, and retention of persons in either the civilian or the armed forces will soon be under strict and centralized control by the federal government. If this be indicated, we had best be rapidly overhauling our present practices of hiring and placing.

To the extent that complete federal control can evolve out of voluntary and experimental excursions into the pooling of hiring problems by employers in a given industry, or by employers and employees in a given labor market, will we have progressively greater efficiency and ultimate success. That we will, and soon, have complete federal control of industrial and military recruitment is so firmly my personal conviction that I offer no apologies for posing as a prophet. Control of that nature is more necessary here on the Pacific Coast than in any other part of the country. The Bureau of Employment Security of the Social Security Board recently published a survey, indicating comparatively for the 10 regional districts of the United States (1) the percentage of total value of all contracts for war materials allotted as of December 1, 1941, (2) the percentage of total labor supply available January 1 for hiring, and (3) the percentage of total hirings that must be made in 1942 to meet production schedules of war materials.

It indicates that, for the Pacific Coast area,

18 per cent of the value of all awarded contracts, 8.6 per cent of the available labor supply, and 17.9 per cent of the total new United States hirings are allocated here. The ratio of our proportion of indicated hirings to available labor is more than 2 to 1. In four other areas the proportionate needs are in excess of resources, and in five the reverse is true. The ratio of indicated hirings to available labor for the total of the four other districts is 6 to 5; in the five other areas it is 1 to 2.

For clarification, let me state the situation in this way: whereas in 5 out of 10 districts the complete recruitment of the nation's indicated 1942 needs will be relatively only half as great as is the proportion of available labor in those 5 districts, and in 4 districts the average ratio is 6 to 5, we here in the Pacific Coast area are facing a 2 to 1 discrepancy in the relativity of our proportion of available labor to necessary hirings.

Already the United States Employment Service has "experimentally" assumed the centralized hiring for all aircraft concerns in the Los Angeles area. The fact that the arrangement was largely suggested by the employers' and employees' representatives made its organization relatively simple and assured its success in operation. It is probably the forerunner of similar arrangements on an ever widening base.

In our normal peacetime employment procedure we talk of the "staff" relationship of the employment manager to the supervisor; we describe him as a sort of coarse sieve to sift out manifestly undesirable applicants and refer to the foreman the most desirable qualified applicants he can discover by combing, in his own resourceful manner, the free labor market. And we insist that the foreman or line supervisor shall have final decision as to the applicant's fitness, based on performance on the job. Such procedure is just plain common sense for "ordinary times."

But the need for 2,800,000 brand new additions to the total labor force this year and the transfer of the skills and occupations of another 10,000,000 persons is not "ordinary times"! Furthermore, a survey by the United States Employment Service in January gave the following ratio of demand to supply in some selected occupations:

Tool designers, 51 to 1
 Toolmakers, 25 to 1
 Marine machinists, 22 to 1
 Boring mill operators, 12 to 1
 Ship carpenters and electricians, 7 to 1
 Turret lathe operators, 5 to 1
 Milling machine operators, 3 to 1

Manifestly the "sifting" theory is out for the duration. For some occupations there will be no qualified applicants, let alone "the most desirable qualified applicants." Final selection of applicants for hiring moves from the control of the supervisor to the fiat of the government agent, with the company employment manager somewhat in the role of a "material

tracer," expediting the hiring process rather than conducting it. And you foremen will soon be lucky to get, in answer to a requisition for an experienced workman possessed of certain skills or qualified for a certain job, a Selective Service registrant possessed of skill or experience only remotely related to the specifications of your requisition.

The peculiar and valuable technique of selection for the job developed by the employment manager will be altered into a peculiar and valuable technique of selection for training, if he is to continue in appreciated collaboration. And if both the employment manager and the foreman will but realize that their certain way to win the war is by "converting potentialities into realities," their related functions will continue on a mutually acceptable and constructive basis, perhaps even more stimulating in its challenge to ability and patriotism than any experience yet had. The most practical way to obtain the skill necessary for the war program with the existing supply of skilled workers is, of course, to utilize existing craftsmen at their best skill and upgrade other workers to take over that part of their normal work requiring lesser skill. Frequently toolmakers and similar craftsmen are utilized as supervisors and instructors, and multiply themselves as craftsmen in the training of machine hands in one part after another of the carefully broken-down job of tool designing, until they are proficient in the over-all function of a tool designer.

Another way to utilize craftsmen at their best skill is, naturally, to keep them on that best skill all of their time, instead of doing what is so frequently regular practice—that of working a toolmaker part of his time as a machine hand. To overcome this, the toolmaker may have to be a more mobile sort of worker than he now is—his job may need to be recast as that of a one-man flying squadron serving several departments or even plants for that portion of their time that they actually need a skilled toolmaker.

Indeed, I have seen a proposal, considered in the general program for centralizing the control of employment in a federal agency, that there be organized just such mobile crews of toolmakers, die sinkers, jig and fixture makers, to move from industry to industry as the successive changeovers from normal to wartime production produce temporary but critical need of their services in great volume. For, contrary to popular belief, the conversion of industrial plants from nondefense to war production does not provide a supply of toolmakers, etc., but actually creates a demand for additional tool, die, and jig makers.

This whole business of changing the function of the employment manager over to having as his principal concern the training for jobs of the applicants assigned by a federal agency has been admirably handled in the area by the Training-

Within-Industry Section of the War Man Power Commission. The work of the TWI is too well known and utilized and contributed to by you men to need description, but its intrinsic value is worthy of recognition.

I realize that what I have dared thus far to suggest smacks of regimentation—of bureaucratic control over the functions of our jobs that could easily become abhorrent under other circumstances. But the saving clause in the present situation is that it is axiomatic that the only way the totalitarian state powers of our Axis enemies can be licked by democratic nations is by their voluntary acceptance of controls that must necessarily approach, if not actually encompass, those of a dictator.

And the great satisfaction is that the leadership in that direction is being had from capable, experienced counselors in whom Mr. Average John Q. American can and does have complete faith.

I returned recently from a visit in Washington, during which it was my privilege to watch and listen to the men who are formulating the policies and procedures which may soon govern the participation of industry in this conflict. And I watched and listened to men who will make the choice of those policies and procedures and be charged, probably, with responsibility for their successful administration.

I had somewhat the same experience in World War I. I came back tremendously impressed with the orderliness and planning and utilization of the lessons of experience that characterize the present leadership. As a matter of fact, it is generally commented upon by those familiar with conditions. And another wholesome sidelight was the fact that the men I watched and listened to were motivated toward a complete and over-all control of the civilian war effort in order that every man and every woman might be placed in that position where he or she could give the maximum possible contribution to the war effort.

It is one thing to have the dictator of a totalitarian state mobilize and dominate civilian effort into virtual serfdom by force; it is quite another thing to have government agencies voluntarily set up, organized, and staffed by citizens who willingly subordinate themselves to a centralized control in order that their united efforts may be co-ordinated into uniform and unified effort. And it is just that difference that assures the overthrow of our enemies, not alone by our efforts, but because of the revolt of their subjugated peoples.

We shall have to experiment daringly in our plans to win—experiment without experience is recklessness, but experiment based on experience is sound, no matter how daring.

We have developed in this country a particularly extensive and valuable curriculum of techniques of labor administration and of industrial management. It is perhaps true that we have sometimes pursued the development and perfection of a specific technique too far—until the technique came to be regarded as a

finality in itself, rather than a means to an end. Nevertheless, we in the United States have managed to evolve ways and means of getting along well together as management and employees, and of planning and doing our work well. In this great pooling of the nation's industrial capacity for the war effort, we shall need to alter, amend, or supplement almost beyond recognition the practices that have served so well. But the very fact that our ultimate planning and doing does evolve voluntarily out of tested, proven methods is the best guarantee of their success.

And, so far as "Industrial Relations and the Foreman" is concerned, the foreman's relationship and responsibilities are scarcely altered. He still remains the direct medium of contact between the individual employee and the company, the line officer charged with the responsibility of securing rank and file execution of the planned program. And he is likewise still the leader, rather than the boss, who knows better than anyone else the difference between a relationship of "so many dollars for so much work" and "a gang that's giving all they've got to the job because they know just how important that job is."

The foreman's job is going to be more that of a teacher and trainer than ever before—but never before has he had such latent elements of high morale, great accomplishment, and personal satisfaction as is contained in this problem of "transforming potentialities into realities"!

And just how is he to do it? Well, I can't tell you, and I would be suspicious of anyone who said he could, if he thus implied he knew more about the foreman's job than does the foreman himself.

And how much can one single foreman do in a cataclysm as great as this? I can't measure that, either, but I can say that all of the foremen in this area, resolving each and every one today that he would, for the duration, give to his job a consecrated leadership (that a Carpenter once said made Him the servant of all), that would resolve potentialities into realities—well, that would just simply and literally win the war. It would change "Too little, too late" to "Enough, and on schedule."

May I close with a true story I am very fond of telling? Some of you may have heard me recite it, but if so, it won't do you any harm to be patient a few minutes longer. It has to do with an incident, or rather two incidents, that taught me more about "right human relationships in industry" and has lightened menial and repetitive tasks more than the sum of all other instruction I've ever had. And my teacher was a man never recognized or known as an "industrial relations expert," yet every day and every hour of every day that he was on his job, he actually was functioning in a manner which I or any of my associates who call ourselves industrial relations experts might well

copy. My attitude toward him first took this particular slant when he accompanied me on a visit to one of the plants of the International Harvester Company. We took a night train from Chicago and arrived at the main office of the plant early in the morning, before the general superintendent, on whom we were calling, or, in fact, any other member of the office staff, was on the job. About the only person on duty was an elevator operator, grim and taciturn in appearance, and even more repelling in attitude. My friend, whom I will call Mr. Jones, stated that we wished to go to Mr. So-and-So's office. Without a word or a glance in our direction, or anything that would dispel the dour cloud about him, he moved to the elevator and, when we had followed him into the cage, closed the door, caused the elevator to rise to the desired floor, opened the door, and, as we filed out, closed it and descended, leaving us in the hallway without a single word of direction.

I am sure that my own countenance displayed anger and affront, but not so that of Mr. Jones. His features portrayed, rather, a hurt and a trouble, and after we had stood in the hall for a moment he pushed the button and brought the elevator and its operator back to our station. Then, in the nicest voice and the most considerate manner which anyone could use to a peer or superior, he said, in substance, this:

"My friend, may I ask your name. I am Mr. Jones, and I want to introduce you to Mr. Young. We are officials from the Home Office of the Corporation and I see that we have gotten in somewhat early and, perhaps, have disturbed your regular routine but, on the other hand, I want to talk to you now about a rather serious business matter.

"You happen to be the first employee of the International Harvester Company that we have met in this town and, were we strangers, I am sure that the first impression we would have formed of the International Harvester Company would not have been favorable.

"I rather suspect that you do not like your job and, inasmuch as we have nothing to do at the present time, and it will not be a waste of your time, may I chat with you for just a few minutes. I would like to point out to you that you have a job that really is very interesting, and if you will but attempt to realize the fine values to you in that job, you can make your work during every day contribute not only to your own pleasure but to the pleasure and profit of others as well.

"If I had your job, I would not think of it as 'running an elevator.' I would think of it as a job that illustrated the ups and downs of life, and I would think of myself as a sort of receptionist for the great International Harvester Company. When a stranger entered the door of the hall opposite my elevator, I would be ready to greet him with a smile. I would seek to pride myself on my ability to recognize him and, perhaps, call him by name if he had ever been here before but, in any event, I would assume that I was the official greeter of the International Harvester Company. If it were a bright and sunshiny day, I would

call his attention to it with a smile on my face, and, if the weather were the reverse of that, I would remark that perhaps there is more sunshine from within than without, and I would ask him whom he wished to see. I would usher him into my elevator as if he were a distinguished guest and, as I deposited him on the correct floor, I would direct him to whomever would properly and thereafter take care of him, and part with some cheery word of adieu.

"You did not know, when we came into the building, but that we were important potential customers of the Harvester Company and, certainly, if we had been, or if we had come on some controversial matter, our feelings toward the International Harvester Company would not have been helped by the manner in which you greeted us.

"Now, my friend—and, by the way, what is your name—I shall remember you the next time I see you, whether you remember me or not. Ah, yes, Mr. Doe! Well, I am very happy to meet you, and I just want to say that this little talk we have had here goes no further. It is just between us girls! I am not going to make a complaint to anyone, and I am giving you this little sermon only because I think it may be helpful to you in making your work and therefore your life, and the life of the people who live with you, a happier one."

Well, it was about the neatest job of its kind I had ever seen, and on a return visit to that plant, some months later, I found that elevator man a changed person. Not only was his recognition of me instantaneous and cordial, and withal dignified, but later in the day, when I had occasion to remark to the general superintendent on the excellence of the training he had given his receptionist-elevator operator, he remarked to the effect that it was a matter of comment to all of John Doe's associates regarding the change that had come over him; that whereas he had formerly been just a "first class pickle," to use his words, he had recently developed into one of the brightest and cheeriest men on the place, and simply radiated sunshine.

My next experience with this same Mr. Jones was at the Harvester Plant in Hamilton, Ontario, which we visited together and, after having attended a meeting of the Works Council, we were shown over the plant. We met, at his place of work, one of the employee members of the Works Council, a Scotchman, and, naturally, very reserved in manner and perhaps of dour appearance, who was operating a machine which cut into proper lengths from long bars the steel rods which were later to become spokes in the wheels of the agricultural machines manufactured at that plant.

Mr. Jones stopped to chat with this chap and, to open the conversation, said, "Mr. Dickson, just what is your job?" The reply was, "Cutting spokes." Mr. Jones said, "Is that all?" and the reply was, "Aye, sir, it is nothing but that. From

the time I start work in the morning until I stop in the afternoon I cut spokes, and I stand here at this machine all day long and cut spokes."

Mr. Jones said, "Well, Mr. Dickson, that does not sound like an interesting job."

Mr. Dickson said, "Indeed, it is not. It is just about as tedious and monotonous as a job could be."

Mr. Jones said, "Well, Mr. Dickson, I wonder if that is your fault or the fault of the job?"

Mr. Dickson replied, "Well, sir, I am sure it is not my fault for I do my work well."

"Ah, yes, you do your work well, but you do it as work."

"But what else is it, sir?"

"Well, let's see. Let me tell you how I would look at your occupation, if I had it to do. These spokes you are cutting now—I take it from their size and length that they are to go into the wheels of an eight-foot binder."

"That's right, sir."

"How many spokes in a wheel? Do you know?"

"No, sir, I don't. I simply get my shop order to cut so many spokes."

"Well, you do see the eight-foot binders here in the plant, don't you?"

"Oh, yes, many of them."

"Well, I happen to know that there are 24 of these spokes in each of the two wheels on that binder, and now I would just like to reveal something to you about your job that you have not sensed."

"It takes about two minutes to cut 24 spokes, or four minutes to cut enough spokes for the two wheels on the binder, and in every hour you have enough spokes for fifteen binders. Now, I happen to know something about the number of this particular binder scheduled for the current operations, and you could find that out, or you could figure it out for yourself from the shop order. Now, let's see, I am pretty good at figures," and here Mr. Jones took out his pocket memorandum book and pencil and, after very rapid calculation said, "Do you agree with me that it is about two miles from here to the top of the hill on which the hospital is located, over there?"

"Aye, sir, I think that's about right."

"Well, as I figure it, you will make wheels enough for binders which, if placed side by side, would reach from here across to that hilltop, and I think, if I had your job, I would think that instead of just cutting spokes, cutting spokes, cutting spokes, cutting spokes, and nothing else all day long, I would be envisioning one wheel, two wheels, one binder; one wheel, two wheels, two binders, and watch that line of binders spread across the valley until, when my shop order was done, and the spokes were all cut, the row of binders in my mind picture would be complete, and then I think I would make a little inquiry and I would find out something of the average acreage that each one of these binders would cut in a season. That's a figure I happen to know, but it is also one that you could easily get by a little inquiry. And now, let me do a little more figuring," and, after another short session with his pocket notebook and pencil he

said, "That row of binders, two miles wide will, on the average, cut an acreage which would be equivalent to a swath two miles wide, and reaching from here to Toronto, nearly forty miles away. So, with this knowledge, I would start my row of binders in motion. Perhaps I would not wait to start the binders at work until I had completed the row, but, as soon as I had finished the two wheels of the first binder, I would start it on its way and I would be thinking of the fresh hay and, later, the golden ripening grain that would fall in its path. I would think of the farm house near the shed where the binder would rest at night, and I would think of the cattle and horses that would feed on the hay, and the other farm animals that would feed on the grain, and then, when I began to cut spokes for the hay tedder, or the grain planter, or the big Harvester Thresher, I would think of those spokes and those machines as things that I myself was creating or, at least, largely helping to create, and it seems to me that instead of my job being just one of cutting spokes, cutting spokes, cutting spokes, cutting spokes, I was really playing a very important part in a very important industry and if I am not mistaken, the closing whistle would blow a lot earlier every day for me than it would if I had been looking on my job in that way."

I visited the plant just a month later, without Mr. Jones, and, after the Works Council meeting was over, Mr. Dickson drew me to one side and said, "Mr. Young, is Mr. Jones with you?" I said no, and that I was sorry he was not. Mr. Dickson said, "Will he be coming here again?" and I replied that I thought he would. Mr. Dickson said, "Well, I wonder if it would be asking too much to have Mr. Jones come out to my house to meet my Missus. She wants very much to meet him, for I'll tell you this—that ever since Mr. Jones talked to me as he did on that visit about my job, my work has been different, and I myself have changed, for my wife asked me what in the world had come over me to make me so happy in my work, and so happy in my home. I told her what Mr. Jones had said to me, and we think that it was a greater sermon than either of us have ever heard in a church, and I would like to ask you, on my behalf, to arrange to have Mrs. Dickson entertain Mr. Jones at our home."

These are true stories. They are my sermon. If they are only fractionally as fruitful to you as they have been to me, then they will aid you in so addressing yourself to the most menial or monotonous task that the job will become a challenging one, and an instrumentality of happiness rather than a humdrum and monotonous task.

The recollection of Mr. Jones's experience will also, perhaps only occasionally, but more and more frequently as you realize the enjoyment that can be had from so doing, help you to suggest to others at opportune times and in appropriate manners as simple a device as this I have related to bring sunshine and happiness and goodwill, and to do away with "the little things that sometimes make big wars."

INVENTORY CONTROL

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Inventory control is not often clearly understood by some men out in the plant. They associate inventory with the period when a plant closes down for an annual inventory, but inventory is material and inventory control is material control. Inventory control is just as important to industry as men, money, and machinery. There are men working in plants today that still do not realize that inventory control is of vital importance to the success of the program of manning and managing our arsenal. It is a fact that our very existence as a nation depends on the over-all inventory control of the critical materials available today for war production.

As a result of this shortage of material, foremen are afforded excellent opportunities to do their part by contributing in many ways to the success of this program of inventory control.

We are concerned with the functions of inventory control that cover the receiving of material, the storing of material, and the handling of materials in accordance with the requirements for production. The scope of this inventory control varies greatly. There may be only a thousand parts in a small plant, while in a large plant it is not unusual to carry twenty-five thousand or even more items.

There are some that liken the inventory to a bank deposit and the stores to a bank, but after trying to get service at the bank on the first of the month during my lunch hour, I would rather consider inventory as a service facility that must blend in with production, help it in many ways, and never be a handicap to it or the cause of production delays.

In our Los Angeles automobile assembly plant we had approximately 8,000 noninterchangeable parts. We have produced in one year 80,000 cars and handled over 8,000 carloads of material to do this job at a production rate of 35 cars per hour. To accomplish this so that the correct part was in the correct location at exactly the right time and in the quantity needed for production called for a very positive inventory control. It might be interesting to note that never once during the year was it necessary to lose production because of a material shortage.

In our case, we were extremely fortunate in having a management that believed that inventory control was just as important as production control and that to get production you must needs perfect material handling methods.

Unfortunately, this is not the case in many plants, and the functions of inventory control and material handling are thus far less advanced than production. Many plants have extensively modernized their machinery without the equivalent modernization of material-handling methods, but we must realize that

as the machine speed increases, so must the speed of the material movement. Further gains in manufacturing efficiency and improved inventory control are easier to achieve by studying and changing handling methods than in any other way. So we will find that in the manning and managing of our arsenal in this period of war production expansion with the pressure ever on for increased production, we can get more output from a plant that is apparently operating at capacity by a study of and a change to modern handling methods.

The greatest difficulty connected with this job is to make the production men realize that the material-control department is part of the production process and not a separate process concerned merely with moving materials in and around the plant or department. Some foremen are hesitant in giving you the co-operation needed for efficient handling unless it can be proved that there will be increased production efficiency as well as reduced handling costs. Good material handling does contribute to increased capacity by moving parts and work in process from operation to operation promptly and quickly, and it can be used to increase the capacity of storage areas, and space today in many plants is increasing in value.

Material handling operations should be a regular function of management. If this work is put in charge of one man, it will get the results desired. It will define the responsibility and assure orderly planning and co-ordinated operation. It will help to bring material-handling methods to the same level of efficiency as production, and most important of all, it may uncover some unexpected bottlenecks before they create an emergency.

Thus, we find that material handling has as its major objective serving production with the utmost efficiency and controlling material so that plants can operate on a minimum inventory.

This brings us to the next things that inventory control must do. It must maintain raw materials in sufficient quantities and of proper qualities to meet the requirements of manufacturing. It must keep inventories of materials and supplies at a minimum. On production parts, the quantity or bank as it is commonly called, is based on advance schedules. Too much stress cannot be given to the importance of setting up quantity standards, for the more rigid the control, the better chance all industry will have to get a portion of available critical materials, and thereby allow the arsenal to meet its over-all schedule. The control of this balance is part of the foreman's duties because this balance has to be found, and it should not be so high that critical

materials badly needed elsewhere cannot be utilized. Neither must it be so small that an accident will tie up production.

Foremen realize that they will have to operate on a close bank of material. This gives them another opportunity to do their part of the job with inventory control so that the material in the plant under their control is handled in such a manner that it will always agree with the record balances of stock on hand. This control must cover completely the checking in of material, the reporting of material damaged in transit, the elimination of floor losses and waste, and the control of scrap. Employees must be prevented from appropriating parts for their own use. Good house-keeping will aid in doing this work.

Our plant, when we were producing automobiles, gave us a good example of how material can be controlled with low balances and yet let production stand protected. We produced and shipped about 1,400 cars per week—Buicks, Olds, and Pontiacs in 35 different body styles—and carried an average of 1,500 jobs of material. Through inventory control, our sources were scheduled to ship so that our unloading program of about 140 carloads per week would bring our stock back into balance as production was run daily. Thus, on Friday night, we had on hand again our 1,500 jobs balance which represented the jobs scheduled to be produced during the next week's production. We were eight days in transit time by rail from our Eastern sources. The way we handled chassis frames gives you an example of how production can be protected against accidents. We received these frames from the East by boat and truck, and the shipping time was approximately 18 days. To protect ourselves against the uncertain shipping schedules, we maintained a larger bank, that was adequate to protect us until we could receive an emergency rail shipment from the Eastern source, and it was necessary on occasion to avail ourselves of this protection. Our local sources gave us an even better chance for inventory control, and the opportunity to work with closer balances, with a resultant saving in costs at both ends. An example of how this was done is the manner in which our seat springs were handled. We had an arrangement with our source whereby we jointly purchased enough trucks to be used interchangeably at either plant, so in a season with 150 specially designed trucks, we handled over 350,000 springs directly from the end of the production line to the start of our line by moving the loaded trucks on a delivery truck and sending back empties on each trip. Cushion pads were handled in the same manner, and we were able to operate with a tire bank storage area of less than forty-foot square.

Waste of material that will have an effect on inventory control is one item that presents a challenge to every foreman, and it is something that demands attention and action right now. It can in most instances be stopped by explaining to the men the value of the material; we must not permit rough handling; we must store materials correctly. The Elliott Service of New York published a chart listing 142 causes of waste and it was surprising how many of these directly had an effect on inventory control.

Next in importance to the production parts are the nonproduction stores covering expense materials. There again we find that foremen can take a definite part in the inventory control of these items.

One of the most successful control methods in common use is the maximum and minimum method in which the maximum represents the largest quantity that should be carried and the minimum represents the margin of safety to be used in case of an emergency. In the establishing of quantity standards for each item in the store, production men, material men, and purchasing and accounting men must enter into a close co-ordination if the method is to be successful. The quantity standards are usually dependent on the ease of purchasing.

In our stores system we have developed an efficient inventory control using this method, and, in addition, we use our record system to determine obsolete and inactive stock so that disposition can be made of this material. This is a highly important point and one which must be given attention in all plants. General Motors recently announced its policy to make available to any manufacturer for other war production any material they now have that they were not going to use in doing war-production work. This is advantageous not only in that it contributes to manning and managing our arsenal, but it makes available much-needed space in many instances, and from a cost standpoint it is found that the carrying charge on stores items runs as high as 15 to 25 per cent of the cost of the part, on active parts, to as high as 40 per cent on inactive and slow-moving items.

Never in my experience with conferences have I found a group that would not open up and talk about inventory control. Everyone in the plant usually feels that he can straighten out the problems. In our plant meetings, many good suggestions came from other departments, so without further conversation, I will turn the meeting back to our Chairman.

METHODS STUDY FOR THE WORKER

TREVOR GARDNER

Assistant to Works Manager, Plomb Tool Company

The war production need combined with a shortage of trained labor has added emphasis to our interest in methods improvement. During normal times we are all concerned with this problem because our survival in a competitive industrial society frequently hinges upon its solution. During these times, however, our problem is not just one of improving methods for cost reasons, but is primarily the all-important one of improving methods so that skilled hands may accomplish the most in the shortest possible time.

Billions of man-hours of work are scheduled to be performed by industry to get our war machine into full action. Now, as never before, the methods-improvement specialist has an opportunity to exercise his science so that these billions of man-hours may be spent most effectively. We all recognize that there are not enough methods men or time-study men to assist with the countless new jobs to be done and to guide the millions of untrained hands that will perform unfamiliar, unimproved tasks. Our traditional approach applied to this national methods-improvement problem is not adequate since it will result in solving only a fraction of it. We urgently need a means whereby methods improvement techniques can be used by the worker to solve the problems our methods men haven't the time to handle. The purpose of this discussion is to indicate this means and the method that may be used to "sell" it to the worker.

During peacetime we consider the methods problem as solely that of management. Many organizations maintain methods departments charged with the obligation of finding the "one best way" to do each job. Now, however, the responsibility for finding this "one best way" rests not only in the hands of management, but also is placed squarely in the hands of labor as well. As methods men we have all recognized that the most effective means of searching for this "one best way" has been through the application of motion-study principles and techniques. Time- and motion-study men, following the teachings of Frederick Winslow Taylor and the Gilbreths, Frank and Lillian, have been able to attack specific job-improvement projects with consistently good results. The tools of analysis which are used in the solution of these problems will continue to be used to solve other methods problems, but "for the duration" we also must simplify these tools and "sell" them to the worker. In this way he will be equipped to improve his own job without the aid of the methods department.

Government, through the War Production Board, has recognized the need for worker participation in methods improvements. They have asked all industry to form joint union-management committees, meeting

regularly for the purpose of stimulating a flow of suggestions from the workers. It has been my participation in meetings of this type that has assured me that such a program to help the workers assist us is necessary. During the first four or five meetings with various committees, I notice a high degree of animation and interest. There appears to be an unending reserve of problems and suggestions. However, after this initial spurt, the meetings seem to stagger and tend to drag along without many useful suggestions resulting. My observation has been that it isn't sufficient to ask the worker to make suggestions and "let it go at that." Management must provide methods-improvement knowledge and get it into the men's hands so that an additional and continuous flow of methods-improvement suggestions will be forthcoming.

Evaluation of Motion-Study Techniques

We have indicated that in order to present our motion-study principles to the worker it will be necessary to simplify them. Let us now review and evaluate the tools of motion study with an eye to determining which will be useful for our purpose.

First, let us obtain a clear mental picture of what motion study should accomplish for us. The entire field of knowledge arises from the motive of reducing costs and increasing production by reducing direct labor. What we have been looking for from motion study is a means to this end and, further, one that is more or less automatic. Briefly, then, we expect the science first to point the finger at what is wrong with a work pattern and second almost automatically to suggest an improvement or remedy for the poor condition.

The methods-analysis tools we have referred to are relatively simple in themselves. They can be summarized and explained briefly as follows:

1. Fact-gathering devices: Such as labor cost analysis sheets and operation analysis sheets for the purpose of maintaining a consistent organized approach to all problems regardless of type.
2. Process-flow charts: Modifications of these are operator charts, man-machine charts, and material-flow charts. These all provide a graphic presentation of facts affecting a specific methods problem.
3. Therblig concept: A classification of motions based on the idea that all work, regardless of

type, can be broken down into certain elemental motions.

4. Simo-chart: A charted analysis of workers' motions depicting the simultaneous actions of left and right body members.
5. Motion-picture analysis: Refers to so-called micro-motion study based on taking motion pictures of the work cycle and making simo-charts by analyzing the film a frame at a time.
6. Principles of motion economy: Loosely established generalizations which amount to check points that may provide a key to job improvement.

It will be quickly appreciated that some of these techniques can have no possible application when considered in the light of worker understanding and use.

Before we proceed with discussion of those methods aids which have a range of application, for our purpose it is necessary to point out one serious weakness which extends through the whole field of motion study. This weakness lies in the tendency which motion-study people have to add a coefficient of mystification to their work. The nomenclature itself is confusing with simple ideas usually presented through the use of mysterious-sounding terms. An excellent example of this can be found in the concept of elemental motions. This is a simple idea and one which the layman can readily understand and use. However, when it is presented to him under the rather baffling heading, "therbligs," he immediately feels that here is something that is definitely beyond his understanding. Simo-charts, possibility charts, process-flow charts, micro-motion study, and chrono-cyclegraph are additional examples of terms which in themselves are not memory aiding and in general lend an air of complexity to what is a ridiculously simple idea. Unless the confusing and mystic approach is eliminated, it will obviate any possibility of presenting the information to the production worker in an understandable form.

I would like to point out that disagreeing with the complex nomenclature does not imply that one disagrees with the techniques themselves. At the Plomb plant, we consistently use the motion-picture approach to our methods problem with good results. We find that on short-cycle operations micro-motion study with flow charts and simo-charts has a very definite range of application.

Now, back to our original thought of determining which of the six methods-analysis tools lend themselves for presentation to the worker. Most of you will agree that fact-gathering devices, process-flow charts, simo-charts, and motion-picture analysis have little possible application. However, the therblig idea, if properly developed and complimented with the use of our so-called principles of motion economy, will be of definite value to us.

Motion Study Techniques for the Worker

The therblig idea as traditionally presented will not afford us a valid basis for "selling" motion study to the operator. It is too complicated and too involved for easy understanding. The idea "that all work can be broken down into elemental motions and that each job, regardless of type, is merely a definite combination of these elements" is, however, very valuable and lends itself to easy presentation.

A practical basis for using the idea of elemental motions is to simplify the total number of them to ten or eleven and then classify these very roughly under two headings; those that are productive, and those which we can call wasteful.

<u>Productive</u>	<u>Wasteful</u>
Transport loaded	Hold
Transport empty	Select
Grasp	Search
Inspect	Pre-position
Release	Position
	Change direction

Through this classification we can quickly teach an operator to watch for and learn to eliminate his wasteful motions. For example, most operators can easily be sold the idea that the hand is the poorest and most unsafe production holding device. Further, they can readily understand that the coin dispenser used by the streetcar conductor is a far better selecting device than the conductor's cupped hand.

From the principles of motion economy, there are any number of ideas which we may make use of. First, and foremost, is the idea that both hands should work simultaneously and in opposite symmetrical directions. Another very useful one is that the hand should be relieved of all work that can be conveniently performed by the feet. The idea of motion classifications with a first-class motion being less fatiguing than a fifth-class one is another usable one. These principles and others can be "put over" very readily through a "catching" pictorial presentation. Without knowing anything about motion classifications, most workers can readily learn to substitute hand motions for body motions, use foot-operated gadgets instead of hand-holding devices, and in many cases use simultaneous motions.

A list of what we should present for operators' consumption would then be as follows:

1. The concept of elemental motions—dressed up in its Sunday clothes—pictorially presented so that it immediately ties in with the "one best way" idea.

2. The idea of classifying elemental motion into those that are wasteful and those that are useful, so that each worker habitually recognizes and corrects the wasteful ones.
3. A detailed attack with pictorial analysis upon:
 - A. Elimination of holds
 - B. Elimination of selects
 - C. Elimination of pre-positions and positions
 - D. Application of principles of motion economy
 - E. Use of drop delivery
 - F. Use of foot-operated devices

Presenting the Idea

There are several avenues of approach in getting our ideas over to workers en masse. Certainly, the easiest of these is the foreman. He is our most reliable transmitter and the one who has the most immediate interest in getting results. Our simplified methods-improvement information can be placed in his hands in the form of a pamphlet backed up by motion-picture presentation. Such a presentation might be developed within a company itself or as a general program such as "Training within Industry" and backed up by the War Production Board or other government agencies. A serious campaign aimed at both management and labor may be worked out which might include posters, motion pictures, demonstra-

tion trailers, and training courses that would add impetus to the already started suggestion committees. Another approach might be made through manufacturing associations and labor organizations. Now, as never before, methods improvement through motion study can be endorsed by both management and labor without fear of complication. We might develop a double-barreled attack aiming our first charge at the foreman and our second directly at the worker. We might reach the worker indirectly through his labor organization, through company newspapers, through posters, and other educational devices, the entire program being tied into the suggestion-committee idea and handled by the methods department. The opportunity for methods improvement, along the lines I have discussed, offers greater rewards than ever have been possible before. We are confronted with a new set of circumstances arising out of our war effort. Certainly, as individuals interested in methods improvement, we should be the first to read the handwriting on the wall and adapt our techniques to the 1942 tempo. We cannot sit back and be content to carry on by merely increasing the number of methods-improvement jobs which we attempt to solve. Taking on more work is only a partial answer. The remainder of the answer lies in becoming "salesmen" and selling our methods-improvement technique to the production worker himself.

CO-OPERATIVE SUBCONTRACTING

AUBRY MILLER
Alhambra Defense Industries

The extent and magnitude of today's events are so vast as to leave most of us without either datum point or proper perspective. Total warfare is difficult to conceive even when confined within the limits of two countries. When it involves a whole continent, and from there spreads to the globe, most of us can see it only as a series of unrelated parts. It is too complex for us to integrate into an understandable picture.

Yearly federal peacetime spending likewise left us a little breathless. A staggering debt load which we jokingly referred to as astronomical led some to predict dire changes in the American Way of Life, and to look to the future with foreboding.

Today's federal expenditures are as far in excess of peacetime commitments as global warfare exceeds an isolated battle. The debt load has left the merely astronomical and flown off into the infinite. Profound changes in the American Way of Life need no longer be predicted, for they are upon us; we are experiencing them, we are living in the midst of them, and if we are wise, we will acknowledge those changes and seek to evaluate them.

Perhaps in no other field are these changes so self-evident and so far reaching as in that of the manufacturing industry. That change is not limited to means and methods of production, of financing, of management, of planning, or of public relations. It is operative to a far more important degree in the field of industry itself—in the relations developing between manufacturer and manufacturer, and more particularly between the larger industrial plants and the small, heretofore independent and highly individualistic shops.

There are certain premises in our discussion which I think we may accept as implicit. That this war must be won at all costs; that anything short of all-out victory is unthinkable; and that in achieving that victory, if we emerge at all, we must emerge as a Democracy. We are not prepared to temporize with victory, to accept terms which we do not ourselves dictate; or to be satisfied with a mess of pottage in place of our birthright. Nor do we, who are today cutting the pattern of tomorrow's clothing, intend that garment to be worn with a brown shirt, a black shirt, or any other symbol of Totalitarianism.

To achieve victory in a mechanistic war, we require the complete co-operation of every productive facility in America. There can be no idle hands, no idle machines, no idle brains. Unless all are aiming at the same goal, all traveling the same road, the production essential to victory can never be achieved. The load of scheduled production demanded by this war is too great, too complicated, and too vast for

any or all of the major industrial plants to carry it unaided. The demand for victory requires the full use of the facilities of the small shop as well as of the great plant.

But even if this were not true, even if our major plants could by expansion, consolidation, and acquisition produce sufficient goods to insure the victory we seek—they would in that very process insure their own ultimate defeat. For by the same token that they grew greater, stronger, and more closely integrated, so would the small plant become less and less a part of the American picture, until by force of circumstances, it would fade from the scene. The result would be the Corporative State of Fascism and the defeat of Democracy. For when the processes of any industry are concentrated in few hands, governmental regulation is but a step behind, and the line between regulation and management is so dim at times as to be like the Equator—an imaginary line found only in books.

Therefore, in order to achieve victory over our foes, and to preserve Democracy within our own nation, the productive capacity of the small shop must be preserved and its continuity as a part of our economic structure insured. It is not enough that these small shops be kept alive as contributing adjuncts to major plants; that is a species of feudalism which contains the seeds of its own destruction. The small operator must be made to evaluate himself as a vital part of the American war effort, to keep and maintain his own fierce pride in the necessity of his contribution, in the quality of that which he contributes, and in his independent relationship to the social, economic, and political pattern of American life.

Now all this is very well as a theoretical and idealistic summation, but what does it mean when reduced to the status of a blueprint? And having so reduced it, can it be translated into a realistic contract and an even more realistic finished product ready for use on the firing line of America's war effort?

Every prime contractor, and every major subcontractor has been besieged by small shop owners seeking to participate with them in the production of war goods. Major plant executives could spend their entire time interviewing these owners or their agents, inspecting their plants, helping them to estimate their costs, their productivity, and their availability for selected war work. On such a basis, the major plant would soon become a minor one and the war would go by default.

The Contract Distribution Office of WPB had on

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file in Washington a few weeks ago the facility records—more or less complete—of over 40,000 would-be sub-contractors, and the list is growing daily.

By far the greater number of these represented highly specialized shops or plants heretofore engaged in producing consumer goods, unrelated by any stretch of the imagination to war production. Some of them would be content to continue in such production but that is no longer possible. They have been told by every existing agency of government and by public opinion that they must convert their plants.

Their natural question is, "Convert to the manufacture of what and out of what?"

All of us know of tanks and battleships and planes; few of us know them intimately enough to be aware of their "bits and pieces." Even though we are familiar with the government's list of 26 types of machines and their 110 subclassifications, we are still unable to translate that knowledge into a working contract because the small plant owner is usually unable to estimate costs in such an entirely new and uncharted field, and when production problems arise—should he be so fortunate as to procure a subcontract—they are all too frequently beyond the technical skill of his production department—if he has one.

Once again he beats a trail to the door of the prime contractor and the wheels stop turning while the ABC's of engineering are explored. In sheer desperation, many large prime contractors have dodged the issue by absorbing the smaller plant, incorporating it with their own, and suggesting to the former owner that the Army, Navy, and Marine Corps are clamoring for recruits.

Now I realize that none of you to whom I am speaking are in that class of subcontractor whose troubles I have enumerated. But I insist that one of the reasons you and your men spend hours instead of minutes in the prime contractor's waiting room is because there are so many ahead of you who are in that class. And I would not for a moment urge that these others are devoid of ability or usefulness. I merely urge that they have problems which they are unable to solve alone and unaided.

It is to help them solve these problems and to relieve the prime contractor of that burden that co-operative subcontracting companies or "pools," as WPB calls them, have been formed.

There are, I know not how many, species and varieties of such co-operatives. They range all the way from industrial engineering firms which serve any and all applicants for a fixed fee, and which are not strictly co-operative at all, to the tight union of a few selected companies into a single unit strong enough to be in and of itself a prime contractor.

In broad general outline, however, such co-operatives tend to fall into three main subdivisions. There is, first, the so-called "hen and chicken" group which is simply a large prime contractor within whose orbit float a few highly selected semi-independent subcontractors. These subcontractors may be separated by

the length of the nation or they may be localized within a community. Their distinguishing feature, however, is that they are dependent upon one prime contractor for all of their work. It's nice work if you can get it, and the arrangement is highly satisfactory where the prime contractor is the type of benevolent despot who takes a paternal interest in the objects of his feudal bounty, and is willing to solve all vital production problems, exchanging the talents of his more highly trained specialists for a somewhat reduced consideration to the selected subcontractors. I have no criticism of the relationship, although it seems to me to be somewhat of a choice between "love and a career" with the scales weighted on the side of immediate security as against eventual independence.

The second type of co-operative is even more highly selective since it involves the more or less temporary union of a group of independent shops and plants into a completely new corporation. An example of such a group during peacetime was the Six Companies Group which built Boulder Dam, or at the present time the San Jose Group who formed such a corporation last fall. Obviously, a corporation of this type may be as strong financially as the United States Steel Corporation, if its component members were strong to begin with. It may, if properly selected, be in fact a prime contractor in its own right. The only feature of it which I find disturbing is that since the new corporation supersedes the old identities of the individual members composing it, the profits of the individual members will naturally be pooled in the over-all corporation and subject to new and unusual excess profits taxes which might cripple the entire project.

In addition, such a corporation does not preserve but defeats the preservation of the independence of individual entities, and it cannot be made elastic enough to embrace the small plant owner whose salvation is so essential to our economic stability.

A third type of co-operative is the one which has sometimes been referred to as the Alhambra Plan, although basically it differs but little from the famous California co-operatives formed long ago by growers of oranges and other market produce.

Properly formed, this type of co-operative proceeds upon the theory that what the small would-be subcontractor really needs is not so much a business-getter or salesman as it is trained and efficient estimating and production men. Obviously the small operator cannot hope to command the services of such trained men nor can he depend upon the intermittent professional services of those who serve an indeterminately large group of clients.

Under this co-operative plan, then, the group itself forms a nonprofit corporation, electing directors from among the members who are composed exclusively of small subcontractors. The new corporation employs trained salesmen, estimators, and

engineers—or in its beginning and if it is so fortunate, it gets all three in one man.

A percentage payment on all business received by the member through the efforts of the engineer supplies funds sufficient to discharge the group's obligations and the excess is repayable to the members.

Under such a plan many subcontracts are divided among members of the group which no one of them might otherwise have undertaken. And since the continued income of the engineer is dependent upon the reputation which his group enjoys with prime contractors, he refuses to procure work which cannot be performed on schedule and according to specifications.

It is to him rather than to the prime contractor that the members look for assistance in their original cost accounting, in their finance problems, in their production difficulties, and in their contacts with prime contractors. If he and his assistants are capable, highly trained, and effective workers, they can gear the shops of their members into any production schedule which may arise.

Obviously such a co-operative does not solve all problems without raising new ones. Nothing human ever does. If the co-operative employs a business-getter, Chamber of Commerce super-salesman, and neglects its engineering, it is doomed to failure. The selection of personnel is one of its most difficult tasks. Therein it differs from the prime contractor only in degree but not in kind.

Where members, having procured contracts, consider that their sole duty is done and that the prompt and efficient performance of the contract is of secondary importance; provision must be made for commandeering the plant on behalf of the co-operative until the contract is completed.

Such a group ought also to be rather diversified in its membership, not overloading itself with too many highly specialized shops possessing similar

machinery and capable of doing only one type of work. It ought to be able to assemble "bits and pieces" into larger units when the contract so requires, the assembly cost being prorated among the members controlling the particular contract. And it ought, above all, to be highly flexible, substituting members, acquiring new ones and dropping old ones as conditions may require.

From the standpoint of the prime contractor, such a group is insurance that the subcontractor will complete his contract on schedule and in accordance with specifications. Furthermore, his own plant executives need not spend their time educating individual subcontractors, solving their financial and technological problems for them at the expense of his own plant. Above all, that most valuable of all quantities—time—is not lost and the constant complaint of the United Nations—"Too little and too late"—can be transformed into a rising shout of "Victory."

The small shop owner, by preserving his identity and his independence of action, preserves also that dignity of the individual which distinguishes the inhabitants of a Democracy from the cogs in the wheel of the Total State.

Those philosophers may be correct who assert that the efficient, scientific state is the ultimate goal of statesmanship. But, I believe, most of us will contend that there is more real power in the free-swinging right arm of an inefficient—if he be inefficient—but independent citizen of Democratic America; than in all of the scientifically—if it be scientifically—guided, guarded, and controlled Nazis and Fascists the world has yet produced.

Our co-operation will be the co-operation of free men; and victory, the victory of individual initiative; and the peace which follows will find us men of dignity and of independence.

TESTING PROGRAM OF THE LOCKHEED AND VEGA AIRCRAFT CORPORATIONS

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Origin

In 1937 Lockheed found that hardly two out of three new employees developed into satisfactory workers. Many beginners were unable to adjust themselves to the team method of making airplanes. They were too fast or too slow, or they could not get along with the other members or the leader of the small, highly coordinated teams. Many of these beginners quit or were terminated.

Lockheed decided that the time to solve these problems was before the workers were hired. Employers had for some time been testing the skills and aptitudes, the intelligence, and the health of their workers. But still there were always many who quit or were fired. The cause of 80 per cent of employee misfits was temperamental maladjustment.

A testing program was designed that would supplement the regular interview and selection practice. It provided the interviewer with objective test measures to aid his personal judgment. The new procedure helped in the selection of employees who fulfilled certain requirements of intelligence, mechanical or trade aptitude, and temperament.

The program was used not only for pre-selection but for re-evaluation of active employees. Misfits were tested, the results diagnosed, and corrective procedures suggested. Men of unusual promise were tested and supervisors picked. Wherever improvement had taken place, it could be measured, and proper use was made of it.

Evaluation of Applicants

Lockheed now gives all qualified applicants at least two tests: the Otis Test of Mental Ability and the Humm-Wadsworth Temperament Scale. Job specifications also may call for one or more of the trade, mechanical, or clerical aptitude tests.

The intelligence test is used as an aid in the placement of an applicant. Certain jobs demand men whose intelligence falls within a given bracket. Some applicants are too smart for certain jobs; others do not have sufficient mental alacrity to keep up with a function. Thus, though an individual's intelligence is apart from his temperament, it is a key in his final placement within the company.

The temperament scale as used by Lockheed attempts to predict the behavior of the applicant in any placement that the company might make. The scale is composed of 318 questions requiring a "yes" or "no" reply. These disarmingly worded questions represent a breakdown of temperament into five fundamental components: self-

control, self-interest, emotion, imagination, and inspiration. Too much or too little of any of these factors usually shows why an employee does not work out at a job.

No one of the components should be judged by itself, but rather in its interrelationship to the other components and to the validity of the responses. The responses themselves have weighted values to the degree that they indicate tendencies toward any of the fundamental components. These "raw scores" are totaled and recorded on a "Profile" or Psychograph which gives a visual picture of the man's temperamental assets and liabilities in terms of "strong," "borderline," or "weak" values. The varying proportions of these values are what make people differ. From these values, Lockheed's temperament analysts measure the disposition and mental well-being of its applicants and predict their behavior under placement conditions.

When the background of an applicant warrants, trade tests that would utilize his experience are given. The trade test attempts to measure the knowledge of the applicant so that when his test score is weighed with his experience he may be placed as a learner, junior, senior, etc., or eliminated as a trade bluffer. Clerical aptitude tests were devised that would give objective prediction for the routine filing job or the most exacting secretarial position. The results of these tests are at once diagnostic and comparative. A woman hired as a clerical-typist might improve her shorthand and typing, take the test at a later date, and become a stenographer.

Some of the Lockheed trade tests measure ability and achievement along skilled lines; others test for trade aptitude in any of several fields. A good garage mechanic might have some experience with the tools of a machinist. Since the employment market has been almost entirely drained of men with aircraft experience, it was hoped to bring men with allied experience into the industry with a minimum of training.

Evaluation of Active Employees

The tests are frequently used as diagnostic criteria of an employee's growth or lack of growth at any point in his tenure.

When the company intends to go to considerable expense giving an intensive apprentice-training program, certain standards can be set up by which trainees can be selected. Thus, a highly selected group can be provided which will be physically,

mentally, and temperamentally fit for specialized service.

Workers who go stale on the job can be re-tested and have a heart-to-heart talk with counselors. Re-adjustment usually follows. The employee has become aware of the assets and liabilities of his temperament. Nearly always he is quite relieved to get something off his chest; at least he makes a genuine effort to correct his fault. The diagnosis may show that a worker is on a job for which he is temperamentally unfit. The day-dreamer who can't keep up on a speed operation might have a quality that would work out quite well in the drafting room where he could project himself away from his surroundings and whip a problem. A diligent worker with an aptitude for blueprints might do well enough on the drafting test to be upgraded into the drafting room.

One of the key advantages of testing is its help in the selection of leaders and supervisors, men with the capacity to get along well with those under them, command their respect, and co-operate to get the job done thoroughly and pleasantly.

Results

Since 1937 Lockheed has tested almost 300,000 applicants, and from this pool selected its present personnel.

The company seldom employs a man or woman even in executive capacity without first giving the

tests. Nearly every time an applicant has been employed in spite of adverse test results, the company has regretted it. Lockheed in the face of national emergency has had to fill many highly skilled jobs with men whose tests would indicate undesirable temperament. It is not surprising, then, to know that two out of every three workers that the company had to terminate in 1941 had shown adverse test results. Yet the rate of turnover for Lockheed is low as compared with the industry average.

Well-balanced employees get along well together, work without dissension in the teams that are necessary in airplane building. Tests help to redeem a man outgrown by his job. When a man has a "beef," facts are substituted for opinion. An unbalanced trouble-maker can usually be weeded out before he is hired.

Apt employees increase production, so that Lockheed's production per man is high. Adjusted employees readily adapt themselves to the pressure of the present emergency.

Training costs per man have been decreased by testing applicants with allied experience and fitting their practical knowledge to jobs in the aircraft industry. Bright, eager men and women with motor co-ordination and stamina make excellent learners, progress rapidly, and help keep the morale of the employees at high pitch.

Lockheed is proud of its present personnel which has been hand-picked by the criteria of experience, temperament, and fitness.

TEST FORMS UTILIZED

Basics

Humm-Wadsworth Temperament Scale, Doncaster G. Humm Personnel Service, Los Angeles, California, Copyright, 1934.

Otis Self-Administering Tests of Mental Ability, Higher Forms A, B, and D, World Book Company.

Mechanical Aptitudes

Johnson O'Connor Wiggly Block, C. H. Stoelting Company, 424 North Homan, Chicago, Illinois.
Minnesota Manipulative Tests, Educational Test Bureau, Inc., Minneapolis or Philadelphia

Clerical Aptitudes*

Lockheed Clerical Test	Stenographic
Typing	Filing
Clerical-Typing	

Trade Tests*

Accounting	Final Assembly—revised	Precision Assembly
Blueprint Reading	Lofting	Sheet Metal Assembler
Drafting	Machinist	Sheet Metal Worker
Final Assembly	Patternmaker	Template Maker

*The trade tests and the clerical aptitudes have been set up and standardized by the Lockheed Testing Division and are not available for circulation.

PRODUCTION CONTROL

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In the present war rush to accomplish more in a shorter time the tendency may sometimes be to rush in on a problem and attack it more or less by brute force under an executive command to "get this done immediately." Quite often under such pressure we may feel impelled to tackle it in the old, hard way, jumping right into the middle of it and gradually working our way out of it by a process of trial and error. That is the hard way and will be the long way both in getting started and in finishing, and by far the costliest way, not only in the end but all the way along to the end.

How much quicker and more surely safe and sound results will come if the subject is tackled with a thorough analysis of the conditions to be met and then the best scientific management principles and technique utilized for intensively tackling that kind of a problem and then the daily progress checked by the best known yardsticks? The quicker accomplishment and the lower cost of the project in the end by this method as compared with the long, hard way will really surprise you.

For instance, in one of our big plants the problem of improving the arrangement of a department was up for consideration with a view to shortening the path of parts, saving of costs, including the handling, and at the same time providing for considerably increased capacity.

An engineer was assigned to the study and he made a good survey and report on a statistical basis. Another engineer was put on it, for a comparative report. But these recommendations did not seem to quite answer the problem.

A third engineer was put on it and he started in on it, tackling it in the same old, hard, statistical way, but could not satisfy himself that he was getting the right answer.

Finally he came to his senses and said, "What have I been taking this course at Cal. Tech. for and learning how to solve production problems by flow charts, if I don't put it into practice on my problems?"

So he got down to brass tacks, laid out a series of flow charts with the different movements accurately timed, and he came up with a materially different answer which resulted in saving the company a large amount of money for equipment contemplated and with the equipment the revised plan called for, making a much larger saving.

So the more scientific approach to the problem brings a quicker and more accurate answer.

Again, the tendency too many times, when a problem crops up, is to jump in and work out a solution to that particular problem, without giving sufficient considera-

tion to the tie-in with the many related problems. This is particularly true of the various factors of production control.

The result of this procedure often is that a lot of little unco-ordinated systems are developed in different departments of the business, when they should each be organized as well-designed parts of a completely functioning mechanism.

As a matter of fact, we cannot get away from it, they are vital parts of the operating mechanism of your business structure, and the ineffective and deficient operation of one unit prevents the gearing in to the whole mechanism to produce the expected results. The family car does not take you very far if the axle shaft does not gear into the differential, and if the operating mechanism of the retractable landing gear of your airplane doesn't function, look out for a crash landing. So let's be sure our production control system is not a little system all by itself but a vital integral link in the whole management setup.

The most important unit in the whole production control system is the assumption of much more responsibility by the top management and their representatives in the plant. Instead of being served by the worker, it is up to management itself to "serve the worker."

It is not a question of systems or forms or cards or even of charts and reports, etc., though these have their place. They don't produce the goods. It is a question of serving the worker, first, last, and all the time.

It is useless to expect maximum production on the part of workers and foremen if when a man is put on a job he finds that he or someone else has to spend half an hour hunting up the parts, or that the material issued is the wrong kind or wrong size, or that the tools cannot be found or are in poor condition, dull, or damaged, or, if the machine has been left to itself till it has become so worn or maladjusted that it won't make an accurate cut; or if when the man goes to work on the job he finds that it is a job he is not fitted for and should be done either by a more highly skilled mechanic or an inexperienced girl.

It is useless to expect schedules to be met if when the operator goes onto a job he has to spend an hour or more figuring out just how it has to be done, and each time this part comes up, a different worker has to go through a similar study process, and then often do it the slow, hard way. The best way should be studied once and for all by an expert and followed each time it comes up. This

automatically forms a ladder up which a man even from the bottom can climb to the top group as his ability increases.

These are all responsibilities of the management, and must be provided for in advance, not waiting till some particularly bad situation brings it to attention.

"But," you will say, "those things don't happen in my plant." Maybe, I hope so, but in altogether too many plants it is being done right today, at least in spots, in spite of what some of the executives think.

In many plants the management departments, the production control department, standards department, etc., have little more than a vague idea of how long it ought to take to do each job—all jobs—with the result that they cannot accurately schedule them to be started at the right time to reach the assembly line in time to prevent stoppage of the line. Did I hear someone say, "Don't work so close—provide a stock of parts ahead of assemblies"? We usually do, a small stock, but materials are too critical; if we stock up on one part we won't have enough material for any of another part. In order to get ships to our fighting boys on the attacking line, we can't afford to hold back a lot of parts to stand idle in stock, waiting for a few others before they can be assembled into the finished product. We must bring the parts up to the line more in balance. "We've done it before, we can do it again, we will do it again." And when we do, MacArthur can carry the war right into the enemy's country.

This is no time for complacency of managements and the passing of the buck down along the line, from the president to the vice-president, then probably to the general manager, from him to the works manager, the superintendent, the foreman, leadman, and finally on to the worker himself. Let's set up these management departments to really function as they ought to to "serve the worker" and "serve the foreman."

I tell you, it is amazing what a good job has been done by foremen, leadmen, and workers in turning out the sinews of war in increasing quantities, sometimes almost with their bare hands. They have turned out the product, but naturally in much longer time and higher cost than if supplied with the help that management can give them, and that they are now giving them in increasing degree.

Let's give them the help they need, give them the tools—right tools, and in time—and the best way figured out by the best, experienced men we can apply to the job, and then see how the production chart will climb.

Without this spirit of "serving the worker" and "serving the foreman," and without this breaking down of the work into functions, the old hard way of driving will not get us very far or very fast.

We can't build tens of thousands of airplanes and tanks and guns and ammunition the old horse-and-buggy way. We've got to streamline it.

And yet, how far are we away from the horse-and-buggy methods? It wasn't so very long ago that many of our plants were on a relatively small production basis,

and nearly everything was left to the foreman and worker to figure out and provide for. Many rapidly expanded plants still continue to try to work on the same basis.

After the first World War, and especially during the depression years, many plants sagged back into methods that were really obsolete twenty to twenty-five years before.

Roving Timekeeper

For instance, since 1900, up until a few years ago, nearly every plant in the country had gotten away from the use of the roving timekeeper. Before that time roving timekeepers had been pretty generally in vogue since the days of early industry in England—back to the days of Adam Smith. By 1905, most of us were using time clocks of some kind, or at least writing the time of day on the men's cards whenever they changed jobs. If a plant had a roving timekeeper, the executive in charge usually apologized, with the excuse that he was revamping his system, and would soon be getting the time of the men at the foreman's desk as they changed their jobs.

But lo and behold! later a young airplane industry began to grow, and into it came young fellows who had not been "through the mill" of earlier improvement, and they began to improve "backwards." They brought the discarded and discredited roving timekeeper back to life—those catch-as-catch-can artists who wander around and maybe catch the "flag raisers" an hour or two after they have changed jobs—how many jobs, no one knew. When a worker went on a job, he was supposed to raise a pretty little red or striped flag or signal at his machine or bench, and the timekeeper, in strolling around to view the scenery, was supposed to spot them and then put down both the flags and the time. But if you have never really checked up on those time tally sheets, and seen how many of them had to be manipulated in the back room to make them jibe with the "in and out" clock cards, you've missed a real treat. It was rich and juicy. And no chance in the world of measuring really actual time against any standards, because you never knew which of the times they "evened up" to bring a balance.

Let's not kid ourselves, boys. Let's put the timekeepers on other jobs where they can really produce, and let's time-stamp the men when they go on and off of jobs. It can be done on the same piece of paper that you give to the man to notify him as to what order to work on, and both this and the traveler that identifies the parts themselves can be duplicated directly from the original planning sheet and no writing or copying required. And it can be the same card you later punch for your tabulating system payroll and cost card. Let's stop this progressing backwards, because roving

timekeepers are not horse-and-buggy relics, they're wheelbarrow relics. And we really do need men for production work or for fighting.

A few years ago, when we were building airplanes a few at a time, it was not uncommon in some plants to hear a foreman shout down to the foreman on the floor below: "Hey, Bill! I'm going to need a pair of wings next week—and put on that bracket that we fitted to the ship we sent to Florida. You wrote it down in your check book."

We ought to be past that stage by now. But really, are we, altogether?

And we ought to be past the practice of the foreman shouting: "Hey, Bill, those blankety-blank engineers must expect me to bolt these pieces together without any bolt holes, as there are none on the drawing, and it can't be welded. Put in four of them about so far apart. No— better make it six."

"And, say, Bill— make me up a spacer about so long, to fill in that gap in the fairing that they forgot to cover in the drawing."

The time of such things as these ought to be past, but ask yourself, "Do they still happen here?" I'll not embarrass you to answer out loud; it really would be embarrassing to many of us.

And how many people along the line in your organization are daily "getting away" with making changes that are not officially approved, and these tools and parts bootleg-made and assembled without any official approval whatever in maybe the last 500 ships and planned to continue so in the future. Meantime the 500 parts already made officially and still continuing to be made out of scarce, critical material will have to be scrapped? You say these things can't happen in your plant? Unless you are the very rare exception, I'll wager dollars to doughnuts that similar things are going on day by day.

And we happen in on Sam saying, "Sure, I made those parts with the bootleg tools Pete made for me— made parts for the 400 ships already flying and am putting through 200 more now. Part number? Hell, no! Tool order? Not yet. I asked for it three months ago, but we can't wait till the war is over. The ships have got to fly, haven't they? Why wait on the tool designers to get legal tools till the whole fleet of these ships have bombed Tokyo? Pete'll make the tools for me in a few hours— and they fly. Months for tool design and orders. Can't wait for them. We've got to 'Keep 'em flying'."

Are there many Sams and Petes? You can bet your life there are. And with your help and your streamlining effort, starting back in engineering and tool design, these boys will double and triple your output. You don't believe it? It's being done, right along. So get going!

It is time to put teeth in our production control and get these things done, and pronto, under definite authorization. "But," somebody says, "you can't do that here, this is the airplane industry, it's different." Oh, yeah?

Do you really know how many parts or subassemblies it takes to make a ship, and what parts they were yesterday, and how many more there will be

tonight? And how many are being made that you don't know about? And are the changes down to yesterday put into effect before changes of those changes are called for?

How many hundreds of thousands, yes, millions, of dollars are these changes costing us as taxpayers for Uncle Sam?

Some of these changes are of course really necessary, but many of them may not be so really critical that they have to scrap a lot of parts already built out of scarce material, or be rushed into planes already built and ready to fly except for this change.

What can we do to reduce the volume of these changes, for they keep coming, even on stable models? Something must be done if we are to step up production as needed by our boys across the Pacific. Some plants are tackling the problem of reducing and controlling the number of these changes, and it is high time all of us accepted it as a major problem.

In 1911, when Judge Brandeis was trying the Railroad Freight Rate Case, scientific management was brought forcibly to the public attention by the testimony that the railroads could save a million dollars a day by applying scientific management to their shops and roads.

With much greater production going on today, I am confident that many million dollars a day of the taxpayers' money could be saved all over the country if more plants would get back to the first principles of scientific management and control, that we have come to understand, respect, appreciate, and follow more and more through the years, as the outstanding contribution of Frederick W. Taylor toward the betterment of our national industry.

But in our zeal to correct wrong practices and improve our plant conditions let us be on guard against "falling for" the tempting "industrial patent medicines" and alluring "short cuts" that may prove profitable only to their sponsors, and we then would be only part way to the goal that we could have reached in even less time had we laid more solid foundations and soundly prepared (and speedily) for the ultimately more substantial and faster progress.

In production control, we recognize that there is a definite program to follow, if we want to get maximum results in both time and accomplishment. But I warn you, don't start the other steps till the first is done and done right. As we say at Consolidated, "Nothing short of right is right."

1. Set up a production planning group of the best-trained foremen or assistant foremen, as a group of top men, and not much less for the rest of the staff. Put the best brains in the plant on planning the operations, tools, and proper flow of work through the plant. Study and put down for each part the material, operations, and tools required, the capacity and kind of machines to be

used for each operation in their right sequence, and at the same time start setting up your inspection standards.

2. Put the best tool men you have onto tool planning and tool design and tool making and then see to it that in your tool control, you schedule and follow up the making of the tools on time.

3. And then see to it that you take this operation planning and, with only a few motions, turn it into shop orders, with travelers, job cards, and material requisitions all ready to send into the shop departments.

4. Then provide a setup for dispatching or assigning these jobs to the right workers and right machines (as specified by the planners) at the right times and with full machine time utilized, but not by stock chasers. They should have no, or very little, place in the industrial picture. Direct the work, don't chase the shortages. You'll have few shortages if you properly plan and direct the flow.

See that this dispatching setup provides not only that the parts are started at the right time, but have been made right and inspected according to specific standards, and then moved with the necessary tooling, to the machine of the next operation, before the operator at that machine finishes the other job he is on.

5. Provide a comprehensive graphic control facility from which you or any of your top executives can recognize at a glance just how you stand to date on the comparative production of all parts and assemblies, materials and tools with provisions for these indications being constantly studied and steps taken to strengthen weak or lagging spots and bring the whole picture up to the desired progress. By this means unfavorable trends can, in most instances, be converted into favorable directions before they become critical.

Again let me warn you, not only should you not attempt to take the succeeding steps until the first, that of thorough authentic planning, is well in hand, but it is of even greater importance that your top production executives do not personally and independently decide detail practice and continue giving personal instructions in the former way, direct to foremen or other department heads, as to where or when or how many parts should be made, or equipment rearranged, or departments assigned, or leeway granted for the exercising of varying individual discretion.

Plants cannot be run on two opposite principles at the same time. So in order to provide maximum accomplishment from the co-ordinated industrial machine, the chief production executives must see to it that after this production planning and control activity has been set up, that absolutely all plans and instructions pass through this channel as the executive's main operating tool for speedy and well-correlated accomplishment. These working-management tools have been provided, so let all concerned use them and not permit by-passing or the continued whittling out of the results in the old, hard, rule-of-thumb way by someone "on his own" and out of tune with the new setup.

In June 1928, this Society, or as it was then called,

"The Taylor Society," held an all-day conference in Detroit similar to this one today, on the theme of "Production Control and Time Study." In one of the round-table discussions I said:

"Before we even approach the setting of tasks, we must study the equipment in a given department and analyze the machine arrangement. Many a straight line flow of product is possible today where arrangement of classes of machine tools was formerly used. In many cases, departmentalization of divisions of product can be used more advantageously than the previous departmentalization by classes of machine tools. Conveyors and other mechanical devices for handling the work from one operation to another can be very frequently adopted to advantage, both to reduce the cost of handling and to speed up the flow of the product toward and through its final operations."

Yet, even today, many of the departments of our rapidly expanding war production plants cling to the old, out-moded, and time-wasting arrangement of their equipment.

I also stated at that time: "Analysis and standardization of the speeds and feeds on the machine tools in a department very often yield a tremendous increase in the output, and also make possible greater flexibility of manufacture."

I also said: "Probably everyone here takes standardized tools for granted, but there are still many managers, superintendents, and foremen who hedge when it comes to adopting standard tools for given operations. If we are to get results in these days of severe competition, no manager can afford to let the operator decide what kind of a tool, the particular cutting edge, or the heat treatment that is to be used on a job, as the majority of even skilled operators do not have the data available to determine, or facilities to provide the most advantageous tool conditioning.

"It is necessary that we make very searching studies of tool requirements and, on the basis of these, adopt standard shapes, clearances, cutting angles, heat treatments, etc., for our cutting tools. We must also make proper provision for the inspection, maintenance, sharpening, and conditioning of these tools in a central tool room well in advance of being issued to the operators. This also develops the advantage of adequate provision for tool storage facilities and provision for rapidly checking tools out of and back into the central tool storage without taking the time of the operator."

Yet, even today, in many of our war production plants, the lack of recognition of the serious handicap of tools left haphazard all around the department is amazing. Many instances have shown up of men spending hours, in some plants, having to go from department to department to locate the tools needed. It is even more true now than when I said in 1928:

"It is useless for us to take time studies and set tasks if, when we need an operation done, either the operator, the material, the tools, or the machine are not available or in proper condition for such a job. Therefore, while the preliminary standardization of machine equipment, tools, and operations is going on, it is extremely important that analysis be made of the control of production and that proper provision be also made for the graphic control of all work going through the department. This calls for the detail planning of all work well in advance and for the advance assignment of jobs to workers and machines, with provision to insure absolutely that tools and materials will be at work stations at the required time, in readiness for the work to be done.

"This makes possible standard and uniform conditions, so that when tasks are set from the time studies that follow standardization, the times allowed will not include superfluous time which should not be part of the producing job, and will force the proper preparation of tools, materials, machines, etc., on all these jobs continuously. One of the most salutary effects of time study, with its preceding standardization, is that it forces management to continually do its part in adequately serving the worker, by providing the proper conditions surrounding the actual producing job.

"There are many incidental gains from this study of production conditions and the institution of proper methods of production control. In one case we found in a department confined to the making of a single part in three sizes, each size having about fifty or sixty operations, that the average number of working days taken for the lots to pass through the department was 152, while actual processing occurred on only 38 days; 114 days, or 75 per cent of the total time in the department, was idle time between operations. Needless to say, the inauguration of proper graphic production control not only provided standard conditions, so that the workers were enabled to do the jobs in less time at higher wages, but also eliminated practically all of this uncalled for 'standstill' time.

"One of the things to study and standardize before taking time studies is the proper type of operators for the different jobs to be done. Where no classifications of operations and workers have been made, it has been found that there is an amazing number of misfits in the work in a department—square pegs forced into round holes. Oftentimes the work that a nimble-fingered girl can do to the best advantage is left to a boy or man, who is better fitted for heavier work. I have found that very fine work, perhaps requiring a magnifying eyeglass is often assigned to a worker whose eyesight is not as good as it should be, or who is not adept or careful with very fine work or small delicate tools. Therefore, one of the early studies should be of the abilities and limitations of the workers within a department, and of the minute requirements demanded of the workers for the various operations done in that department."

We in the airplane industry in southern California

are inclined to think that we have done a pretty good job in setting up a standard job analysis and job evaluation plan.

But in just how many plants do they make a really serious and definitely prepared attempt to actually assign the work to the workers that they are best fitted for and have any means to make fairly sure that the same operation will be put on that part and operation when it comes around again?

That's all part of good production control.

Are we not just a little bit inclined to let the very large number of individual parts entering into our complete product blind us to doing the right thing in the making of each of those parts?

Each of those individual parts are vitally necessary to the final functioning of the ship or truck or tank or gun, and we certainly should not, merely because we have lots of parts, cut down the staff for handling it to less men per part than we used when we built a simpler product. It could even be economically wise to say that the larger number of parts and assemblies and the more complicated product justifies considerably larger number of indirect employees per part, properly employed to direct and police the producing activities. So let's not set up any really false, inadequate standards or limitations to getting the job done right and fast and under close control.

"In one case recently studied, we found that on thirty lots of the same part put through a given operation, twenty different workers had been assigned to the operation, while only five workers were particularly adapted by experience and aptness to the performance of this operation. Following the classification of workers and operations and the time study of the job, a limitation of the work to these five workers, and in a majority of the lots to but three of the workers, resulted in each of these becoming much more expert.

"We must be sure that the operator has a detailed instruction sheet showing him (graphically where possible) just how the operation must be performed, and then we must have the machinery in operation to insure that we are actually getting the work done as specified. This involves not only a proper inspection of the work after the operation is done, but an adequate 'preventive inspection' and check-up of the operation when it is started, and while it is in process in some cases."

Practically all of these admonitions given in 1928 are of equal importance today and we should make our plans for putting as many of these factors into our production control picture as possible, with other factors covered later as initial progress is made.

Big program, you say? Sure it is, but evade it or camouflage it as you may, in every plant

the program is there, and somebody along down the line is either effectively or haphazardly making some kind of attempt to do each one of these things, so it's no bigger than you already have at hand. Let's face the music. Let's relieve the foreman and ultimate worker at the end of the line from having to worry out an answer to these things every time those

parts go through the shop. Let's make the setup that permits the best thought and experience to concentrate on each case and get the best answer down in black and white so each time it comes up it can be handled with speed, accuracy, and uniformity in the one best way. Let's simply do it right. "Nothing short of right is right."

RETOOLING FOR WAR WORK

THOMAS W. KENDALL
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Retooling for war work has often been discouraging in the past year. We have had to cope with the inherent problems of production. We have been deterred by problems of labor shortages, strikes, and slow downs. Our work has been disrupted by public and political lethargy, and we have been delayed by material shortages and design changes.

It is with relief that the tool engineers now find all problems relating to labor and peacetime lethargy removed. We are preparing for an intensification of material shortages and design changes. We can expect that a system of allocation will replace the priorities setup, and that this will handle the material problem as expeditiously as possible.

The importance of tools for doing work has been recognized from the earliest times, and the maker of tools or weapons has always been honored. The American pioneers were known as the greatest wielders of the axe the world has ever known. Going back to more ancient times, there is a story known as "The Legend of King Solomon and the Iron Worker" which gives delightful emphasis to the importance of tools.

Tools have had such an overpowering effect upon the lives of the working people that few factors in the development of modern civilization equal them in importance.

There are three major classifications in war production tooling. First, mass production in large quantities of 100,000 or more units. The second, moderate quantities from 5,000 to 100,000 units. Third, the low-production quantities of 10 to 5,000 units.

The first, mass production, where the large quantities are involved, the tooling problems, although complex and intricate, are not difficult. Mass-production tooling approaches automatic production with very little labor involved and very few parts handled by hand. This production is standardized to a point where tooling is no major problem, and once the tooling is set up it is seldom changed.

The second, production of moderate quantities from 5,000 to 100,000 units, presents a more complicated problem. Tooling costs are quite limited and production of these quantities means constant changes in machine setup, and the tooling cycle is much shorter.

Third, low production such as we have in aircraft industries where from 10 to 5,000 units are made on one production run, tooling is very complicated. Here, because of the urgency of getting into production, the tooling program is started long before the design has been accepted or has been crystallized. This means that the first few ships have to be tooled for with the

thought in mind that many changes will be made on the actual production line. A good illustration of this is on one airplane on which eleven thousand machine parts had to be tooled, and by the time this plane was in full production, thirty-four thousand changes had been made. They say, when they flew the first production model, they chased it down the runway with a change notice and that three more changes were waiting when it landed.

There are two approaches to this problem: First, is to make all temporary tools for building the first twenty ships. This means that there will be two tooling programs, one for the experimental group and another for the production group. The other approach is to build production tools for the total production run when the plane is in the development stage. This has been done in several cases, for the assumption has been made that these tools which had to be discarded and replaced cost less than the temporary experimental tools which were made for a run of from one to twenty airplanes, and production was accomplished more rapidly.

Tooling is affected by design through standardization of parts and through the application of tolerances. The standards group is being worked out to the point where many parts which were developed especially for one unit are now being used on many units.

In war production, the very rapid pace of development has a very disconcerting effect upon tooling programs, the mechanized units which were used in the Army and Navy and aircraft industries being a most classical example where production is rarely started before the airplane is obsolete. This means that there is a constant demand for reorganization of tooling, and the job of retooling is never finished.

The greatest need for retooling in our war work is in the low production industries such as tanks, airplanes, and shipbuilding. These industries have been constantly changing design and, therefore, constantly changing tools; whereas, on the other hand, munitions production, once it is started, has been very little more than the maintenance of the tools. A good example is the production of thirty- and fifty-caliber shells by the Salt Lake Arsenal, where the tooling has been crystallized, the design is fixed, and further development is unlikely. In such an industry, the tooling consists more of special machine tools rather than jigs and fixtures and special dies. In this arsenal, the part is not touched by hand from its start on the assembly line until it is packed for shipment. This program was developed over a period of nine months and the production is now in the millions per day. Compare this to the tank-building and shipbuilding industries, where each unit as it comes off the assembly line is different from the one that went before.

Since the immediate war-production requirements

are being stepped up, the demand for additional sources for tooling is very great. The small-arms-ammunition industry requires additional sources for perishable tools. More manufacturers and contract tool and die shops whose facilities are qualified for making precision tools in production quantities, small or large, are urgently needed in all defense industries. Here in southern California we find it difficult to obtain tool-fabricating sources which can deliver tools for production in a reasonable length of time. Most tool and die shops are loaded up for a period of six to eight months in advance and most small companies find it impossible to have tools built on short notice at any cost.

Outside production facilities for special aircraft tooling, such as inexpensive blank, pierce, and form dies, are practically nonexistent. The same is true for special shipbuilding tools where the production quantities are relatively low, and inexpensive tools are required.

The problems of a small manufacturer in tooling for war work are many. The first is a social problem of keeping the companies going during the transition period to defense work and the social necessity of the large corporations subcontracting work out to small manufacturers, even though they could do the work more efficiently and at less cost themselves.

Many small companies are faced with the problem of analyzing their production and tooling facilities to decide which type of work is most suited to their business. The major sources in the Southwest are aircraft, shipbuilding, and munitions. These three subcontract the majority of the work which small companies are now doing. Special training programs are being given for the benefit of the personnel of these small companies to help them adapt themselves in retooling for defense work. Manufacturers should use their heads and wherever required use old machines for war-production work. The use of special jigs and fixtures can make an old, worn-out machine do precision work. A good example of this is in drilling where a hardened bushing is frequently used in a drill jig to guide the drill and to hold in accurately in relation to the part.

Material shortages are really giving the tool engineers something to think about. A good illustration of what is being done to offset material shortages and to facilitate production is the case of aluminum. In one southern California aircraft company where they have been building an aluminum ship, they are changing over production to eliminate the use of aluminum in the tail assembly and are using laminated wood construction which is lighter and stronger, although not as durable as aluminum. The light wood assembly had to be tooled for and weight had to be added to balance the airplane. A new development is being worked on to develop an all-steel wing which can be fabricated in enormous quantities at very low cost, and with a very small fraction of the man-hours required on an aluminum wing.

War material is a little like a parachute—you can test it in the laboratory as much as you please, but you cannot be sure that a new design will work until it has actually been tested in combat. If the parachute fails to open, if the fabric tears, if the shrouds break, if the diameter is too small, and it falls too fast, then you would not expect to continue production of that design, but would change it immediately upon the basis of experience gained from the failure.

We have had an opportunity to examine some of our ordnance under actual fighting conditions. Tanks, for example, that looked invulnerable on paper, impressive on the testing ground, and invaluable in sham maneuvers, developed defects when placed in actual service. It was found that their high construction made them an easy target, their low guns prevented firing from concealment behind low hills, and, perhaps worst of all, that rivets struck by shell fire had their heads sheared off and went right on through into the tank, acting like shrapnel. Already these faults are being corrected, new designs are lower, guns are higher, and welding is replacing riveting in the assembly of armor plate.

We expect no short cut to remove design changes. In this war there can be no frozen designs. There will be constant changes in retooling for war work. The tooling industry faces the mightiest challenge of its history. They will have to work as they have never worked before, for on their shoulders will rest ultimate victory.

THE INDUSTRIAL SUPERVISOR'S RESPONSIBILITY IN ACCIDENT PREVENTION

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of Man Power in War Industries*

I would first like to spend a few minutes building a background for the presentation of my subject by giving a brief picture of the seriousness of the accident situation in industry in our country today.

Then I would like to discuss the matter of responsibility for the correction of a situation that is indeed serious.

Following that I would like to discuss the part that men like you—supervisors and representatives of industrial management—must play if we are to reduce the toll of disabling and fatal injuries in order to conserve the already low supply of skilled men we so sorely need in the war-materials-production program.

I do not ask you to agree with every specific point I make, but I hope these points will start you thinking on this subject of preventing disabling injuries and that the discussions of the panel members will crystallize some of the points so that you will leave here agreeing at least in the general principles that will be outlined.

Disabling injuries seriously interfere with the production program because they remove skilled workmen from the production line. Even in ordinary times this constitutes a serious economic problem. In these days of crowding every available plant, every machine, and every skilled worker to maximum output, any occurrence that retards production jeopardizes the safety of the nation and may in the end cause more than just an economic loss. Materials, machines, and equipment will place us in a position to win this war. Lack of them leaves us vulnerable.

Skilled men are scarce and it is almost impossible to replace men who have been injured with men of equal skill. The only way that replacements can be secured is to train them, and it cannot be expected that such replacement will equal the efficiency of the older men in any time less than two years. Therefore, it is important and necessary to expend extra effort to conserve our present supply of skilled men.

Many men in industry have no conception of the annual toll of industrial injuries, so let's review what happened in American industry in 1941. That year is probably typical of the last three or four years, and you can rest assured that the experience of 1942, 1943, and the balance of the years that we will be working at rush speed producing war materials and equipment will not be less than the 1941 experience; that is, unless we do something about it in the form of adopting practices, organization, and safeguards to prevent work injuries.

In 1941 about 19,000 Americans were accidentally killed while at their work. Another 92,000 or 93,000

suffered permanent injuries, ranging from permanent total disability to such relatively minor injuries as loss of a finger or a stiffened joint. Over 1,850,000 more were injured to an extent that incapacitated each from his work for more than one day. The average duration of such incapacity was 20 days. The total loss to production of the 1,850,000 temporary total disabilities amounted to 37,000,000 man-days of working time.

That is the picture as it was in 1941. So far in 1942 it is worse than last year. If we keep going at the rate set in the first four months of this year, you can add at least 25 per cent to the figures I have given you and you will have a close approximation of the 1942 figures. In other words, the present rate will result in the loss of 46,000,000 man-days of working time—time that would build a lot of bombers and tanks needed so badly by our armed forces out there in the far-flung battlefields of the world.

One of the greatest needs in our present maximum production program is to keep skilled men working at maximum efficiency each work day. To do this, the accident-prevention methods found so successful in larger industries must be learned and adopted by smaller industries. The National Committee for the Conservation of Man Power in War Industries was organized in 1940 for just that purpose. I am Regional Director of that committee for the eleven Western states. We are meeting with considerable success in bringing to the smaller industries the best accident-prevention methods as practiced by the larger industries.

Some firms, already comparatively large, have grown larger and therefore there is a need for proper training of additional men in such companies to carry on an already-established accident-prevention program. Many companies that were small a year ago have expanded, and supervisors and key men in such concerns, brought up and trained under a small-plant production program which did not usually include a systemized safety program, must now be trained in the proven methods used by larger companies.

The sudden influx of "green" men in industry, and the many cases of changes of occupation and increases in responsibilities, have placed a terrific burden on industry's safety program and the safety engineers guiding it. More "safety committeemen" properly instructed in the fundamentals of accident prevention are needed to supple-

ment the work of the safety engineer, and they must be trained.

It is well at this point to present in brief form major conclusions drawn from industrial safety accomplishment to date. This list is not intended to be complete, but does present lessons of outstanding importance to those who are seeking to continue and expand the effort to prevent occupational injuries. Briefly, these lessons are:

1. As proven by the accomplishment of numerous firms in every major branch of industry, disabling injuries can be reduced to a figure that closely approaches elimination.
2. It is financially profitable to do so.
3. The expenditures required are relatively small.
4. Some degree of hazard is associated with every form of activity; therefore, the highest degree of accident elimination can be achieved only by careful, painstaking attention to safety in every form of activity carried on in any given establishment or undertaking.
5. Accident prevention does not rest upon involved theory or special technical skill. Instead, it depends mainly upon safety-mindedness by management and men. Safety-mindedness may be defined as "The ever active attention to safety in every detail of each day's work."
6. If properly applied, the knowledge and resourcefulness possessed by every industrial organization, large or small, is adequate to bring its safety performance into accord with best practice and keep it there.
7. Any management, regardless of size of the establishment, type of industry or undertaking, or financial condition, can eliminate the majority of its work injuries.
8. Each injury results from the combination of a physical hazard and human error. The correction of either will usually prevent the injury, but top safety performance can be had only by eliminating or reducing every physical hazard to the maximum degree practicable and in addition using every feasible means of controlling all work habits and practices in the interest of safety.

The maintaining of safe working places and the promotion of safe work practices is the responsibility of management. The carrying out of that responsibility in the plant and in the field rests with the supervisors in industry—the superintendent, the foreman, and the leaderman.

Existing laws, rules, and ordinances require in varying degrees that work places, machinery, and equipment be maintained in safe condition; that adequate first-aid facilities be provided; that accidents be reported; and that the employee be compensated when accidentally injured. The burden of responsibility for compliance with these requirements is fixed and defined by law.

The moral obligation of an employer to his employees and to society requires that a reasonably safe working environment be maintained. It likewise demands that consideration be given to the physical and mental fitness of employees to perform safely the tasks to which they are assigned; that adequate training and instruction of employees in safe methods be provided; and that a systematic effort, suited to the individual circumstances and conditions be made to eliminate, minimize, and control the physical and mechanical hazards and the unsafe actions of persons who have produced accidents or are likely to do so.

Dependence must be placed largely on the recognition by management of its moral, rather than its legal, responsibility for preventing accidents; not only because existing legal requirements are limited in scope, but also because it is a most difficult task to be practical and fair in any attempt by law to achieve wholly safe employee working conditions. This is due in part to the fact that the worker himself is often negligent and in part to the complexity and tremendous variations of industrial processes.

The term "management" as I use it applies broadly to the entire managerial and supervisory staff. A foreman or even a "straw boss" is a representative of management, and because he is authorized to direct the work of employees, he is a part of management.

The immediate and proximate causes of industrial accidents are known to lie in two general groups; namely, mechanical or physical and personal. We shall try to show that both causes, physical and personal, are controllable by management.

Control of Physical Conditions

Mechanical or physical causes of accidents include such typical hazards as unguarded or inadequately guarded machines, defective or improper tools and equipment, inadequate exits, defective stairways, inadequate light or ventilation, and inadequate personal safety equipment, such as goggles, respirators, and masks.

These conditions are obviously within the control of management. To begin with, management selects, purchases, installs, and makes use of the equipment. Management is the sole authority in final decisions as to its handling, operation, maintenance, placing, and guarding. The persons who are charged with the task of building safety into mechanical equipment, planning safe and efficient manufacturing processes and procedures, repairing and replacing defective equipment, and otherwise maintaining safe working conditions are directed by management. And

remember, the foreman and "straw boss" are part of management and responsible for carrying out their part of this work.

Control of Employee Activity

Personal causes of accidents are usually considered as unsafe acts of persons, such as oiling machinery while in motion, removing guards from machines, riding suspended loads, driving motor vehicles carelessly, failing to wear protective equipment, and many other personal acts.

I believe another personal act or the lack of a personal action should be considered as a personal cause of accidents; that is, faulty supervision, which would include failure of the supervisor to give adequate or proper instructions; failure to provide personal safety equipment and insist on its use; too much rushing of jobs; and many other items in the industrial work scheme that can be carried out only by personal action.

Management's responsibility for controlling the unsafe acts of employees exists chiefly because these unsafe acts occur in the course of employment that management creates and then directs.

Management selects the men upon whom it depends to carry on its work. Management also selects and trains its supervisors. It may, if it so elects, choose persons who are experienced, capable of and willing to do this work, not only well but also safely. Management may also train and instruct its employees, acquaint them with safe methods, and provide competent supervision.

In following the principles of delegated authority, management, through its representatives in the supervisory staff, may set a safe example, establish standards for safe performance, and issue and enforce safe practice rules.

Safety, I believe, is a by-product of planning for and control of production.

Safety must be more than a stated policy of a company; it must be woven into every operation of the company, the same as cost control and maintenance of pro-

duction schedules and quality of product are inherent if a concern is to remain in business. The control of both the physical and the personal conditions that are vital to good safety performance is well within the power and financial means of any firm that is able to continue in business at all.

Accident prevention is good business, as the cost of accidents is always greater than the cost of prevention.

Many of you men are supervisors in industry. Your job is to help develop and to maintain efficient production methods—to produce the best product possible at the lowest possible cost and in the shortest possible time. Speed in meeting production schedules is the most important responsibility of supervisors today. You cannot maintain your production schedules if your best men, your skilled and experienced men, are disabled. The goal of any safety organization is to help you keep these men on the production line every work day of the year. To do this, we must have the active support and co-operation of every man who supervises workmen. It is not the safety engineer's responsibility to maintain safe working places and to train workmen in safe practices. That is your responsibility. The safety engineer is your adviser. He is a specialist, advising you how you can reduce the chances of accidents that result in disabling injuries to workmen. I do not think you will find him lacking in willingness or ability in helping supervisors to keep men on the job and out of the hospitals. He welcomes the chance to help you, but he needs your active support of his program.

I leave you this parting thought. The most successful executives in industry today—the ones who have had the least of labor troubles—are those who, when they were supervisors, foremen, and leadermen, gave their active support to every company program that improved the lot of the workingman, made his task easier, and made his work safer.

WOMEN IN WAR INDUSTRIES

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The induction of a vast number of women into war industries provides a subject that is as broad as it is long. Throughout the entire world, an increasing share of the burden of war production is being taken over by women.

The present conflict has truly been called a "civilian's war." In view of the mounting total of casualties among noncombatants in active theaters of battle and the prodigious total of those killed or maimed in England, in France, and in other European countries, it is not inaccurate to say that a woman in her kitchen has no greater protection from enemy shell-fire and bombs than have men in the fighting forces.

In the degree to which this fact is realized, women, as a comparatively new source of labor supply, have come forward to share in the effort for victory and a peace worth having.

It is my understanding that English factories have been able to employ women to replace men called into the armed services to the extent of about 50 per cent. Evidently the factory procedures in that country cannot be readily adapted to the capabilities of women workers, for there is every reason to believe that that figure can be exceeded in this country.

It is obvious that the rapidly increasing employment of women in practically all types of war-production jobs is having an important effect upon industry in this country, particularly since such a large percentage of all our industries now is engaged in the war effort.

As to what the producers of ordnance, of tanks, jeeps, explosives, and ships are experiencing in this respect, I am not in a position to say. Nor can I competently evaluate changes being evolved in the production practices of these industries as a result of their employing women shop workers. It appears not improbable, however, that the general trend of these changes throughout America's war industries is reflected in the changes which have evolved at Vultee. With these I am familiar, and it is assumable that most of the contributing conditions in each, such as increased volume and speed of production which we have encountered, obtain likewise in other war industries.

Vultee last month completed its first year of manufacturing experience involving the use of women on direct production jobs. We were the first military aircraft manufacturers in the United States to begin the employment of women in the shop.

We began this program largely as an experiment. Data available from other fields of industry appeared too unrelated to apply specifically to our case.

A survey of the situation was begun, in order that we might block out some rudimentary basis for our

program. There were certain conditions which worked to our advantage.

First among them was the fact that Vultee held the largest unit order for military airplanes ever placed by the War Department with a single concern. Consequently our production system was being broken down to include a large number of routine, repetitive operations.

Because of this job simplification, it was concluded that no pre-employment training would be given the women to be hired. They would be drawn directly from allied lines of industry and be schooled in the routine of their new job by the foremen concerned.

During April of last year, Vultee put to work the first fifty women, using them in the radio and electrical subassembly department. Several were hired on preparatory jobs, such as masking, in the paint shop, and on the sewing of fabric covering for control surfaces and blind-flying hoods.

By May of last year, at the end of the first month of our experience in the hiring of women, our program passed beyond the experimental stage. Women, within that brief time, had proved conclusively that they were capable of handling a large number of the jobs involved in large-scale production of military aircraft.

This fact we learned substantially in advance of the appeal made by Sidney Hillman (then co-director of the OPM), that defense plants make an effort to employ resident women, in preference to attracting men from distant localities, with consequent uprooting of entire families and their influx to crowded defense-production areas. The advantage, in terms of a more stable personnel to be obtained from following such a policy, already was becoming apparent from our experience. Our personnel turnover among women is extremely low.

Several hundred additional women have been added to the payroll in the ensuing months—many problems have arisen, satisfactory solutions to which have been incorporated in our personnel policies.

With this in view, and on the basis of a recently completed survey, we have concluded that the present total of women employees in the plant can be quadrupled, if need be, and the total number of job classifications for which they are hired can be more than doubled. Considering draft conditions, with an eye to which I may say the program originally was started, the advantage of this is obvious.

Our first problem was with the men. They resented what they considered to be an encroachment of women upon their sphere. They sought to be-

little the notion that women might successfully fill jobs similar to the ones on which they worked. Of further injury to their masculine pride was the fact that Vultee committed itself to the payment of wages in direct relation to the job done—making no distinction in wage scale between men and women.

Here, then, was a situation in which men found themselves working shoulder to shoulder with women, on similar jobs and receiving similar pay. Since there was little else they could do about it, the men awoke to the realization that the only way out was "up." For the most part, they began to train themselves for better jobs.

This reaction fitted admirably into the company's program of expansion. It was never Vultee's plan to replace men with women, but rather to employ women in order that available men could be released to fill jobs requiring greater capacity.

Spurring the men on to fulfill this expectation was the fact that the first few score of women employed began to do an excellent job. Almost immediately, they exhibited an adeptness for their new tasks. They knew, of course, that they were on trial and the desire to "make good" heightened their efforts.

They became what might be termed "model employees." Their morale was excellent—they did not abuse privileges given them; there was no congregating in the restrooms; no smoking in forbidden areas.

The radio and electrical subassembly department in particular had been a continuous problem as long as men were employed there exclusively. Most of the tasks involved routine repetitive operations. Men quickly learned them, and, as quickly, became dissatisfied. They wanted more money than the job was worth. Failing to get it, they demanded transfers to other departments. Specifically, they lost interest in their work.

An instance of induced physical fatigue, resulting from such loss of interest, may be worth citing. One of the men in electrical subassembly had been using an air-driven wrench. He began to complain that the wrench was too heavy. Lifting and handling it all day was overtaxing his arm muscles. In so far as could be determined, he was sincere in his complaints, which became incessant. When a woman was assigned to his job and he was transferred to another, the foreman frequently took occasion to ask her if she could handle it—was it too much for her? She, on the other hand, was equally sincere in saying that she never gave a thought to the physical effort involved. Her interest was centered in proving her competence on the new job.

Such experiences as that focused attention on the fact that men, of a type worthy of retention on the payroll, naturally lost interest in their simplified jobs almost as quickly as the routine involved was mastered. Their dissatisfaction was merely an expression of unemployed capacity.

Since the company was pursuing a course of rapid expansion, opportunities for advancement to better positions were seldom lacking. By reason of this, our problem with the men practically solved itself.

Meanwhile, women were being inducted into the plant in increasing numbers. They were put to work in the machine shop, doing filing and burring. Then they were tried and found competent in the operation of drill presses, and on mills, hand-turret lathes, and similar tools.

But, within the first three months, women began to take advantage of the situation. Their number had increased considerably and they realized the trial period was over.

They began to carry to an extreme the tendency of some of the men who had not recovered an interest in the job. The women began congregating in the rest rooms, or loitering there to chat awhile.

Up to that time, only foremen had been given the right to correct deficiencies in the women's conduct, and they had had very little trouble in doing it. But this situation was a "poser."

Obviously, the foremen could not enter the women's rest room. The situation became a bit delicate. A woman needed only to imply that her absence from the job was necessary and her foreman could do little about it, even though he had reason to believe she had deliberately abused the privileges reserved to her.

To meet this problem, our first matron was employed. She solved it in rather quick order, by entering the rest room and catching the girls there smoking or loitering to talk.

It was not difficult to make them realize that their abuse of privileges placed their jobs in jeopardy. And they wanted to keep those jobs. At that time, there was no other company to whom they might apply for similar employment. Nor could they return to former jobs in allied industries without accepting wages that, on the average, amounted to about 30 per cent less than they were getting at Vultee.

The situation was cleared up quickly, but it brought repercussions. The matron was a little tactless in her handling of the problem. We had been a little careless and lacking in forethought when selecting her.

As a first step, special rules pertaining to women were adopted. These rules now comprise a special section of the company's rule book. Care is taken to explain them to each new woman employee on the day she goes to work. A copy of the rule book, of course, is given her, so that she may refer to it as occasion arises.

As a second step, two new matrons were brought in to replace the first. Care was taken this time to select matrons who were mature, womanly women, capable of commanding respect, but tactful, considerate, and able to win their point by persuasion rather than by threats.

It was unnecessary to terminate any of the women involved in the foregoing incident, so readily did the presence of the two new matrons

dissipate the aftermath of resentment against their predecessor.

Other than in dealing with infringements of these special regulations, the matrons have no supervisory authority. Each reports directly to the assistant superintendent of the departments assigned to her. And each, by her tactful enforcement of these regulations, has assisted the foremen in responsibilities naturally difficult for them to handle.

For instance, foremen make an awkward job of it when they have to tell a woman employee that the sweater she is wearing is far too tight. Nor is it easy for them to instruct a girl not to use extreme makeup.

In carrying out dress regulations, it is far more satisfactory for the foreman to call infringements to the attention of the matron and let her take care of the matter for him.

Reversing the picture, women employees dislike having to ask their foreman for special consideration on account of their occasionally acute periodical condition in order to secure his permission to visit the plant hospital. Yet no employee is permitted to see the company doctor without a special pass. Women are not reluctant, however, to place their request with the matron, who can obtain a pass from the foreman for them.

In fact, these new matrons have so won the confidence of women employees that the latter voluntarily discuss matters with them that they would not otherwise have acceptable means of bringing to the attention of supervision.

These results, in turn, went far to modify an attitude toward women workers that had been apparent on the part of many of our foremen. Relieved of the irksome phases of their supervision of women, they were free to recognize more clearly the ability of their feminine employees. They found in these women, newly inducted into the military aircraft industry, a high degree of pride in being found competent on the job.

While foremen still look upon a woman with a hammer in her hand with some indulgence, they unhesitatingly rely upon women to do their work exactly according to instructions. The foremen realize that it is largely a lack of direct mechanical experience from childhood upward that prevents women from handling certain jobs with a facility equal to men.

But they recognize, too, that this very handicap makes women more painstaking in their efforts to fulfill the requirements of their job with absolute accuracy. Because the women themselves recognize their shortcomings, they exhibit less tendency to pass over minor errors in their work.

As an instance, they may be more completely relied upon than men to replace a rivet improperly headed.

By reason of the reliance they are able to place in their women employees, the foremen are inclined to minimize in their own mind the added burden of having to deal more tactfully with women than with men.

Otherwise we might have greater objection from the foreman when a woman takes "time out for tears" because she has been transferred to another job.

It is necessary in such instances we find, to explain carefully to the woman that such transfer does not indicate incompetence on her part. It appears to be their tendency to feel when they are placed on another job that they were not fulfilling expectations on the previous one.

Other special considerations made in behalf of women include only minor changes in the usual procedure for induction of new employees.

The same application form is used, the same interviewers consider the applicants' qualifications and their required character references and letters of recommendations from previous employers. Both men and women are subjected to the same routine of fingerprinting and gathering of identification data. But separate rooms for physical examinations have been welcomed as an added facility.

When the special dress regulations are explained to new women employees, recommendation is made that they wear the standard uniform, obtainable at the employees' store.

There is a point worth noting here, however; the first uniform adopted comprised slacks and blouse of a pattern that apparently imposed some restriction on their freedom of bodily movement. Women, normally accustomed to wearing dresses, dislike any apparel that binds or hampers them in unaccustomed ways. Furthermore, they will not like the uniform if the color does not do justice to their appearance. Nor do they like it if it makes them conspicuous should they need to do a bit of shopping on the way home from work. Women dislike being made to feel conspicuous.

If company insignia is sewed to the uniform, and is of such size and in such a position that it cannot be easily covered by a coat or jacket, or if the material and color of the slacks are such that they are readily distinguishable as being other than acceptable street wear, the majority of women will refuse to wear them because of the resulting occasions on which they are made to feel conspicuous.

Furthermore, a one-piece uniform appears to be more acceptable than the two-piece variety.

Should it fall to your lot to attempt the task of persuading women employees of your plant to wear a standard uniform, these points may be borne in mind with profit when selecting it.

To return again to the point from which I digressed—that of inducting new employees—both men and women are taken in charge by the Employee Service Supervisor, who explains the company policies and other items contained in the rule book.

Thereafter, the women are introduced to the

Note: The foremen

matron of the department in which they will work, while the men continue on a tour of the plant conducted by the Service Supervisor.

The matron explains further the special regulations applying to women.

When the foregoing provisions have been explained and discussed with new women employees by the matron, the latter conducts them to their various departments, acquaints them with the location of rest rooms and first-aid units, then introduces them to their foreman.

Experience has shown it is preferable not to parade new women employees through the plant in groups on a conducted tour.

While the need for making these provisions in behalf of women was being learned, experimental data on their performance on the job was being gathered and compiled. It has led us to rather definite and far-reaching conclusions.

To begin with, factory jobs for women must be tailored to women.

By reason of general usage, the tools and facilities of American factory jobs largely are designed to be handled by men.

It definitely was in Vultee's favor that the hiring of women was started when production jobs were being simplified to meet the needs of fast, quantity production. Consequently it was a comparatively simple problem to so plan many of the jobs that they can be said to be tailor-made for women.

Throughout the electrical subassembly department, most operations are arranged so that women may sit at their work, with all materials and tools close at hand.

Special jigs were added to hold small tools, such as drills, so that women could concentrate on employing more effectively their proven capacity for repetitive operations requiring high digital dexterity. They excel at making every movement of the hands count.

While I cited earlier an incident in which one of the women failed to feel fatigued from having continuously to lift an air-operated wrench, the actual lifting and handling of it obviously detracted from her potential efficiency.

Unlike the man whom she replaced, she, as a woman, had the capacity to withstand the monotony of even more simplified repetitive operations.

To have suspended the air wrench from a counterbalanced support for him would have served merely to heighten his boredom with the job.

As for the woman who replaced him, she now handles two such counterbalanced, air-driven wrenches, one in each hand, and with them simultaneously tightens two lugs at the same time, instead of one as formerly.

This retailoring of jobs to suit them for women has extended amazingly the list of job classifications in which women have proved themselves proficient. But the extent to which it could be carried struck definite limitations when it was sought to segregate women

into sections of the plant separate from those in which men were required.

In so far as was possible, that effort was carried out. But efficient warplane production, by a streamlined flow from raw stock to fly away, without backtracking does not permit such an idea to be carried very far. Many of the jobs for which women are admirably suited must be carried out by them shoulder to shoulder with men.

It was essential, therefore, from the outset, that men and women be treated with equality.

With but the few exceptions mentioned (and those desirable to best efficiency of both), this policy has been carried out explicitly. Results have been most encouraging. Having proved their ability to hold their jobs, being paid on the same wage scale and treated the same as men, women began to react to their own competence. They gradually began to accept an equal share in plant activities.

Cardinal virtue among the latter is their participation in the Vultee employee's suggestion plan. Ideas submitted by women for improvement of products and manufacturing procedures have increased measurably of late. None of their ideas has been rejected by the Suggestion Plan Committee because it was found impractical.

Of high interest is the fact that many of the women's suggestions are found to parallel developments already being undertaken by the production engineering department. In other words, Vultee's women employees have gained such a grasp of their new situation that they already can view their jobs in perspective—recognize wherein procedures fall short, from their standpoint—and suggest improvements that are practical.

Women's suggestions repeatedly have led to their own increased efficiency. They have applied their knack for contriving ways of doing things more quickly and with less effort. One has designed a new type of rack on which light parts are conveyed from subassembly to the paint shop and supported during paint spraying operations. Another developed a means of sewing tall wheel boots that saves valuable material and time. Yet another drew upon her previous industrial experience in a bottling works to suggest the use of a glue-spreading machine to replace the former method of applying adhesive with a brush. By doing so, she multiplied her own production three times. A woman employee in the paint shop developed a means of masking which saves masking tape and can be used more quickly.

While this newly acquired self-confidence was beginning to find expression, another factor, which favorably affected it, was being felt noticeably. From the time last year when announcement was made that Vultee would begin hiring women on direct production jobs, a considerable amount of

publicity has appeared. As we progressed through each stage of our program, newspapers, magazines, the radio, and newsreels have kept pace with our progress.

To those of you who may from time to time have been exposed to some of it, it is obvious that much consideration was being given to the selection of rather a high type of woman shop employee at Vultee. For instance, the percentage of women now working in the plant who are married is 46.57. Of the large number with dependents, 67.80 per cent support children; 27.29 per cent are single and 14.42 per cent are divorced. Only 7.66 per cent of the factory women are separated and 4.66 per cent are widowed.

Preference is given to women applicants of 22 years of age or more. There is no top limit of age. At present the oldest among them is 59. As to the average educational background of Vultee shop women, 46.06 per cent have completed 4 years of high school. This includes the three who have a college degree. One and forty-three hundredths per cent failed to complete more than eight years of school.

From this it may be seen that Vultee's feminine plant personnel compares very well with the working section of the feminine populace of a good, sound American community.

These facts about Vultee women employees, when widely broadcast and further related conversationally among friends, attracted a continuously ample number of women applicants of similarly high caliber. From these we were able to make selections with even greater care.

Meanwhile, data gathered on their performance on the job of women who had been selected principally on the basis of their previous industrial experience led us to question whether or not we might profitably abandon that tack in many instances.

In the few cases tried, our experience shows that women with good background, who exhibit a high aptitude, can be put directly on the job and quickly trained with better results than could be obtained if they were selected solely on the basis of their previous experience in allied fields.

In the first place, such applicants do not have to unlearn certain attitudes and habits of work and they are far more apt to express enthusiasm and initiative on the job.

If we could find a dependable means of selecting by aptitude simplified jobs in subassembly, along the powered monorail final-assembly conveyor line, and in receiving, inspection could be filled by women from unallied fields of industry as contrasted to the need for training and experience for such jobs as welding and machine shop.

Mechanical aptitude tests, Johnson-O'Connor Pin Block, Stenquist Mechanical Aptitude Test, and the Minnesota Manual Manipulation Test were tried. Foremen of the various departments selected the 10 women they considered to be of top-flight efficiency, and likewise the 10 whom they rated (to use their own language), as "hanging on the ropes," in so far as their contin-

ued employment at Vultee was concerned. Two representatives of the U.S. Employment Office put the 20 women, in mixed order, through the tests. Results coincided with the foremen's judgment with but one exception, and that case, when traced down, was the exception which proved the accuracy of the tests. She was a new employee, having been inducted but a day or so prior to the time her foreman rated her in the inferior group. During the two weeks which had elapsed between then and our checking into the matter, she had oriented herself in her new situation and already was employed in one of the highest-skilled jobs in her department.

Since almost all initial interviews now are conducted at the office of the U.S. Employment Service for all aircraft factories of the Los Angeles area, I understand that office is now preparing to make regular use of these aptitude tests on all applicants intended for reference to Vultee.

The question most frequently asked by visitors at Vultee— one which, frankly, gave us some worry at the outset of this program of hiring women— is beginning to find its answer in the results of our present trend toward evaluating the applicant herself, rather than entirely by her experience.

Everyone seemed certain that we would have a moral problem on our hands if we worked women and men shoulder to shoulder in the plant. We were not entirely unconvinced ourselves.

Of greater worry to us was the probability that this condition might result in frequent transferring of an employee's concentration on work to his or her fellow employee. I am happy to state that, since the very early stages of the women's hiring program, we have encountered no more difficulties of this sort in any of the shop departments than among office employees. Emphasis on evaluation of the character and background of new employees has raised us above that pitfall.

I have stated that it was never the intention at Vultee actually to replace men with women. Instead, it was our dual objective to release them from the doldrums that resulted from job simplification and to make better use of the capacities of those among them whom the draft did not take.

Conversely, only men are used for supervision at Vultee. This too has proven definitely advantageous. Women resent taking orders from men, but readily accept direction from men competent to supervise them. Under this condition they accept supervision more readily than men.

This fact is borne out by our experience with them in defense training classes. A substantial number of our feminine personnel regularly at-

tend these classes. They learn more slowly than men, because they learn meticulously. They ask interminable questions and practically exhaust the possibilities of each step taught them.

In this they express decidedly less tendency than men to skim over details as a result of hasty evaluation of themselves as being basically superior to their instructor.

Men are prone to take this attitude in spite of the fact that must be obvious even to them that they are not yet as well trained in the subject being studied.

To sum up, employment of women at Vultee functions now, on the basis of a year's experience, with recognition of the following points which make for its definite success:

Factory jobs have been tailored to women's natural proclivities, enabling them to employ the high digital dexterity in handling repetitive operations in which they excel, and to express the same efficiency as they do in their own fields.

Secondly, equality of treatment and remuneration on the same scale as men has won from women at Vultee a favorable reaction to their own competence. This, in turn, spurs their initiative. Results are expressed in terms of suggested manufacturing improvements, that already have been cited.

Furthermore, those among them who have membership in the unions represented at Vultee share in the activities of those organizations. In view of Vultee's policy of paying women equally with men on the basis of the job done, unions readily accepted the Company's program for hiring women. And Union Grievance Committees now include women representatives.

Thirdly, taking pains to evaluate the individual in terms of her basic character, coupled with an analysis of her mechanical aptitude, has gone far to set a favorable pattern of shop conduct. Furthermore, it has resulted in a heightened morale and efficiency among both men and women. We have former lingerie salesgirls, school teachers, dress models, housewives, show girls, business-school-graduated girls turned shop workers, novices, and those with previous related industrial experience working together in the plant with men of as many dissimilar backgrounds.

Their tacit acceptance of each other is based on individual competence on the job, but, beyond that, the upgrading of the plant personnel, effected by careful selection of applicants from the standpoint of character, has developed pride among employees in being recognized as Vultee workers.

Finally, exclusive employment of men in supervisory capacity actually has eased the friction usual between those who give and those who take orders.

A condition frequently encountered at Vultee, which would have been wholly astounding a brief twelve months ago, leads me to believe that a trend is building up that may reach unforeseeable proportions.

A substantial number of women, now lucratively employed as private secretaries elsewhere, have applied for shop jobs at Vultee. In fact, many members

of our own office force have made known their willingness to transfer to direct production jobs.

While a part of this tendency is accounted for by existence of war conditions and a prevalent patriotic desire to take a more direct part in the effort for victory, there undoubtedly is a further factor involved.

Some light is thrown upon this by the advancement achieved by certain of our women employees, from mediocre shop jobs to increasingly higher brackets involved in direct war-plane production.

As an instance, a girl of 23, with college background and considerable initiative, has advanced from paint-shop helper through successive steps to her present position as process planner in the tooling department.

Another woman is successfully holding down a job as a manufacturing planner. Yet another woman, whose background is quite unusual, has advanced from the comparatively simple, routine job of magnetic inspection to a position in the production department.

Women definitely are coming into their own in the handling of direct production jobs. Those whose natural aptitude was less suited for the types of jobs formerly open to women now are finding opportunity to prove their latent ability. It reasonably may be concluded from this that a full new field of endeavor is being opened for women as a result of wartime necessity, and that women are proving themselves capable of meeting its requirements. Such opportunities have not heretofore existed.

Perhaps this very lack of opportunity caused a rejection on the part of women—somewhat in the manner of a psychological defense mechanism—of the notion of an industrial-production career for themselves. Now, however, with the pressure of the war emergency popularizing the notion of war jobs for women, a directly opposite trend has developed. The shop girl no longer is looked down upon socially as one who cannot find a better means of earning her livelihood. Existing wages in the aircraft industry, perhaps, have had considerable effect upon this change of attitude, but beyond that, the ability to hold down a job in direct production is gaining an equal importance in women's scale of values with that accorded it by men. Once fully established, it is probable that this trend will continue beyond the war effort.

As women in direct production gain competence and skill through experience, it appears probable that they may offset the disadvantage inherent in such relationship and we shall find them in supervisory positions in the factory. Therein, they will be accepted equally with men on the basis of their individual competence.

In other fields, such as communications, women for some time past have been included in supervision. Pressure of the present emergency may do much to hasten their acceptance in such capacity throughout the war industries. Admittedly, this

looks toward a reversal of the present policy at Vultee of employing only men in supervision.

There are three salient factors involved. One is the pressure of war emergency. The second will be the number of years of experience it will take for women to acquire competence equal to that of men now in supervision, who have spent their entire working lives in direct production, and their ability to meet peculiarities of the problem that will exist when women are given foremanship over women.

A third modifier, and an important one, will be

the degree of job simplification that will develop from industry's increasing mass-production efforts.

If I am right in assuming that the effect of women being inducted in large numbers into war industries is reflected by results at Vultee, it seems not unreasonable to point out that development of this new source of war labor supply—by which half, or perhaps more than half, of direct war production may be carried (if that becomes essential to victory)—may culminate, sometime in the future, in an industrial revolution.

Women in industry, I believe, are here to stay.

HOW CAN A FOREMAN MEET THE CHALLENGE OF ALL-OUT DEFENSE PRODUCTION?

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The present national emergency is making unprecedented demands on industry, and the foreman is the key man in production. It is pertinent, therefore, that we should seriously consider the question, "How can a foreman meet the challenge of all-out defense production?" No single answer can be found for the question, but the following points are among those which are believed to be of vital importance and bring out a few of the necessary qualifications for obtaining maximum results.

He Must Fully Realize the Challenge Himself

Before a foreman can properly qualify to meet the challenge of the present emergency, he must first fully appreciate the challenge himself. There are still too many men in industry who have not grasped the urgency of the situation, and who continue to look upon their job in the same way they always have. A foreman in industry should understand that he is an officer in an army that is even more essential to our national defense than is the army now training in our military camps all over the country. He must realize the gravity of the situation and the importance of the particular group for which he is responsible in its relation to the whole production program.

He Must Be a Leader, Not a Driver

Having the appreciation of the challenge himself, he must inspire and lead his men, by both example and instruction, to maximum accomplishment. He must develop in his men the same realization that he has reached: that each one is a part and an important part of our first line of defense, and that getting the utmost in results is not only a patriotic duty, but is also essential to his own continued safety and personal liberty. Men must be brought to the point where they are personally interested in seeing their industry reach the utmost in accomplishment.

He Must Place Full Value on the Quality of His Product

In times like these, when the demand for goods far exceeds productive capacity, there is a very natural tendency to feel that anything will go and to give the quality of the product less attention than usual. The foreman who is really alive to the situation will do everything in his power to combat this tendency. He will keep the matter of quality constantly before his men and make them realize that poor quality always results in increased waste, and in a measure

defeats the maximum production program. Quality consciousness is essential to high efficiency.

He Will Welcome and Make Use of Suggestions

Valuable suggestions by which either quality or quantity of production can be improved, or costs reduced, often come from the most unexpected sources. The good foreman is, therefore, constantly on the alert for such suggestions from his men, and will not only act upon them but will see that those offering them receive proper credit for them. In this way, he will develop their confidence both in his judgment and in his fairness.

He Will Develop the "We" Attitude in the Workers

Every man takes more pride in his own accomplishments than in those of others. If the job being done is something "they" are doing and he is just working for "them," much of the incentive to achievement is lost. When a whole organization gets to the point where every man feels that he is a part of it, and not merely "working for the company," there is developed a morale which results in greater efficiency of operation than is otherwise possible. Every man must feel that he is one of the "we" that are doing things. The foreman, therefore, must always have the "we" attitude and make his men feel the same way.

More Than Ever He Will Look out for the Safety and Welfare of His Men

In a time of emergency such as the present, accident prevention and the preservation of health is, if possible, more important than ever. Not only is it important from the standpoint of humanity and interest in our fellow men, but there never was a time when it was so imperative that the utmost in production of goods be secured. Every hour lost through accident or sickness means the loss of the productive capacity of the individual involved, and this loss can never be made up. The foreman must, therefore, scrutinize by check and double-check every possible hazard and must see that every precaution is taken to avoid accidents and to instill the importance of the safety program in the minds of his employees.

He Must Be Loyal to His Own Men

Loyalty as a rule begets loyalty. The good foreman not only knows his men, but will go to

Reproduced by special permission of the National Industrial Conference Board. This paper won first prize in a nation-wide contest conducted by the N.I.C.B. Because the paper was originally written before December 7, 1941, Mr. Olmsted added the section on "The Foreman to Meet the Challenge of All-Out War Production Must Now Be an Effective Instructor" when he presented it at the dinner meeting of the First Southern California Management Conference on "Manning and Managing Our Arsenal," held at the California Institute of Technology, Pasadena, May 2, 1942.

bat for them whenever occasion demands. If a man is under fire, or the subject of criticism for any reason, his foreman should be the one to stand up for him, just as long as there can be any question regarding the justice of the criticism. This may at times even involve a stand between his subordinate and his superior, but if the foreman is known by his men as one who will maintain confidence in them and be loyal to them to the limit, he is bound to have their enthusiastic loyalty and support in return and they will use every possible means to carry out his wishes or orders.

In fact, the whole question here under consideration comes down primarily to a matter of human relations, and the foreman who is most successful in developing the loyalty and enthusiasm of his men is the foreman who will best meet the challenge of all-out defense production.

And now if I may, I would like to inject one more thought which has, I believe, assumed increasingly vital importance in recent months—especially since December 7 last.

The Foreman to Meet the Challenge of All-Out War Production Must Now Be an Effective Instructor

New men must be trained and the necessary skills developed in them in the shortest possible time. Industry is now continually losing and having to replace skilled operators, and this labor turnover will probably continue at an ever increasing tempo as the war effort progresses and the number of those called into our armed forces grows. This means that young and inexperienced men, or older men who are unfamiliar with the tasks required, or perhaps in many cases

women, must take the places of experienced employees.

Upon the foremen and supervisors falls the added burden of making efficient workers out of these new recruits. And this must be done quickly. Any period of basic training, such as is given to new recruits in our armies, must be eliminated in many cases and men must take over important jobs and become producers almost from the very start of their employment. Also many others must be promoted to jobs of greater responsibility long before it would normally be considered possible for them to attain the knowledge and experience needed to fill them.

All this means that more than ever before the foreman must be an efficient instructor and educator. He must not only know his industry, his processes, and his tools, and how to get the utmost in quantity and quality from them, but he must be able to impart his knowledge and his skill and develop trained men in a fraction of the time he may have always considered necessary for this purpose.

So here again is another side to this question of human relations, wherein the foreman's responsibility in meeting the challenge of production can scarcely be overestimated. He must study and learn to teach.

The foreman or supervisor today has a big job on his hands. He is the major, or the company captain, as the case may be, in the great army of industry, and more is expected of this army than ever before in history. Meetings like those we have been attending today show that the task and responsibility is recognized, and as we all go back to our jobs next week may we all be a little more effective and do our jobs a little more efficiently for having participated in these conferences.

ALL-OUT MOBILIZATION OF MAN POWER

LAWRENCE A. APPLEY
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War is Hell, and the Hell that war creates is not restricted to the battlefields. It is Hell in the way in which it tears and warps individual lives. It is Hell in the way it breaks up human relationships. It is Hell in the affairs of nations. He who thinks he can remain aloof from it, unchanged and uninfluenced by it, is a fool. He who thinks he can benefit from it is an A-1 candidate for the lunatic asylum.

Pleasant experiences of the past are but memories and in all probability will not be repeated in our lives or duplicated in the lives of future generations. The catastrophies during the depressions of the 'twenties were Sunday School picnics as compared with what lies ahead. We are entering a new world with new standards and concepts. We will be subject to new social orders, new economic systems which may not yet have been conceived, and to these we must become adjusted.

Present Duty and Emphasis

In terms of such changing conditions, such an immediate future of darkness and a distant future of uncertainty, we must now ascertain what our present duty is and where the emphasis should be placed. It is not a question of what we want to do or would like to do. It is a question of what we have to do because of the requirements of the circumstances surrounding us.

Our present duty is mobilization. Our emphasis is on man power. The confusion of the times and the complete disorganization of the elements involved have, in many cases, unbalanced our evaluation of what is first and most important. Shortages in equipment, materials, and facilities are tangible. Because of the inconveniences resulting from such shortages, they have received the greatest attention and publicity. After working out careful plans for the solution of problems involved we are amazed and frustrated when results do not meet the plans.

It is slowly dawning upon us that questions of equipment, materials, and facilities can be handled only in terms of capable and adequate man power. Without sufficient human energy directed in the proper channels at the proper time little can be done of any consequence in relation to the material problems.

In the newspapers and in the newsreels a few weeks ago there were pictures of a huge American eagle on the drill grounds at Fort Bragg. Close scrutiny disclosed that that eagle was made of human beings—thousands of them—each in his proper place, each according to a plan. As we look at the bombers, the battleships, tanks, and guns outlined in the skies and on the oceans of this world we should see that each is constituted of men and women—millions of them—each in the proper place at the proper time, according to a plan.

The most recent figures coming to my attention show 1,700,000 employees engaged in what were then known as defense industries at the end of 1940. At the close of 1941, there were 7,500,000 employees in what, by then, had become war industries. In order to reach the production schedules for 1942, 10,000,000 additional employees must be mobilized this year. In addition to this demand upon the labor market, the armed forces of this country are increasing by the hundreds of thousands. The government agencies involved in this war effort are adding thousands of people to their civilian payrolls each month.

The most important function now resting upon the shoulders of industrial and government executives is the mobilization of man power. It may seem strange to some of us to realize that this has always been the case in peace, prosperity, depression, or war. It is a sad commentary that it takes a war to burn this fact into our minds so that it becomes a vital, living reality that we actually put into practice.

Definition of Terms

"All-out" means complete. It calls for all the effort of which we are capable without reservation or concern of personal welfare. "Mobilization" is assembling and putting elements into a state of readiness for active service. "Man power" is the productive skill, knowledge, habits, and attitudes of both men and women.

The subject, "All-Out Mobilization of Man Power," therefore, calls for complete, immediate, unreserved assembling of the knowledge and skills of every man, woman, and child for the service demanded of us in this present emergency. The success of the war effort is dependent upon the full acceptance by all of us of the challenge which this presents. Lip service on the part of anybody means possible disaster.

Further interpretation of the subject discloses that all-out mobilization of man power calls for the acceptance and application of what have been proved to be sound personnel policies and practices. Man power and woman power are personnel. Mobilization of this power is personnel administration. The subject is now reduced to terms with which we are all acquainted but which many of us do not fully comprehend.

Past Status of Personnel Administration

Unfortunately, personnel and personnel activities have not in all cases enjoyed the recognition which they deserve. Unless such recogni-

tion now becomes complete, all-out mobilization is impossible.

This message is being addressed to line management. By that is meant anyone who has the responsibility of getting things done through the efforts of other people. That includes any individual from a top executive to the gang pusher who has people under his or her direction. Varying only in degree, the same principles apply and the same activities are involved.

Personnel administration to some line people is a nuisance. Some will not even give it credit for being a necessary nuisance. Many conceive of it as a mass of detail, forms, paper work, investigations, and approvals. There are executives who consider personnel departments as the agencies that take care of petty difficulties with which they do not wish to be bothered.

There are still other line executives who think of personnel departments as mediums for keeping them out of trouble or as insurance against personnel problems. Such executives are inclined sometimes to place the entire responsibility for personnel on the personnel department with the attitude, "We will run the business and make the money and you see that we have enough people adequately trained to do the job, and keep them happy."

A continuation of such attitudes toward personnel by line management will be fatal. It is a faulty conception to begin with and leads to trouble rather than insuring against it. Line management from the top down must accept personnel administration as one of its major responsibilities.

Personnel Administration—A Line-Management Responsibility

It has been proven through many sad experiences that it is absolutely impossible to separate the responsibility for production from responsibility for the people who have to get out that production, and, at the same time hope to have a smoothly operating, efficient organization. Any attempt on the part of line executives to side-step, avoid, minimize, or delegate their responsibility on personnel is now branded as a serious management malpractice.

Personnel administration is a living, vital, realistic, and tangible activity. It is not only a contribution to, but a necessary part of management and supervision. The basic function of executives and supervisors is to determine what they wish to accomplish; to gather together human beings who can accomplish it; to periodically check the performance of these people and to find ways and means by which to increase their productiveness. Management is the development of people. Management simply creates a situation in which people can work, grow, and contribute their productiveness to the effort at hand.

If the mere issuance of a law, directive, executive order, or management policy meant that all human beings would follow such instructions without deviation, supervision would not be required. We have supervi-

sion for the purpose of increasing the knowledge, improving the skill, changing the habits and correcting the attitudes of human beings so that they will be able to use their capabilities to the greatest possible extent. Management and supervision are personnel administration.

This observation is made with some feeling and conviction. This is no time for argument. If further argument is required to pass this conviction on to others, I would be glad to participate in it. My hope in such an argument would be to lift the activity of personnel administration out of the realm of routine details delegated to a specialized department up to the level where it belongs — that of a major activity in the considerations and councils of top management.

It so happens that I am personally what is known as a personnel man, and am proud of it. Any individual in personnel work who apologizes for what he is doing or tries to explain weakly how he got into it doesn't belong in it. Personnel work is the most living activity there is today and the most important.

Because of the importance of personnel it requires the finest abilities and capabilities that exist. We have a right to assume that the best capabilities are possessed by those who are in the management jobs and carry the responsibility for accomplishment. Those of us who are so-called personnel men act in an advisory and service capacity to the line. It is our job to serve as staff officers and to give of our best but it is line management's job to make the decisions and to put them into operation. The importance of the activity justifies nothing less than this.

What to do About It

If line management is willing to accept this viewpoint on its responsibility toward personnel, then there are certain definite items to which you should give your attention in order to bring about all-out mobilization of man power. They are items which only top management can do, and if done by top management, with the assistance of the line supervisors and the staff, can be done with greater speed and assurance of sound results.

1. Make sure you have an adequate personnel (industrial relations) policy. Put it in writing. To be complete that policy should include objectives, procedures, and assignment of responsibility. The objectives should indicate the results you are after in relation to man power. The procedures should indicate the steps that have to be followed to attain those objectives. The assignment of responsibility means giving each step of the procedure to some individual, department, division, or section.

That policy should provide for all of the personnel activities required for a full mobilization of human effort in your organization. It should start with sources of labor supply, continue on through employment, payment, training, promotions, safety, labor relations, and terminations, to post-service considerations. That policy should plug every gap so that if what is contained therein is accomplished, complete mobilization will be the result; there will be an adequate supply of capable people with a high degree of morale, working conditions which they enjoy, and a management in whom they have confidence and for whom they have the deepest respect.

The need for such a policy is as important as that for a production, manufacturing, marketing, or financial policy. The same people should prepare it and the same amount of consideration given it.

Because we have heard such advice so often we are sometimes inclined to be impatient when it is repeated. Sometimes we shove it aside as academic, impractical, and unnecessary in the present emergency. It may, therefore, be advisable to say that the recommendation just made is not academic. It is absolutely essential to the furtherance of the war effort.

Why has the President of the United States, the Commander-in-Chief of our armed forces, taken the time to create the new Man-Power Board for the purpose of establishing and guiding personnel policies in this war effort? The War Labor Board has persistently insisted it is not a policy-making body. Chairman Davis has said that the function of the Labor Board is to settle labor issues in terms of the particular situation involved and without regard to all-over policy.

The personnel policies that have been established during peacetime have proved inadequate for wartime. Therefore, a new Man-Power Board has been organized under Chairman Paul McNutt, with a membership made up of ranking officials of the federal government for the purpose of supplying what is needed for full mobilization of man power.

The Secretary of War has just created a Civilian Personnel Council. On this Council is the Administrative Assistant to the Secretary, Consultant to the Secretary on Civilian Personnel, a member of the Civil Service Commission, and ranking officials from the Army air forces, ground forces, and Service of Supply. This Council is for the specific service of developing adequate personnel policies to cover the activities of the War Department.

It is, therefore, without hesitancy that I say to a group of busy men involved in the realistic situation of exceeding all records in war production, that you cannot do it effectively without adequate personnel policies.

2. Have a full-time staff executive on personnel activities who has the personality and the courage to be a part of and deal with top management, and who, at the same time, will enjoy the confidence of the rest of the organization. Such a personnel executive

should report directly to the chief executive without intervening layers of supervision. It will be his function to determine what personnel staff is required to properly assist the line in the application of a personnel policy.

A common error in industry and in government is leaving the personnel executive out of the discussions of management problems. It has been a feeling in some cases that the personnel man has a specialized task and that problems of priority, allocation, budgets, etc., do not concern him. All problems, however, involve personnel and should not be discussed except in terms of personnel.

Many improper decisions of management have been made because the staff executive on personnel was not present at the time to advise and counsel in relation to the human element involved. If personnel is a major responsibility of management and if the function of the personnel executive is to assist management in the fulfillment of this responsibility, then he should be closely tied in with the problems of management.

This is not an attempt to establish more prestige and better status for personnel executives because of any possible personal gain. Neither is it an attempt to take advantage of a situation when personnel is being emphasized more than ever before. It is recommended as an absolute necessity in the furtherance of the job at hand.

Lieutenant General Somervell, Commanding General for the Service of Supply, one of the three major branches of the War Department, is one of the most personnel-minded executives it has been my privilege to know. He has had the reputation for years of fully realizing the importance of personnel policies and sound procedures. One of the first positions he established on his new staff is that of the Civilian Personnel Director. This man, a civilian himself, reports directly to General Somervell and is a member of the staff, attending staff conferences just as are the commanding generals of the various bureaus such as Ordnance, Engineers, Quartermasters, etc.

There is another prominent organization in this war effort similar in status to the Service of Supply where this condition does not exist. The Director of Civilian Personnel is three or four levels down in the executive staff. He is not in on the councils of top management and is not considered a very important cog in the machine. As a result, that organization is having continuous personnel difficulties, some of which are growing in seriousness. Because of the effect they are having upon the operating success of that organization they will ultimately be forced to the attention of top management.

There is another classic illustration of the fallacy of not having the personnel executive in on top-management councils. The civilian personnel problem in the War Department is a huge one. Civilian maintenance and production men and women keep the planes flying, the tanks rolling, and the guns firing. Two years ago there were less than one hundred thousand such civilians on the War Department payrolls. Today there are more than six hundred thousand.

A prominent industrialist in this country offered to build barracks and a training school near his production plant and to pay all the expenses including room and board for twenty-five hundred civilians at a time, to be trained as government mechanics. Because this offer involved personnel it was routed to the office of the Personnel Director.

Because the Personnel Director did not know the production schedules of the department of which he was a part, and did not know of the anticipated increase in demand for skilled help, the offer was refused. When it was later discovered by top management what had happened, apologies had to be made to the industrialist involved, the whole question had to be opened for reconsideration, months had been lost because of the delays, and the whole war effort had been hampered. Fortunately, the program was saved and is now in full swing. Just another illustration to support the fact that these recommendations are neither academic nor theoretical.

3. Build an organization structure in which people can function properly. Organization structure is the medium that management has to make it possible for people to work together in groups as effectively as they would work alone. It is a human mechanism.

If the organization structure is not sound, simple, and understood by everybody in it the result is friction, misunderstanding, duplication of effort, and omission of responsibility. All of these interfere with complete mobilization of man power.

To bear out the importance of this particular subject it is interesting to note that the first consideration of the new War Man-Power Board is the question of organization structure. It was my privilege just last week to sit in on a discussion of this question just a few days after the personnel of that Board had been designated.

Why is the War Production Board more effective than the OPM was? The answer is better organization structure, more authority, more intelligent assignment of responsibility. Organization structure is a basic consideration in the war effort and too many well-conceived programs have collapsed because of improper attention to this item.

4. Simplify the routine of personnel administration. In normal cases there is too much paper work, there are too many pet forms. Much detail is often required which does not contribute anything to the improvement of human effort. There are cases where paper work and routines have for their sole objectives the building of good-looking files.

As said previously, war is Hell. Hell is fire. Papers and forms do not last long in a fire. There is not place for unnecessary paper work in a war effort.

Emphasis on this particular item is not intended to encourage the abolition of all personnel records. Many of them are necessary and valuable. Its purpose is to encourage re-examination and simplification of what exists and very careful consideration before any added work is adopted.

The United States Civil Service Commission is the personnel agency of the federal government. The top management of the Commission was quick to adjust its thinking to wartime conditions and issued instructions to cut out the red tape, to simplify the details, and to eliminate considerable paper work. In some cases this top-management attitude has been slow in filtering out to the field offices.

Civil Service regulations require that a job be classified by title, functions, and pay before it can be filled. In one government war plant a new job was created. People were needed at once and the usual peacetime procedures were followed. Forms were made out requesting that the job of "auto-mechanic learner" be properly set up, classified, and authorized.

After two months' time a letter came back requesting more elaborate information as to what the functions of the auto-mechanic learner would be. Some clerk was following a formula and insisted upon filling up a certain amount of space on the form with a lot of words. Anybody with an ounce of common sense would know what an auto-mechanic learner was without specific description. This is given as an illustration that we must eliminate all unnecessary routine details, paper work, and forms. The job we have to do today is to get men and women to work and get them to work fast.

5. Develop supervision. Supervision is the key to sound personnel administration and it is an absolute necessity in this war effort. Many of the problems of the past have been the result of poor supervision and we all say so and admit it but few of us do anything about it. The ability to supervise and the knowledge of techniques of supervision are not inhaled out of the air. Supervision is a profession and requires training.

There is much ado at this time about specialization and upgrading in connection with the development of skills required by the workers. A very excellent effort has developed along these lines and training of this nature is well under way. Nowhere near as much attention has been given to the training of supervisors who have to mobilize and direct the use of the skills resulting from such training.

Time does not permit a discussion of proper

supervisory-training methods. The country, however, is full of talent and advice along these lines. If you do not have a comprehensive and adequate supervisory-training program you cannot expect all-out mobilization of man power.

There are many splendid sources of supervisory training outside specific organizations. While a complete supervisory-training program requires company plus outside activities along these lines, those on the outside are very valuable. I am referring specifically to conferences such as those held at the California Institute of Technology, at U.C.L.A., at U.S.C., at Stanford, plus the conferences conducted by the National Foremen's Association, as well as the National Industrial Council of the Y.M.C.A.

There are cases where executives' attitude toward these outside foremen and supervisory conferences has not been too healthy. There have been instances where the chief executive has said, "All right, if the boys want a few days off or want to take a part of their vacation let them go but get them back to work as soon as possible," or when they have come back on the job, "Now you can forget the nice-sounding theories you have heard and get back to work, we've got to get out production." If any top management has not personally investigated the quality of these conferences or even personally attended parts of them or participated in them, they have missed a bet. Such training is rendering a real service and is playing an important part in this war effort. The conference today is an excellent illustration and needs no further elaboration on my part.

Summary

The theme of this presentation has been that all-out mobilization of man power is a current term for sound personnel administration. It has been my attempt to raise the status of personnel administration in the minds of some by lifting it from the realm of second or third importance to that of first impor-

tance. The same principles which have been true in relation to sound personnel administration are being emphasized as never before in the present need for the mobilization of people.

Management must accept its full responsibility for such mobilization. It must tackle the problem intelligently by developing adequate policy, by securing a capable staff personnel executive, by giving him proper status, and by taking him and that with which he deals into the councils of management. Any compromise with this situation is interference with the biggest job that you and I have to do at this time.

Remember Pearl Harbor? Remember it for what? For the destruction of human lives and the mass wreckage of naval units that were the pride of our fleet? Remember it for the humiliation and the loss of prestige to America? Remember it because it was a dastardly deed of a supposedly friendly nation? What is there in all this to cause this country to adopt the slogan, "Remember Pearl Harbor"?

The heart, soul, and spirit of that slogan is to remember Pearl Harbor because of the challenge that it presents to the very finest that there is in America. It is a challenge to rally every human being, to ascertain what knowledge and skills each has to offer, to mobilize the power so represented into smoothly operating units, and to tie those units together in a great mass of humanity that moves ahead without hesitancy to crush those and all like them who have brought into this world the conditions at Pearl Harbor. It is a challenge for all-out mobilization of man power. It is a challenge only to the respective managements who have to bring about that mobilization. We will meet that challenge only by appreciating the significance and adopting the finest personnel practices that we can discover. Humanity needs America's help. Americans need leadership. Leadership requires an understanding of human nature and the ability to deal with it in such a way that response is favorable, complete, and immediate.

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