WASTE IN INDUSTRY

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By the COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY *of the* FEDERATED AMERICAN ENGINEERING SOCIETIES

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"Engineering is the science of controlling the forces and of utilizing the materials of nature for the benefit of man, and the art of organizing and of directing human activities in connection therewith.

"As service to others is the expression of the highest motive to which men respond and as duty to contribute to the public welfare demands the best efforts men can put forth, NOW, THEREFORE, the engineering and allied technical societies of the United States of America, through the formation of The Federated American Engineering Societies, realize a long cherished ideal,—a comprehensive organization dedicated to the service of the community, state, and nation."

PREFACE

Toward the end of 1920, The Federated American Engineering Societies came into being, through the convening of its executive body the American Engineering Council. On November 19, Herbert Hoover was elected the first President, and among his first acts suggested a study into the restrictions and wastes in industry. On November 20, the executive board authorized the appointment of a committee to make such an investigation and immediately thereafter the general plans were drafted and a small preliminary committee selected. On January 12, 1921, Mr. Hoover named fifteen engineers as the Committee on Elimination of Waste in Industry and added two others at a later date, making the membership seventeen in all.

The essence of the plan was to gather quickly such concrete information as might be used to stimulate action and to lay the foundation for other studies. It was believed that a limited, yet carefully studied volume of findings obtained through a rapid, intensive study would not impair the value of the facts disclosed or the validity of the recommendations based upon them. So within less than five months the committee completed an assay or analysis of waste in six typical branches of industry, and presented a summary of its findings to the American Engineering Council. This took place on June 3, 1921, in St. Louis, at which time a condensed news abstract was given to the press. The final report is now presented in the name of the Committee.

The original plan contemplated ten investigations in the field, including transportation and coal mining.

A study in the pulp and paper industry was dropped for lack of time and funds. One planned in the rubber tire manufacturing industry was likewise dropped, due to a failure to secure co-operation in the industry itself. The other six studies were completed, including the building trades, men's ready-made clothing, boot and shoe, printing, metal trades, and textile manufacturing, and form the second section of this report. The studies in transportation and bituminous coal mining have not been completed to be included in this report. A considerable investigation was made in both cases but it was found that these two fields were of such large proportions and the situation inherently so intricate that adequate studies could not be made with the time and funds available. It is hoped that in the immediate future resources may be at the disposal of the Committee, or some other agency, to continue these studies.

Furthermore, a regional assay comtemplated in the City of Worcester, Mass., has not been completed in a form to become part of this investigation.

In addition to these specific field studies, seven reports of a statistical character were prepared, each of them dealing with some aspect of industrial waste or its elimination on an extensive or nation-wide basis. These form the third section of this report.

The industries selected for specific study are of great public importance, for their operation directly affects the daily life of everyone.

Further studies will be necessary to determine the extent of preventable waste in American industry. Since in the six industries studied, of varied character and enormous annual output, waste was found to be very large, the Committee believes that studies in other industries will disclose similar preventable wastes, generally traceable to the same causes.

The extent of the field work is indicated by the fact that some fifty engineers spent a time approximately equal to two months each in securing the information upon which the industrial reports are based. In addition thereto, every part of the complete report has been submitted to engineers or others having particular knowledge or specific experience, with the request for constructive criticism and suggestions. The report as a whole therefore, represents the combined effort of about eighty engineers and their associates.

It is a privilege to acknowledge and express gratitude for all this work and effort. As many organizations and individuals must be nameless because of the general promise given by the Committee that the firms whose plants were studied would not be mentioned in the report, the Committee names no one in extending this credit, but does express its very great indebtedness to all who have assisted.

The work of the investigation has been carried through at cost or less. No fees have been paid and no overhead has been charged for field or office work. The engineering firms which made the investigation have been reimbursed only for the actual salaries of the men in the field and for their traveling and clerical expenses. The heads of these firms have spent many days on the work without compensation. All of the office work has been done at actual cost and much has been directed without remuneration. Had we paid for the services which have kept some fifty engineers in the field for approximately two months at the ordinary rates for such professional service, the cost would have been many times larger.

The Committee believes that this study of waste in industry will prove of lasting benefit to the industries studied and to the public which uses their products. It hopes further that the benefits will be farther reaching, and will extend to other industries by stimulating similar studies and outlining the methods by which they can be made. The Committee believes that such additional studies will prove of great value and that through intelligent application of conclusions reached, American industry will take another long stride in advance. In expressing these beliefs the Committee recognizes that many of its findings and recommendations have previously been pointed out by individual engineers, but this report is the first instance of a collective or group endorsement of a general analysis of the sources and causes of waste and recommendations for its elimination.

This report is the first work undertaken by The Federated American Engineering Societies in rendering public service. It discloses losses and waste due to the restraint and dissipation of the creative power of those who work in industry. It lays the foundation for knowledge of the destructive influences which have too much controlled in the past. From this knowledge will grow the conviction that mental and moral forces must be added in a much larger degree, to the physical resources now employed if industry is to serve all who are dependent upon its continuous and effective operation.

NEW YORK CITY, N. Y., June, 1921.

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FOREWORD

THIS reconnaissance report on waste in industry is the result of five months of intensive study, carefully planned and rapidly executed. A part of its value lies in the speed with which the work has been done, and the promptness with which it presents definite lines for future action. It reveals facts which may serve as a foundation for an advance in American industry. It has a special message for government officials, financial, industrial and commercial leaders, labor organizations, economists, engineers and research groups, the general public and the press.

We have probably the highest ingenuity and efficiency in the operation of our industries of any nation. Yet our industrial machine is far from perfect. The wastes of unemployment during depressions; from speculation and over-production in booms; from labor-turnover; from labor conflicts; from intermittent failure of transportation of supplies of fuel and power; from excessive seasonal operation; from lack of standardization; from loss in our processes and materials—all combine to represent a huge deduction from the goods and services that we might all enjoy if we could do a better job of it.

HERBERT HOOVER.

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ELIMINATION OF WASTE IN INDUSTRY

CHAPTER I

INTRODUCTION

Responsibility and Opportunity—The Point of View.—In making the studies upon which this report is based and in preparing the report itself there has been no purpose or desire to place blame upon any individual, group or class. The wastes revealed are the result of methods, tactics, practices and relationships of long standing in industry, and the Committee has merely desired to indicate the main opportunities for eliminating waste and to show whose opportunity or responsibility it may be to adopt proper measures for such elimination.

No attempt has been made to write an academic definition of waste or to speculate in regard to ultimate savings. For the purpose of this report no attempt has been made to consider all economic wastes. Rather, in the Committee's investigations industrial waste has been thought of as that part of the material, time and human effort expended in production represented by the difference between the average attainments on one hand and performance actually attained on the other, as revealed by the detailed reports. In assaying waste in industry the Committee has undertaken to evaluate this difference. Thus it has established no theoretical standard of performance or excellence, but has developed a method of measurement to determine the degree of effective use of those factors within which it was believed waste might be discovered. It has conceived that a given practice is not wasteful until a better has been revealed, and that the value of a newer practice, or the amount by which it is an improvement over an earlier one, can only be determined by units and methods of measurement.

The investigations clearly indicate that industrial waste is caused not only by failure to use the time and energy of living men, but also from failure to use the productive equipment which has resulted from the time and energy expended by past generations. In the effort to eliminate waste of human energy, it is recognized that more must be accomplished in the same time, or the same accomplished in less time, and to this end the vast heritage of recorded knowledge of past experiences must be made available to an ever increasing number of men.

Thus the first work of the Committee was to set up units and methods of measurement in an endeavor to determine and to proportion the main constituents of waste. Knowing the main constituents and the relative importance of each, an effort was made to ascertain the cause and to suggest the remedy.

Difficulties of Studying Waste.—The difficulties in studying waste in industry are many. As an institution, American industry is composed of 288,376 establishments—according to the census of 1919.

It is a fact that no accepted management and labor terminology exists and, further, few units of weighing or measuring the performance of industry, or of any plant or department or section thereof have been developed by engineers in a way to be standardized, or to yield results and conclusions on a comparable basis. A search through the literature in the Engineering Societies' Library showed that few standards of this kind were available.

The impossibility of making a comprehensive study of the nearly three hundred thousand industrial plants grouped in the census into fourteen major classes is obvious. Neither time nor funds were available for such a task, and even if it might have been attempted, it is doubtful if the results would have been commensurate with the expenditure. Therefore the decision was reached to make a study of a group of representative plants in each particular branch of industry selected. The lack of standardized terminology and of units and methods of measurement was overcome by preparing a standard method of investigation used in each branch of industry and in the plants in which intensive studies were made.

This means that the nature of the study can be compared in point of view to that of a reconnoitering party for a proposed railway, or to the preliminary assay of a mine, or to the first pencil drawings of the design of a new machine. The object in each case is to disclose the main phases of the project, which may then be developed and perfected by the engineers, through further study and elaboration, in whatever detail may be required.

The limitations of the study are indicated in the following tabulation:

Branch of Industry	No. of Plants Investigated	No. Plants Furnishing Additional Information
Building Industry	73	33
Men's Ready-made Clothing Manufacturing	9	
Boot and Shoe Manufacturing	8	34
Printing	6	19
Metal Trades	16	17
Textile Manufacturing	13	

Each engineer who made a field investigation was thoroughly acquainted with the industry he studied, and the choice of the facts to be presented and the deductions drawn from those facts were made by him on the basis of his expert knowledge and the composite experience and knowledge of the entire Committee.

Plan of Study—Questionnaire and Evaluation Sheet.—The plan of study followed in each of these six branches of industry was this: at the outset the members of the Committee prepared an analysis of those factors and operations in industry in which waste might be expected to be discovered, provided a comparison was made between average practice and the best known practice. From this analysis a trial questionnaire was prepared to secure information and quantitative data to permit of comparing the record of one plant with another.

This trial questionnaire was then used in making a study of one plant in each industry. The results of these trial studies were then brought together, compared, reviewed by the Committee and, as a result, a revised questionnaire and an evaluation sheet were prepared, to be used in making the studies upon which this report is based.

This revised questionnaire, as used with suggested modifications based on the experience accumulated in its use in the field studies, forms an important part of this report. With it is presented the evaluation sheet. The answers from each plant were secured and judged by the engineer who conducted the field examination.

To indicate the material brought into the hands of the Committee by the use of the questionnaire, it may be valuable to describe briefly the set of answers for one plant in which the information was particularly well arranged.

In this set the answers to the questions covered fifty-eight single-spaced typewritten pages, or more than double those used in printing the questionnaire. This shows the detail in which the replies were worked out. Accompanying these answers was a book of exhibits comprising twenty-nine classifications of reports, charts, diagrams and records presenting detailed and confidential information in regard to the operation of this particular plant.

Calendar of the Study.—The statement has previously been made that the field work was completed and the summary written between February 7 and June 3, 1921. Such rapid progress was made possible through strict adherence to a previously prepared schedule for the completion of each portion of the work. This calendar follows:

1921

Jan. 12, Committee on Elimination of Waste named.

Jan. 19, First meeting of the Committee and approval of general plan of investigation.

Feb. 7, Approval of detailed program.

1921

Feb. 21, Preliminary studies of one plant in each industry completed and report submitted.
Mar. 21, Work to date reviewed and final calendar approved.
Apr. 1, Report on Textile Manufacturing submitted.
Apr. 22, Report on Boot and Shoe Manufacturing submitted.
Apr. 26, Report on Ready-made Men's Clothing Manufacturing submitted.
May 2, Report on Building Industry submitted.
May 3, Report on Printing submitted.
May 5, Completion of Summary Report commenced.
May 7, Report on Metal Trades submitted.
May 13, Report on Sales and Purchasing Policies submitted.
May 15, First draft of Summary Report completed and submitted to Committee as a whole.
June 3, Summary Report submitted to Executive Board of American Engineering Council.
July 6, Complete Reports edited ready for printing.
July 15, Approval of Report as a whole by the Committee.

Field and Statistical Reports.—It will be noticed that the work of planning, including the making of the trial studies and the revision of the questionnaire and evaluation sheet took five weeks of the short total. The field studies yielded six reports which form the second section of this complete report. Each is signed by the name of the engineer who supervised the work. Five of the six present an evaluation sheet for each plant studied and a composite sheet for all of the plants studied. The sixth report, the one on building trades, presents an evaluation sheet for the best organization studied, and a composite sheet for all. In addition to this disclosure of basic facts, each field report presents a written summary of conditions discovered, conclusions drawn and recommendation and opportunities for improvement.

The individual reports forming the third section of this complete report differ in character from the field studies, inasmuch as each is a survey of conditions generally, rather than a study of any one plant or branch of industry. They were compiled from existing information, and each is signed by the one responsible for it. They therefore support from a broader point of view many of the specific findings presented in the field reports and for this reason give a more general background for many of the recommendations offered.

The Committee realizes that before there can be a material reduction in the sum total of waste in industry, much earnest, painstaking work must be done. The solution of such a problem is not one of hours or days but of years. Fundamental changes in our economic, financial, managerial and operating concepts and practices will be required. There will be need of both cooperative and individual effort. As regards groups, each must frankly face its own responsibility and meet its own duties.

Each individual—plant executive or worker—must discover his own opportunities and then accept responsibility for performance. To such a one, the Committee on Elimination of Waste in Industry suggests that the methods developed for investigating and compiling the information as revealed in this report be utilized in individual plants to show the way for betterment and improvement.

CHAPTER II

SOURCES AND CAUSES OF WASTE

Four Aspects of Waste in Industry.—Waste in industry is attributable to

1. Low production caused by faulty management of materials, plant, equipment and men.
2. Interrupted production, caused by idle men, idle materials, idle plants, idle equipment.
3. Restricted production intentionally caused by owners, management or labor.
4. Lost production caused by ill health, physical defects and industrial accidents.

Relative Responsibilities.—Management[1] has the greatest opportunity and hence responsibility[2] for eliminating waste in industry. The opportunity and responsibility of labor is no less real though smaller in degree. The opportunity and responsibility chargeable to outside contacts can not be so clearly differentiated or evaluated. The relative measure of these is shown by the quantities in the following table which come from the composite evaluation sheets in the engineers' field reports.

[1] The term "management" as used in this part of the report refers to the agency (owners or managers) which exercises the management function in industry. This function is thus defined in a report approved by the management division of the American Society of Mechanical Engineers:

> Management is the art and science of preparing, organizing and directing human effort applied to control the forces and to utilize the materials of nature for the benefit of man.

[2] The "responsibility" of a given agency as here used does not mean moral responsibility as ordinarily understood, but only that responsibility which arises from the undeniable fact that a given cause of waste can be removed only by a particular agency. "We measure responsibility not by the thing done but by the opportunities which people have had of knowing better or worse."

Industry Studied	Responsibility Assayed Against Management, Points[3]	Responsibility Assayed Against Labor, Points[3]	Responsibility Assayed Against Outside Contacts (The Public, Trade Relationships, and Other Factors) Points[3]	Totals, Points[3]
Men's Clothing Mfg..	48.33	10.50	4.95	63.78
Building Industry....	34.30	11.30	7.40	53.00
Printing [4]...........	36.36	16.25	5.00	57.61
Boot and Shoe Mfg...	30.25	4.85	5.83	40.93
Metal Trades........	23.23	2.55	2.88	28.66
Textile Mfg..........	24.70	4.70	19.80	49.20

From the preceding table are derived percentage values for each of the agencies against which responsibility is assessed, as follows:

Industry Studied	Responsibility Assayed Against Management	Responsibility Assayed Against Labor	Responsibility Assayed Against Outside Contacts (The Public, Trade Relationships, and Other Factors)
Men's Clothing Mfg...	75%	16%	9%
Building Industry....	65%	21%	14%
Printing [4]............	63%	28%	9%
Boot and Shoe Mfg...	73%	11%	16%
Metal Trades........	81%	9%	10%
Textile Mfg..........	50%	10%	40%

The quantities presented above justify the following statement: over 50% of the responsibility for these wastes can be placed at the door of management and less than 25% at the door of labor, while the amount chargeable to outside contacts is least of all. It must be recognized that if management is to meet this responsibility fully it must have the cooperation of labor.

In every industry studied there are outstanding examples of good management but the bulk of the industry does not approximate this standard. In the clothing industry, for instance, one plant was rated by

[3] The relative responsibilities have been evaluated in "points." A theoretical total of 100 points represents all possible waste. As no plant is or could be entirely wasteful the number of points assigned in any case must be less than 100.

[4] Adjusted by field engineer to a basis comparable with the other field evaluations.

the engineers 57 points higher than the worst one studied and 42 points better than the average.

The following table gives a comparison for each industry studied of the total number of points assessed as waste in the best plant investigated, compared with the average of all the plants.

Industry	Points Assayed Against the Best Plant Studied Points	Points Assayed Against the Average of all Plants Studied Points	Ratio Best to Average
Men's Clothing Mfg...	26.73	63.78	1 : 2
Building Industry....	30.15	53.00	1 : 1½
Printing.............	30.50	57.61	1 : 2
Boot and Shoe Mfg...	12.50	40.83	1 : 3
Metal Trades........	6.00	28.66	1 : 4½
Textile Mfg..........	28.00	49.20	1 : 1½

These tables present the consensus of opinion of the engineers engaged in field studies to the effect that the average of management is much below the standards set by certain individual executives who have achieved notable success.

It must not be assumed that these points or ratios are valid in comparing the waste in one industry with that in another. They are useful only in making a comparison of waste in plants within the industry where they were assessed. Further, the quantities disclosed by the evaluation sheets are only a part of the findings dealt with in this report.

LOW PRODUCTION

Faulty Material Control.—In certain industries the waste of materials is a serious drain on production—a fact which is revealed by a comparative study of plants in the same field.

The methods of control which are common in the shoe industry account for the greatest loss in shoe production, with the possible exception of seasonal demand and production. Firms leave it to the cutters to economize in leather. Where standards are in use, waste frequently occurs through carelessness and lack of training of cutters. The loss from idleness in shoemaking occasioned by waiting for work and material amounts to some 35% of the time.

The average contractor has no calendar of operations except the dates of starting and finishing a job. He largely regulates deliveries of materials by visits to the job, or through statements received from the job superintendent. Haphazard methods of planning result in delays for want of material, or in burdening the job by an over-supply of material. The same practice results in frequent layoffs, causing dissatisfaction, the loss of good mechanics, and a high labor turnover.

Still another waste from inadequate material control comes from the speculative purchasing of raw materials. In the clothing industry gambling in cloth is common. Fortunes are made or lost in this practice, with a consequent train of evils which affects most of the processes of production, and raises the cost of the product.

Faulty Design Control.—The defective control of design results in a major waste, since it prevents standardization of product. In the building trades, for example, while the standardization of dwellings and other types of buildings is not generally practicable, yet certain details are entirely capable of standardization. Standardization of the thickness of certain walls might mean a saving of some $600 in the cost of the average house. Standardized mill work, such as window frames, doors and other similar items would reduce the cost.

In the printing trades there is wide variation in flat bed cylinder presses; there are more than six hundred types of folding machines. Formerly each type foundry cast its type on a more or less different body, and although the change from the old system to the point system involved an expenditure of some $3,000,000 by the type founders, it is universally conceded that this expenditure has been saved many times over. Such an example points the way to further efforts.

There are approximately 6,000 brands of paper; 50% of which are more or less inactive. The duplication of brands serves no useful purpose and ties up money in unnecessary stock.

As an example of the disregard of standard size, the Federal Reserve Bank check will not cut without waste from any of the regular paper sizes. A draft questionnaire issued during the war was of such non-standard size as to require special filing cabinets. The Technical Publishers' Association on measuring 927 catalogues found 147 different sizes. A trim of one-quarter inch on a 6 × 9 page is equal to 7% of the total cost of the paper.

Among current magazines there are 18 variations in width and 76 in length of page or column. Among trade paper publications there are 33 variations in width and 64 in length. Among newspapers there are 16 in width and 55 in length. These variations cost the public not less than a hundred million dollars each year.

The standardization of newspaper columns to one size would make possible an annual saving of $3,000,000 to $5,000,000 on composition and plates alone.

The waste of time and money through duplication of estimates and of designs in the building trades runs into the millions every year. Frequently the architect makes a general design and for lack of knowledge of how to keep down its cost, asks all the bidders to design the structural details in order to get their quantities. Thus not only must the bidder include the cost of the design in his proposal, but he must allow, in addition, an overhead to cover the cost of various similar designs he made for unsuccessful bids. This duplication of design is waste for which owners must eventually pay.

Another source of waste through inadequate design control comes through defective drawings, specifications and tolerances.

Faulty Production Control.—The lack of adequate methods of production control is evident in every industry studied. It is one of the outstanding weaknesses.

In most tailoring shops there are no dispatching stations for recording the progress of work and giving out work assignments; no work tickets and progress records for the various manufacturing lots; no record of production either of the individual worker or operation; no record of the balance of work ahead at each operation or of the plant as a whole. Lots of garments introduced at the beginning of the process drift through. In such a shop production is measured only in shipments of completed garments. No record is made of the losses or when they occur. No systematic method of keeping the operators supplied with work is followed; they either hunt up work for themselves or else the foreman acts as a porter. It is obviously impossible for the foreman and his assistants to keep an even flow of material to each operator. This practice results in a congestion of work at some points; idleness at others. At the very height of the season, a part of the force may stand idly by, waiting for work. The lack of effective planning and administration in one large typical plant wastes one-fifth of the worker's time.

Examples of avoidable waste such as the following are fairly common:

A shoe factory having a capacity of 2400 pairs of shoes a day could turn out for a considerable period only 1900 pairs because of shortage of needed racks. Another factory had 50,000 pairs of shoes tied up in the fitting room instead of the normal 15,000 because of congestion of operations. In another case a factory producing 700 pairs of shoes a day had 36,000 pairs in its fitting room, or ten times the normal supply. An entire factory was held up for several days waiting for leather heels.

From shop records it is found that the average loss in clothing factories during running time, not including shut downs, is between 30 and 35%. If we call 80% running time the maximum readily attainable, this means a possible increase of nearly 20% in productive capacity, and a similar increase in plant capacity.

It is found that at least ten hours per week per man is thrown away on energy-wasting and time-wasting work resulting from lack of shop methods, while an additional two or three hours per man per week are wasted in unnecessary work.

Fixing the value of annual output in the men's ready-made clothing industry at $600,000,000 it should be relatively easy to save three-quarters of a million dollars a day, an increase of 40% in effectiveness.

The lack of production control is not a question of large versus small plants. In the metal trades, for example, the engineer declares that the size of the plant does not necessarily determine its efficiency, for some of the large plants as well as some small ones show a large waste factor.

Lack of Cost Control.—The majority of the industrial plants studied lack a knowledge of costs and have no cost control. Therefore there is no adequate method of judging fairly and accurately when improvements are needed and when waste is occurring. Not having the facts prevents prompt correction of defects. The above conditions are disclosed, for example, in the report on the metal trades. A survey of the printing plants in New York City made by the United Typothetæ showed that:

> " 56 plants use standard cost system.
> " 187 plants with no cost system, but with a knowledge of all general costs.
> " 741 plants with no cost system and incomplete knowledge of all general costs.
> " 554 plants with no cost system and incomplete knowledge of general costs.
> " The first two groups made money, the last two lost money in 1919."

Lack of Research.—While certain industries are ahead of the rest in plant research, the need for more intensive research activity is apparent in every industry. One industry which is backward in this respect is clothing. In the majority of men's clothing plants nothing approximating research is practiced to improve materials, processes, equipment or product. The assertion probably will not be challenged that there is not a single individual throughout the entire industry who is solely engaged in research and is thus without operating duties.

In the shoe industry there is lack of information as to market demands in this country and abroad. In all the leather industries there is need for scientific research to aid in predicting the kinds and quantities of leather required.

Faulty Labor Control.—With perhaps two or three exceptions, shoe shops have no departments maintaining modern personnel relations with the employees. Thus the worker has no unbiased means of approach to his employer, and the employer lacks the means for treating with his own employees. Among the plants studied, only a few have effective employment methods. Fewer keep a record and make an analysis of the reason why men quit. Men are usually discharged or quit work without any executive knowing the reason why. No steps are taken to correct the conditions that bring about so many expensive separations from the working force.

A high labor turnover is a rough index of one of the common wastes resulting from inadequate labor management. No facts are available to show the extent of labor turnover as an unavoidable element in industrial waste. The accessible data are not comparable for no common method of computation and analysis has been followed. However, this is an important factor of labor waste because of its magnitude and because of the expense involved in training new workers to take the place of those who leave.

In the shoe industry the cost of training an inexperienced man for cutting upper leather in a well managed shop is $576; for a semi-experienced man, $450; and to install an experienced man in a different shop costs $50. For the average shop these figures are unquestionably low.

The average labor turnover for the year 1920 in the metal trades plants covered (wherever record were kept, which was the case in less than half of the plants), was 160%—figured in most cases as the ratio between the number of "separations" and the average number of employees on the payroll. The highest turnover was 366%.

The building trades have given little consideration to the subject of labor turnover. In construction work it is particularly difficult to estimate the extent, because the actual percentage of turnover constantly varies as the building progresses and the number of men is increased and later decreased. Men quit for such reasons as the type of work they are to perform, the risk involved in the particular work, and unfair treatment by foremen. They are discharged for lack of work, incompetence, laziness, causing trouble, or sometimes because there are better men available. The labor turnover and service records of typical contractors show large losses.

Employment managers are rarely employed even upon the largest jobs, and "hiring and firing" is at the will of the foreman or superintendent.

Another fault in labor control is improper or inadequate rate setting. In negotiations and controversies between employer and operator in the shoe industry, what stands out is the lack of knowledge of facts which can be used as a basis for setting rates.

In a shoe factory, for example, with the adoption of a new style new rates have to be set. The operatives through their agent make a guess at the time demanded and therefore the proper rate to set. The manufacturer makes a similar guess. His estimate is usually lower than that of the operatives. A compromise is made, based not on facts but on the argumentative ability of the two parties. If the rate is set too high, it means unequal payments to the workers or else cutting rates later on. This policy is responsible for much of the friction in the shoe industry.

Ineffective Workmanship.—Still another loss resulting in low production arises from inefficient workmanship; for much of this management is responsible through failure to provide opportunities for education or special training. Management, however, cannot do more than provide these facilities, and experience has shown that it is difficult to interest workmen in training courses which are designed to increase effectiveness. Further, much ineffective workmanship arises from lack of interest in work or lack of pride in good workmanship. The field reports give no evaluation of spoilage, which is one of the measures of this form of waste.

Faulty Sales Policies.—The cancellation of orders is a condition peculiar to certain industries. It is especially acute in the clothing industry. Purchasers buying on long-time contracts return unsold goods at the end of the season, and claim and receive credit. In normal seasons cancellations have ranged from 3% to 14%, and returns from 5% to 11% in the average shop. In abnormal years, like 1920, cancellations have reached 33% and returns 18%.

The evil is general in the clothing and allied industries. It is common practice for manufacturers to oversell the dealers and oversell their own manufacturing capacity. They make and deliver what they can, and cancel the rest of their orders. The manufacturers follow the same bad custom in dealing with the textile mills.

INTERRUPTED PRODUCTION

Idle Men.—(1) *Minimum Unemployment.*—The amount of idleness or unemployment in industry can only be evaluated through rough estimates. There is no national machinery for collecting the facts.

But in the best years, even the phenomenal years of 1917 and 1918 at the climax of war-time industrial activities, when plants were working to capacity and when unemployment reached its lowest point in twenty years, there was a margin of unemployment amounting to more than a million men. This margin is fairly permanent; seemingly one or more wage earners out of every forty are always out of work.

This unemployment means for the worker a loss in wages, for industry increased overhead due to idle equipment and idle materials, and for the public a lessened purchasing power, with all its attendant evils.

(2) *Unemployment Caused by Industrial Depressions.*—During periods of industrial and business depressions, unemployment reaches its greatest amount. Such depressions appear more or less regularly at seven- or ten-year periods and each brings its increase in unemployment and wastage of the productive capacity of industry.

In January, 1921, a nation-wide survey of employment made by the U. S. Employment Service of the Department of Labor showed that there were 6,070,648 workers then employed in industry as compared with 9,402,000 in January of 1920, a decrease of 3,331,352 or approximately 35.5%. This survey covered 35 states and 182 industrial cities and centers and may be considered as fairly reflecting conditions at that time.

(3) *Intermittent Unemployment.*—In addition to minimum and climacteric unemployment, many essential industries show a high unemployment or idleness once a year or oftener. Practically all industries are in a sense seasonal.

To present a few examples: The clothing worker is idle about 31% of the year; the average shoe-maker spends only 65% of his time at work; the building trade workman is employed only about 190 days in the year or approximately 62% of his time; the textile industry seemingly has regular intervals of slack time; during the past 30 years bituminous coal miners were idle an average of 93 possible working days per year.

During the exceptional year of 1919, in the paper box industry 4,311 employees in 77 establishments averaged 90% of full time; in the women's clothing industry 6,772 women workers employed in 157 establishments averaged 91%; in the confectionery industry 12,152 workers in 101 establishments averaged 87%; and in the overall industry 6,546 workers in 129 establishments averaged 87% of full time. In the brick, chemical and glass industries the percentage of full time worked was 85, 84 and 87, respectively. In most years the percentage of lost days is much larger.

Not only does intermittent unemployment reduce the productive capacity of the industry in which it exists, but it brings other wastes. One consequence is a concrete but fallacious industrial philosophy, the "make work" or "lump of work" theory. This is the belief that there is only so much work to be done and that the sensible course of action is to retard production to make employment last throughout the year, or to uphold prices.

(4) *Unemployment Due to Labor Disturbances.*—Another form of unemployment comes from open conflict between management and labor. Here it should be said that in the past, at least, the amount of waste from the general run of strikes and lockouts through loss of wages and curtailment of production has been less than is popularly supposed. That these disturbances do produce unemployment is true, but in the industries studied they do not of themselves appear to constitute a major source of reduced production. The ramifications of such strikes with their attendant and indirect losses the Committee has been unable to trace.

Such labor disturbances are either strikes or lockouts. As it is difficult to distinguish between them and the industrial effects are practically the same, it has seemed best in this summary to deal only with strikes.

More than one-half of all the strikes that occurred between 1881 and

1905[1] and more than one-half of the employees thrown out of work were in highly irregular or distinctly seasonal occupations.

Since most strikes occur in seasonal employments, it can be deduced that output is not necessarily penalized, for it is often possible to make up the losses incurred by strikes through increased production at other times.

More coal was mined in 1910 than in 1911, although the former year witnessed many protracted strikes involving large numbers of employees. The year 1912, with 47% of the entire labor force out on strike and with an average loss per man of 40 days, showed an increased output of coal per man per day and per year, and six days more employment than in 1911, which was relatively strikeless.

The total production was also more. Low production in 1914 and 1915 was due to general business depression caused by the World War rather than to strikes.

In New York State in 1916 two days were lost per capita per year by those classed as gainfully employed, because of strikes. This was a loss only one-fifth as serious as average time lost through illness. In the same state in 1918 about 32% of the time lost from strikes and lockouts was in the building and clothing industries.

In addition to the direct loss of time, however, there is a loss incurred through retarded production previous to and immediately following strikes.

Wages and hours have always been the chief cause of strikes. There has been a marked falling off in the relative number of strikes for this cause in recent years as compared with 1898-1905.

Jurisdictional disputes, that is, strikes by the members of one trade against the performance of work which they regard as belonging to their craft by members of some other craft or trade, are relatively unimportant. The Bureau of Labor Statistics reports there were 19 such strikes in 1916, 21 in 1917, 16 in 1918, and 15 in 1919. However, there are disputes constantly arising which, while they do not lead to formal strikes, work demoralization and are a fertile source of inefficient use of labor.

In the building trades, jurisdictional quarrels represent about one-quarter of the total number of strikes.

Idle Material.—The waste of idle material through deterioration, obsolescence and carrying charges is large, particularly where there are great inventories of both raw material and finished goods. Unbalanced production is another notable cause of idle materials and consequent waste.

Idle Plants and Equipment.—Unsound production policies result in wasteful over-equipment.

Clothing factories are built 45% larger than is necessary; printing

[1] There are complete statistics for these years. Since 1906 the Department of Labor has had no authority " to require reports relative to strikes from anyone."

establishments are from 50% to 150% overequipped; the shoe industry has a capacity of 1,750,000 pairs of shoes a day, and produces little more than half that number; throughout the metal trades, standardization of products would permit of large reductions in plant and equipment.

Standardization of machine sizes would make possible the use of one machine for a greater variety of different jobs. The printing industry illustrates this point also. A common sight in any large printing establishment is expensive machines covered up and out of use, or inefficiently used for purposes other than that for which they were built. A printer secures a contract and buys a machine to do the work economically. When the work comes up for contract next time, if some other printer secures it, it invariably means another special machine. One concern paid $17,000 for a special press for printing a trading stamp. On losing this job, the press was scrapped, and later sold for $2,000. The contract in the meantime had been awarded to three other printers in succession, and each in turn had purchased a new press which he had to scrap or use disadvantageously at the expiration of his contract. Similar practices are common in other industries.

It has not been possible in this assay to estimate the amount of idle equipment, nor the accompanying waste through maintenance and depreciation charges.

RESTRICTED PRODUCTION

Production Restricted by Owners and Management.—Some of the evils of restricted production are chargeable to owners and management. In the building trades, contractors, builders and supply dealers have restricted production by maintaining high prices, collusion in bidding and unfair practices. At times there has been collusion between employers and labor, tending to raise prices unduly. The waste from these causes cannot be measured in this study.

By Labor.—Restrictions of individual output for which workers are responsible are susceptible of measurement. They are of two kinds. On the one hand, when workers are scarce the less conscientious workers become independent and slacken speed, whereas when workers are plentiful, they work with greater diligence and care for fear of unemployment. On the other hand, the dread of unemployment is so pronounced that employees engaged in seasonal enterprises frequently restrict production in order to make employment last longer; some workers, moreover, through consideration for their fellow employees limit production to provide work for them, a practice which ultimately results in an economic loss.

Important restrictions of output by employees can only result from collective action. In the building trades, for instance, some painters' unions do not permit of the use of a brush wider than $4\frac{1}{2}''$ for oil paint, although for certain classes of work a wider brush is more economical. Plumbers' and steamfitters' unions prohibit the use of bicycles and vehicles of all sorts during working hours. Members of those unions in some sections of the country demand that all pipe up to $2''$ shall be cut and threaded on the job.

The tools of the engineer are standard weights and measures, scientifically established. He cannot serve industry unless he can set standards for production and can measure work performed. Many unions now oppose the use of such standards. Practically all of the printing unions oppose these devices. The rules of the craft unions in the building trades also object to many labor saving devices, and thus contribute to waste in that industry.

The restriction of the number of apprentices is a common rule. The engineer in the building trade notes that restriction of apprentices in many cases seems extreme and unfair.

Unions are charged with restricting the use of machinery. Painters' unions refuse to allow their men to work on a job where a spraying machine is being used, making claim that the use of the machine is injurious to the health of the workman. Some labor organizations of minor importance, such as windowglass and stonecutters' unions, may also be mentioned as opposed to the introduction of machinery.

All such restrictions, so far as they prohibit the use of the best and most efficient machines, constitute limitations of output. The actions of most unions, however, are confined to the restriction of the use of machinery rather than its prohibition

The rule requiring that members of one craft union shall not encroach upon the work of another results in large waste and little benefits. Unions frequently require three or four skilled employees to perform various operations on a plain job which a single worker could satisfactorily do by himself. Union carpenters are forbidden to lay bricks, union plumbers are forbidden to do carpentering work, and the like.

A union rule in newspaper printing requires that all advertising matter coming into the plant in electrotype form must be reset by the compositors. This useless work is sometimes done weeks after the advertisement has appeared.

In as simple a matter as printing the names of individual firms on catalogue covers, where the imprints are all set up in slugs, after each imprint is run off, the pressroom workers have been known to insist that a compositor be brought from the composing room to make the change to the next imprint, while they stand idly by. In a case of this kind, where the runs are short, it amounts practically to requiring two persons to do the work of one. Similarly with paper handlers, sheet straighteners, feeders and pressmen, it is not at all uncommon to be forced to have men from several different unions participate in a simple piece of work which could be performed more easily and economically by one person. In the printing industry a somewhat different situation is found, in the case of pressmen, where the union sometimes requires four men to operate a machine, although three would suffice.

The following instances further illustrate restriction of output through divisions of labor:

Carpenters' helpers are prohibited from using carpenter tools, requiring carpenters to do such work as stripping forms from concrete. Experience shows that helpers can do this more economically and as well.

Brick masons insist on washing down and pointing brick work when laborers could do it more economically.

Structural steel workers under certain rules must bring the steel from the unloading point to the building site, thus doing laborers' work at high cost.

Structural steel men place reinforcing steel for concrete, whereas experience has proved conclusively that properly trained laborers can do it to as good advantage, and at greatly lowered cost.

Structural steel men claim the rigging on a job. In operating a small derrick used in footing excavation, the bucket cable had to be guided by hand and the hoisting engineer signalled by a skilled iron worker.

Hoisting engineers claim the right to run all types of engines, including small gas-driven pumps which require no skill. On one job a contractor had to hire a union engineer at $8.00 per day simply to start a pump in the morning, oil it occasionally, and stop it at night.

Union rules generally require distribution of plumbing materials above the first floor by union plumbers.

LOST PRODUCTION

From Ill Health.—A report on national vitality prepared in 1909 for the National Conservation Commission, appointed by President Roosevelt, estimated that there were then about 3,000,000 persons seriously ill at all times in the United States. This meant an average annual loss per person of 13 days owing to illness. It was estimated that 42% of this illness was preventable, and that such prevention would extend the average life by over 15 years.

Since that report was issued, an apparent reduction in illness has been accomplished; so that to-day an estimate of between eight and nine days working time lost through illness is probably near the fact.

In discussing public health conditions there is no clear distinction between the standing of the 42,000,000 persons classed as gainfully employed in the United States and those specifically engaged in industry. The 42,000,000 men and women gainfully employed probably lose on an average more than eight days each annually from illness disabilities, including non-industrial accidents—a total of 350,000,000 days. Of the 500,000 workers who die each year, it is probable that the death of at least one-half is postponable, by proper medical supervision, periodic medical examination, health education and community hygiene.

Assuming that the average life has, aside from all spiritual and human values, an economic value to industry of not less than $5,000, and assuming that the special diet, care, and medical attention required by a man chronically ill costs $3 per day, it has been estimated that the economic loss from preventable disease and death is $1,800,000,000 among those classed as gainfully employed—or over $700,000,000 among industrial workers in the more limited meaning of the term.

The preceding figures are derived from studies of individual groups, from insurance experience, from census records, from draft records, and there is experiential basis for the statement that this loss could be materially reduced and leave an economic balance in the working population alone over and above the cost of prevention of at least $1,000,000,000 a year.

Tuberculosis is the most important disease among industrial workers, two or three deaths per 1,000 per annum occurring at the working ages. It is estimated that 3 per cent of the wage earners, or about 1,250,000 lives are affected. The economic loss from tuberculosis death rate as affecting the working population is $500,000,000 annually. Pneumonia, influenza and typhoid fever are the most important communicable diseases among adults. Influenza and pneumonia, in non-epidemic years, take about 35,000 lives in the working ages, and account for at least 350,000 cases of illness. Typhoid fills close to 150,000 sick beds annually and takes 15,000 lives, mostly in the working ages.

In a large industrial area hookworm infection was present among at least 5% of the laboring population.

Malaria is so seldom a direct cause of death that it is difficult to estimate its extent and influence. It is responsible for much sub-standard health, and probably affects 1,500,000 people annually, covering 27,000,000 days absence.

It may be roughly estimated that 1,500,000 workers are infected with venereal disease. Judging by the draft figures, 5.6% would be an outside estimate for ages 21 to 31 in the general mixed population, white and colored, for all venereal infections. It has been estimated that about 60% of the infection occurs in this age period. Another study, it should be said, found less than 1% of syphilis in industry and about 3% in mixed population. The Mayo Clinic found 4.6% of syphilis in mixed classes and 10% among railway men.

There are more than 6,000,000 workers with organic diseases resulting mostly from infection.

Defective Vision and Defective Teeth.—Special attention has been given in recent years to the question of defective vision and to that of defective teeth. It is estimated that 25,000,000 workers have defective vision requiring correction. It is the experience of a number of plant executives that the correction of sub-standard vision brings increased quality and quantity of production, sufficient to pay for the cost.

A very large proportion of workers have defective teeth and mouth infection and other serious physical defects which reduces their effectiveness. Sub-standard conditions of health and physical deficiencies should be studied as a cause of fatigue in industry.

From Industrial Accidents.—In 1919 there occurred in industry about 23,000 fatal accidents, about 575,000 non-fatal accidents causing four weeks or more of disability and 3,000,000 accidents causing at least one day's disability. The figures for 1918 were about 13% higher.

The time lost is estimated to be 296,000,000 days. Allowing for an average wage of $4 per day during the time actually lost, adding an estimate for impaired earning power because of disability or death, but subtracting the subsistence of those killed, this gives an economic loss to the country of about $853,000,000 for the year 1919.

This is not the whole loss chargeable to accidents.

In one state (Wisconsin) the costs to employers for medical and surgical aid and hospitals' bills, and the overhead expenses of insurance, equaled 86% of the actual compensation paid to workmen. The compensation paid the workmen was about 22% of the total actual and prospective wage loss. Records from other states indicate that this is probably typical. On this basis the total direct cost of industrial accidents in the United States in 1919, including medical aid and insurance overhead, was not less than $1,014,000,000. Of this $349,000,000 was borne by employers and $665,000,000 by employees and their dependents.

These approximate figures are low because they do not include medical expenses incurred by workmen and not paid by the employer or insurance company; overhead cost or personal accident insurance carried by workmen; cost of training new men to take the place of those injured; employment and welfare department expense in keeping track of injured workmen and their families. The addition of these items would bring the total well over a billion dollars per year.

In this calculation no account has been taken of the indirect loss of production due to the stoppage or slowing up of work when an accident occurs. This affects not only the operation at which the man is injured, but associated operations as well. It applies also to "near-accidents" in which no personal injury occurs.

Experience indicates, and authorities agree, that 75% of these losses could be avoided, with a saving in direct, clearly ascertained losses alone of a quarter of a billion dollars per year to employers, and half a billion to employees.

In the State of Massachusetts, where about 150,000 mechanics are employed in the building trades, for the year ending July 1, 1920, there were 5,032 tabulated accidents representing a loss of time at 485,486 days.

In New York State during the four years 1910 to 1914 more fatalities due to accidents occurred in building and construction work than in all the factories put together, although about four times as many people are employed in the factories as are employed in building and construction work.

It may be noted that whereas accidents in some construction trades involve losses up to 10% of the labor cost, certain contractors have found it possible to cut their accidents in half through special efforts.

Insurance rates in building construction are higher than in any other industry. Rates are dependent on the cost of the accidents which actually occur. Therefore, any reduction in accidents reduces the insurance paid.

Approximately $30,000,000 is paid to insurance companies each year by builders alone for compensation and liability insurance. This figure by no means represents the total loss. While state laws vary, in general an injured workman must be disabled some seven days to two weeks before receiving an award, and then receives as compensation only a part of his average daily earnings. The loss to the contractor is less tangible, but where a man is out, a new one must be broken into a job with loss of time and frequently loss of material. In case of serious accident, also, there is stoppage of work and extensive loss of time of the entire force. In the opinion of one of the best authorities in the country the actual cost of insurance represents not more than 25% of the total economic loss, which, if correct, would bring the total cost due to accidents in the building industry to $120,000,000 per year.

An official of a large insurance company believes that by proper safety measures, the waste due to accident in the building industry can be reduced 75 to 80% in two to five years of earnest effort, and that construction labor cost can be cut 3% by these measures. Another official estimates, from actual accomplishments in safety measures, that a total of more than 12,000,000 days a year could be saved the industry by the application of safety methods. In certain industries, on the other hand, such as boot and shoe manufacturing, accidents are insignificant.

CHAPTER III

RECOMMENDATIONS FOR THE ELIMINATION OF WASTE IN INDUSTRY

Opportunities and Responsibilities.—In preparing this third part of the summary, the Committee has endeavored to interpret responsibility in terms of what might be done to eliminate waste in industry. The policies and methods recommended are such as are already in successful use in the industries and plants investigated. The opportunities outlined show how support may be given to those efforts and what are the agencies especially responsible for elimination of waste in its broader aspects.

This part of the report has been developed under seven major groupings of responsibility and opportunity as follows: responsibility of management, responsibility of labor, responsibility of owners, responsibility of the public, opportunity of trade associations, opportunity for governmental assistance, and duty of engineers.

Detailed data supporting the general statements which follow will be found in Section II.

I. RESPONSIBILITY OF MANAGEMENT

Improvement of Organization and Executive Control.—Planning and control should be adopted as fundamentals of good management. For the most part they have not as yet penetrated the mass of American industry.

Managerial control, when properly planned, extends its influence into every activity of an industrial organization and plant, reaching materials, design, equipment, personnel, production, costs and sales policies and coordinating these factors to a common objective. While this statement applies more particularly to large plants, still the smaller units can utilize the same principles and thus secure the advantage of modern methods.

Production Control.—Conscious production control tends to reduce or eliminate waste by shortening the total time of production. It ensures the delivery of material where needed, whether it be material in process or a finished product ready for shipment. Material schedules should be installed and used. These are a means to reduce idleness of material, of the workers who are going to operate upon it and of the machines and tools forming the equipment for the processes which it is to enter. Work in process should be planned in advance by methods which will ensure its timely delivery to the machine or operation where it is needed, so that there will be no idleness between jobs.

Balancing Productive Capacity and Demand.—Productive capacity should be conservatively based upon a careful study of normal demand.

The sound relation between capacity and demand is shown only as a wise policy is adopted in regard to planning, routing and scheduling work and as improved shop methods are put into effect. There is plenty of testimony to the possibility of increasing production from a given amount of equipment through improved management.

Development of Purchasing Schedules.—There should be the same careful coordination of purchasing function and control of material purchased and not yet received as is given to material already in the plant. Where this is done the interruption of work due to lack of material, or to imperfect material, is largely done away with.

Elimination of Cancellations and Curtailment of Returns.—The practice of cancellation of orders between manufacturer and mill and between manufacturer and customer should be eliminated and there should be a curtailment of the privilege of returning goods ordered and received. Such cancellations and return practices are vicious and directly hinder stabilization.

Correlation of Production Schedules with Sales Policies.—Production schedules should be based on a carefully formulated sales policy determined from an intensive study of markets, thus stabilizing production. By this method, which differs radically from the usual haphazard practice, the pernicious effect of seasonal manufacturing can be partially overcome. In a few plants in the boot and shoe industry this beneficial result has been brought about.

Inspection.—Adequate inspection should be maintained.

In many factories, losses of labor and material in spoiled and defective work are unwarrantedly high. The aggregate annual wastage of human effort and goods from this cause is very great. The indirect losses, which are harder to detect and measure, are often greater than the direct losses.

Maintenance of Plant and Equipment.—Plant and equipment must be maintained continually in working condition.

The methods and means for anticipating possible breakdowns and the like have been developed and are well known. Upkeep of plant is conducive to maximum production as it assures that equipment and machinery will be continually in a condition to operate.

Uniform Cost Accounting.—Generally accepted systems for finding costs should be established in each American industry. In controlling production and in judging fairly and accurately when and where progress and improvement are being made, the lack of a good cost control system is necessarily a source of much waste.

Methods of Wage Payment.—Methods of wage payment should be adopted, equitable and just in their basis, ensuring a proper relationship between effort put forth and results achieved by all who participate in the enterprise.

Two leading facts should be grasped: special wage methods are almost wholly futile in the absence of standardization and system in the work; production standards and proper control of work will, without any special wage method, accomplish a large part of the desired result.

A danger lies in assuming that clever devices can take the place of good management. The most important function of a wage payment method from the production standpoint is to oblige management to do its duty.

Standardization of Product.—Products should be standardized consistent with progressive development of manufacturing.

Standardization of Materials.—Materials should be standardized to the fewest practicable kinds, sizes and grades.

Standardization of Equipment.—At least the details of equipment, including machines and tools, should be standardized so as to permit of the widest interchangeability and maximum usefulness consistent with improvements in design and invention.

Performance Standardization.—Performance standards should be developed as a valuable aid to planning and production control. Under the week-work system such standards are the basis of a just measurement of the individual worker's performance and of the adjustment of his wage rate to his capacity. Under the piece-rate system they are the basis of just rates. Without standardization of appliances, conditions, work content and method, no valid performance standard can be maintained.

By constantly comparing actual performance with the standards and promptly investigating the causes of departure from standard, the manufacturer can quickly detect adverse conditions as they creep in, and can rectify them. Performance standards, in fact, will enable him to plan the size of his plant and operating force for a given volume of business for continuous operation.

Management and Workers.—Management has a definite responsibility in selecting, up-grading and maintaining personnel.

Experience indicates that the best results can be obtained when employment and personnel direction develops a sense of mutual interest in production on the part of management and workers. To accomplish this, management should stimulate the interest of workers, individually and collectively, in creation, in craftsmanship and in the contribution of their experience and knowledge to the productive processes. "Industrial relations" to be effective should be closely allied to production and concern themselves with educating the workman in the science of process, recording his accomplishment and enabling him to become conscious of the relationship of his work to the whole.

During the past few years, there has been a widespread advance and extension of employment and personnel methods in industry and many of the accruing advantages are now generally known. Among these is a means whereby the worker has a direct avenue of approach to his employer, and the employer has a means for communicating organization policies to the employees.

Such industrial education and training as has been conducted by certain leading manufacturers has obtained beneficial results, and it is believed that further developments along these lines is desirable.

Prevention of Accidents.—Management has a definite responsibility to prevent industrial accidents. Systematic preventative measures can and should be inaugurated. With regard to methods there is already an abundance of information.

Research.—Industrial research should be consistently carried on both in the individual plant and by associations. The need for knowledge obtained by such research is manifest in every industry studied. Although comparatively new in this country, the success of research laboratories conducted by a few large industrial firms and trade associations is well known.

II. RESPONSIBILITY OF LABOR

For Increasing Production.—In discharging its responsibility for eliminating waste in industry, labor should cooperate to increase production.

The need for facts instead of opinions stands out everywhere in the assay of waste from intentional restrictions of output. All concerned need to remember that science is an ally and not an enemy, and that no policy can be soundly based which ignores economic principles.

Ignorance of these principles lies at the root of most of labor's restriction of output. The engineers who made the field assays unite in pointing out that this attitude is beginning to change. The change should be aggressively led; not allowed to drift. Labor organizations have an opportunity to-day which may not soon occur again to draft for themselves a new bill of rights and responsibilities. Unions are now great organizations with such funds and personnel at their disposal as would have seemed fantastic even a quarter of a century ago. Their influence permeates the whole of American industry, unionized or not. No service which they can render can be socially more valuable than that of studying the needs of the industries in which they earn a livelihood, and allying themselves with the technicians who serve with them to increase production which will inure to the ultimate benefit of all.

For Standardization of Work.—Labor should cooperate to prepare for and even demand the determination of and use of performance standards.

This recommendation made by the engineer reporting on the printing industry applies to labor in many other industries as well: The unions rightly insist on reasonable hours and the best pay obtainable, but to discharge a responsibility in eliminating waste they should lend themselves to the greatest flexibility in the utilization and economy of the services of their members. It is to the worker's interest rather than to his detriment that his services should not only be efficient but definitely recorded and evaluated.

For Changing Rules Regarding Restrictions.—Labor should change its rules regarding restriction of output, unreasonable jurisdictional classification and wasteful methods of work, thereby removing sources of waste.

Certain restrictions probably have seemed necessary to labor as a basis for trading with employers. This report is concerned with restrictions only in their relation to waste. It recommends a revision in the light of the strength and standing of organized labor to-day. The trading basis is not sufficient justification for union rules.

For Improving Health and Reducing Accidents.—Labor is responsible no less than management for improving the health of the workers and for preventing accidents in industry. Unions have accomplished much in protecting their members through educational work in health and safety, but there is still much to be done, in cooperation with management and community organizations.

Periodical physical examinations and medical advice have resulted in a number of instances in substantial improvement in the health and well-being of workmen. In many cases, however, there exists a strong prejudice against such examinations. As a result of this unfortunate attitude many workers live in subnormal health when their condition is easily remediable.

For Improving Industrial Relations.—Inasmuch as the organization of personnel relationships in industry can only be accomplished through the co-operation of both employer and employee, labor should assist in such work of organization and in maintaining and utilizing the structure developed. Among the most important causes of industrial discontentment are those connected with waste in industry: intermittent employment, fear of unemployment, lack of scientific and accepted methods of determining wages and hours, inequalities of opportunity, ill health and industrial accidents, as well as those caused by backward management and restrictions of output.

III. RESPONSIBILITY OF OWNERS

The owners of industry through the banking function or otherwise share in the responsibility for eliminating waste in industry. They have the duty particularly of assisting in stabilizing production. To carry out such a policy is peculiarly the banker's interest.

While it is true that balance sheets and income statements are gages of the degree of success of a business, it is evident from the assay of waste that these statements often do not reveal all or even the greater part of the facts regarding production. Certain banks have an industrial staff to give service to their customers and to study industrial questions more closely. It may not be long before such things as good management methods are universally recognized as commercial assets.

IV. RESPONSIBILITY OF THE PUBLIC

Need of Public Interest.—In the study of industrial waste, there can be no setting apart of the public as a separate group. The public comprises all groups, and the public's responsibility for eliminating waste is large. A campaign to increase the productivity of industry cannot be conducted without widespread interest and support. The engineers can initiate such a campaign, but they cannot press it to a solution unless the public so desires.

Style Changes.—In certain industries the consuming public is to a degree responsible for seasonal fluctuations because of the eagerness with which it accepts or adopts changes in style. Styles should be viewed at least in part from the standpoint of usefulness and economy.

Distribution of Demand.—The public can assist in stabilizing industry by accepting a sensible distribution of demand throughout the year.

This applies for example to the building industry in which there is a strong tradition to the contrary. Instead of crowding our main construction work into seven or eight months, not only must work in the slack months be developed, but all that can be deferred from the busy to the more idle season should be so deferred.

Community Co-operation With Industry.—Public and semi-public agencies can assist by definitely encouraging and supporting the efforts for elimination of waste. Bodies such as local Chambers of Commerce and other civic and community associations can bring influence to bear through local conferences with the different branches of industry. In particular such effort might be directed toward the construction of dwellings, the furtherance of public health and the prevention of non-industrial accidents.

Collective purchasing agencies may assist by educating the public in better methods of buying, thus having an influence on the stabilization of industry by reducing the number of items of goods demanded and distributing the demand over a longer period of time.

V. OPPORTUNITY OF TRADE ASSOCIATIONS

Work for Comprehensive Organizations.—Trade associations should be formed in those industries lacking comprehensive organizations.

The clothing industry lacks any comprehensive trade body through which common problems can be studied and common remedies applied. The organizations supported by this industry as a whole have to do principally with marketing the product, such as displaying goods and meeting buyers. There is no joint agency studying the obvious weaknesses in manufacturing.

As another example, there is no association for the printing machinery trade, and it is recommended that one be formed.

In many industries which already have trade organizations a greater degree of cooperation and publicity for their work and policies would steadily improve and increase their effectiveness. Trade organizations should collect and make public trade information, including current data on production, stocks on hand, consumption, the general price levels of essential commodities, and statistics of active and idle plant capacity. Such information would make for stability and elimination of waste.

Industrial Standardization.—Trade associations should promote programs for the standardization of cost accounting methods, the introduction of standardized material specifications, the establishment of production standards, the standardization of equipment and the standardization of finished products.

VI. OPPORTUNITY FOR GOVERNMENTAL ASSISTANCE

National Industrial Information Service.—A national industrial information service should be established to furnish timely, regular, and complete information on current production, consumption and available stocks of commodities, supplementing the work of private agencies.

One of the outstanding facts in connection with this assay is the scarcity of authoritative sources of satisfactory information. Various industries have tried to secure data informally. But it is essential that such information be collected and presented to the entire industrial community, including the buyer, the seller and the banker.

The great need for complete information with regard to current production and consumption and stocks of every important commodity, is obvious to all serious students of industry.

A National Statistical Service.—A national statistical service should be established and maintained covering employment requirements and conditions throughout the country.

The fundamental knowledge required to make a correct analysis of unemployment in any period is not at present obtainable. The meager information for such a study has to be collected from many agencies. These are under no central control, they are often not in contact and frequently duplicate effort.

During the past seven years the U. S. Bureau of Labor Statistics has gathered statistics of strikes and lockouts from various sources and has published them in the *Monthly Labor Review*. These figures are not comparable with the statistics contained in the earlier reports either in completeness or in accuracy. The Bureau has not undertaken any special field investigations, and it has no authority "to require reports relative to strikes from anyone."

As the extent of seasonal employment and temporary shutdowns and layoffs has not been subjected to a general statistical measurement, the resulting industrial waste cannot be determined with any degree of accuracy. There are no employment figures comparable, for instance, with those collected in England by the Board of Trade.

Principles for Adjustment and Settlement of Labor Disputes.—A body of principles for the adjustment of labor disputes should be accepted, which can be developed with experience.

Thus far American legislation for the settlement of these problems presents almost as many varieties as there are states. The nomenclature of the bodies created to deal with controversies between employer and employee may in many cases be the same, but their duties and manner of appointment differ widely. Almost the only consolation to be drawn from this legislation is the fact that it recognizes a need. In no state has the existing machinery shown itself capable of meeting a great crisis. The experience of Kansas is too new to be included in this comment.

No federal legislation has resulted from the recommendations of the Second Industrial Conference (1919)—the most comprehensive attempt yet made in America to meet this pressing problem. In view of the waste resulting directly and indirectly from labor disputes, there is obvious need for wisdom to create and operate successfully agencies endowed with sufficient power and vision to adjust or stop the destructive and needless controversies over labor questions.

Public Health Policy.—A national policy regarding public health should be accepted and put into effect. The reports dealing with health, prepared in connection with this study by a group of physicians, indicate the importance of maintaining the health of industrial workers as a factor in production and as a means of eliminating one form of waste. These reports also declare for an aggressive, continuous, national public health policy.

National Program for Industrial Rehabilitation.—The national program for industrial rehabilitation should be encouraged. It should offer opportunities for the education and placement of those having physical and mental defects as well as those handicapped by industrial accidents or by war. Formerly such incapacitated men were treated as if they had no economic value. Many striking examples, however, have led to the conviction that many such men can be so trained as to make them useful workers. Comprehensive efforts for their vocational rehabilitation are being made through the co-operation of federal, state, industrial and commercial agencies.

Nation-wide Program of Industrial Standardization.—A nation-wide program of industrial standardization should be encouraged by the government in cooperation with industry. In the standardization of design of product, methods of procedure and number of models, there rests a large opportunity for the reduction of waste.

A special service which the government can render in this connection is the standardization of its own demands. Several government departments have their own paper specifications, for example, with no relation to each other, or to any standard brand. These departments might well take the first step by standardizing the paper they use on the basis of a selected list of well-known brands.

It is not sufficient, however, to attempt to standardize the product of a given industry, for almost every industry is so dependent upon others that they too must co-operate. The federal government could call together the representatives of the trade associations of interdependent industries and in co-operation form committees for this purpose. The opinions or decisions of such committees might from time to time be promulgated as standards of practice.

Revision of Federal Laws.—Where federal laws interfere with the stabilization of industry they should be revised in the interests of the whole people.

The largest area of waste lies in the periods of slack production and unemployment, due to the ebb and flow of economic tides between booms and slumps. Studies of industries as a whole show that we usually expand our equipment at the periods of maximum demand for products instead of doing our plant expansion during periods of slack consumption. While it cannot be expected that all industry could be so stabilized as to do its capital construction in slack periods, there are some industries which could be led in this direction by co-operation with the government and co-operation among themselves. This applies particularly to railways, telephones, telegraphs, power concerns and other public utilities, and to expenditure upon our municipal, state and national public works.

As a striking example, in a seasonal industry such as coal mining, no adequate solution regarding stabilization can be found except through organized co-operation of operators, labor, railroads and large consumers. Under existing laws as to combinations, such co-operation cannot be carried out. Therefore, we believe that federal legislation is necessary permitting such cooperation under competent government authority.

VII. DUTY OF ENGINEERS

The duty of engineers is a part of all the responsibilities previously stated in different recommendations.

Engineers come in contact with and influence every activity in industry and as a body possess an intimate and peculiar understanding of intricate industrial problems. They are in a position to render disinterested service, and their peculiar responsibility is to give expert judgment wherever engineering training and technical skill are needed to reach a just decision.

This report brings forward certain pressing problems concerning the solution of which engineers should hasten to assist. The assays of waste show first the need of definite and quantitative industrial information on a multitude of points. Science has pushed ahead in some directions; it lags behind in others. The duty of the engineer is pre-eminently a duty to enlarge the boundaries of knowledge. His lifelong training in quantitative thought, his intimate experience with industrial life, leading to an objective and detached point of view, his strategic position as a party of the third part with reference to many of the conflicting economic groups, and above all his practical emphasis on construction and production, place upon him the duty to make his point of view effective.

It is peculiarly the duty of the engineers to use their influence individually and collectively to eliminate waste in industry.

CHAPTER IV

DESCRIPTION OF QUESTIONNAIRE AND EVALUATION SHEET

THE METHOD OF ASSAY

The Questionnaire.—The Questionnaire used by the Committee was prepared as a guide for field investigators. Wherever it has been used, however, plant managers have shown such marked interest that the Committee believes its publication may provide a standard of measurement for American industries in general.

Waste is classified under three heads:

1. Organization, which deals with the human factor.
2. Technical knowledge, which deals with the physical factor.
3. Utilization, which deals with performance.

Fifty-eight main topics and two hundred and sixty leading questions are covered by the Questionnaire. Twelve main topics come under the heading "General"; twenty-one main topics and ninety-two leading questions under "Organization"; seven main topics and forty-four leading questions under "Technical Information"; and eighteen main topics and one hundred and twenty-two leading questions under "Utilization." (See Questionnaire, page 39.)

The Evaluation Sheet.—The Evaluation Sheet is a summary of the information contained in the Questionnaire, and is intended to be a mechanism for analyzing and comparing the relative values of the waste factors. (See Evaluation Sheet, page 50.)

The same grouping and sequence of information is followed as in the Questionnaire, with the addition of an assignment of responsibility for waste to Management, Labor and Outside Contacts (the public in general, trade relationships, etc.).

Instructions for using the sheet are given on page 35.

The Evaluation sheet does not attempt to determine the efficiency of a plant in percentages. The totals indicate waste and not effectiveness.

It will also be noted that the key of percentages ranges from 0% excellent to 80% bad, making no provision for 100%. This decision was arbitrary, and limits the maximum possible points of waste to 80. In the same way, the best practice now existing was taken as standard or 0% of waste.

INSTRUCTIONS TO FIELD DIRECTORS.

Fill out one field report as per attached copy for each plant investigated.

This field report is an evaluation of the answers to the guide questions or questionnaire.

The causes of waste to be assayed have been grouped in three headings, the guide questions or questionnaire being arranged according to this grouping.

1. *Organization.*—Mechanism of industry as to type, methods (paper work) and personnel. Assignment and discharge of responsibilities and relationships.
2. *Technical Knowledge.*—Available engineering knowledge as to product, plant and materials.
3. *Utilization.*—Effectiveness of organization and technical knowledge. Direction, control and accounting factors.

Avoidable waste is evaluated in comparison with the best attainable conditions now practicable according to present knowledge.

ASSIGNING POINTS—OR RELATIVE IMPORTANCE

Put 100.0 in space (*d*).

100.0 assigned points representing 100% possible waste. Determine according to judgment and impressions from investigation, the relative weights of the three main divisions of causes, placing figures in spaces (*a*), (*b*), and (*c*), the total equaling 100, space (*d*).

This relationship will be identical for all plants in the same industry.

Determine according to judgment and impressions from investigation, the relative responsibility of management, labor and outside contacts, dividing the assigned points on total line, column 13, to total, same line, columns 1, 5, and 9.

This relationship may be varied for different plants as may appear necessary from their type, size or geographical location.

Distribute according to judgment and impressions from investigation the total assigned points columns 1, 5 and 9, to separate questions or group of questions as may apply. Bracket grouped questions.

Check figures by adding across and down.

ESTIMATE PER CENT OF WASTE, IRRESPECTIVE OF ASSIGNED POINTS

For each question answered, estimate per cent avoidable waste as keyed with relation to condition being excellent to bad in relation to least waste.

Place per cent opposite question number in columns 2, 6, and 10 as applies, if these questions are grouped. If they are independent of each other, place the per cents in columns 3, 7, and 11.

Average per cent in columns 2, 6, and 10 where and as questions are grouped or bracketed.

Enter averages in columns 3, 7, and 11 on line with corresponding assigned points in columns 1, 5 and 9.

CALCULATING WASTE BASED ON ASSIGNED POINTS

Multiply relative weights in columns 1, 5 and 9 by corresponding per cents in columns 3, 7 and 11. Enter results—points waste—on same line in columns 4, 8 and 12.

Add points waste, same line, columns 4, 8 and 12. Enter totals same line column 14. Add columns 4, 8, 12 and 14, entering totals under each of 3 main divisions.

Check additions. Total each division, columns 4, 8 and 12 = total column 14 (Sps. *e*, *f*, or *g*.)

Obtain grand total, cross checking as above.

GUIDE QUESTIONS FOR FIELD WORKERS

Index to Questionnaire

Subjects in italics have been added to the original Questionnaire.

INDEX TO QUESTIONNAIRE—*Continued*

Index to Questionnaire—*Continued*

GUIDE QUESTIONS FOR FIELD WORKERS

Questions in italics have been added to the original Questionnaire.

D. Descriptive

1. Date of Report.
2. Type of Industry.
   As classified for investigation.
3. Name of Concern.
   (a) *Conducted as corporation, firm, or individual.*
   (b) *Date of beginning business.*
   (c) *Date of incorporation.*
4. Address.
   (a) Is plant well located as to:
      (1) *Incoming raw material and supplies?*
      (2) *Outgoing product to be marketed?*
      (3) *Desirable grades and sufficient supply of labor?*
5. Where are the General Executive Offices?
6. Location of Plant or Plants and when was each Established?
7. Class of Work—contractual, repetitive or continuous.
8. What are the Products Manufactured?
   List in sufficient detail to show any variance in type with reference to process or secure catalogue to support any generalization.
   (a) To what extent have you advanced the trade or art, as to:
      (1) Increased yield of finished product?
      (2) Increase in per-worker production?
      (3) Reduction of hard manual labor?
      (4) Safety of operation?
      (5) Improved quality of product?
      (6) Decreased maintenance costs?
      (7) After allowance for investment charges, what would you estimate as the net economy?
   (b) What patent protection is enjoyed, and when do existing patents expire?
   (c) What part, if any, of business is for export?
   (d) Briefly describe competitive conditions existing.
   (e) About what percentage of your trade's total output do you produce?
   (f) Are sale-prices and terms uniform to all customers?
   (g) After a proper return on invested capital, do returns provide means for reasonable expansion; has this condition changed since the beginning of the War?
9. What has been the Volume of Business for 1918, 1919, 1920?
   State in months, both in units of product and in money value.
   (a) *Is work seasonal?*
      (1) *What month is busy season?*
      (2) *What month is dull season?*
      (3) *Explain the seasonal feature.*
      (4) *What effort is made to overcome seasonal fluctuations?*
      (5) *Is work taken at less (or no) profit during slack season to keep organization together?*
10. What was their Manufacturing Capacity in 1918, 1919 and 1920?
    State in units of product.

D. Descriptive (Cont.)

11. What is the Total Investment in Plant?
12. What Percentage is Required on Investment to Preserve Total Investment?
13. *What activities are they chiefly interested in?*
    (*a*) *Standardization of types and sizes?*
    (*b*) *Standardization of wages for identical jobs?*
    (*c*) *Standardization of cost data?*
    (*d*) *Standardization of sale prices?*
14. *Have they established any plan to scale wages according to fluctuating prices and living costs?*

K. Organization.

1. Is there a Chart of Organization?
    (*a*) When was it prepared?
    (*b*) Do means or responsibility exist to keep it up?
    (*c*) Is it kept up-to-date?
2. Is Organization Built up Functionally or around Individuals?
    (*a*) *What is policy with reference to understudies?*
    (*b*) *Are understudies trained for minor executive functions, and are latter filled by promotion from body of workers?*
3. Is there an Organization Write-up?
    Are the duties of each unit function or member of the organization contained in writing?
4. *Are there Standard Written Instructions as to How each Function is to be Performed?*
    (*a*) *How are method changes authorized and followed up?*
    (*b*) *If corporation has plants in various locations, how are they co-ordinated with Home Office—including appointment and supervision of resident managers?*
5. Is there a Research Department?
6. Are Personnel Records Maintained?
    (*a*) Are they kept up progressively as to quality and quantity production of the worker?
7. What is the Procedure of Employment?
    (*a*) Is any evidence of ability required on hiring, as O.K. of foreman, medical examination or investigated references?
    (*b*) How is worker introduced to job?
    (*c*) Is definite policy practiced to develop each worker systematically?
        (1) Vacancies filled by promotion, so as to recruit mainly for lowest positions?
        (2) What effort is made to develop worker's versatility or all-around trade skill?
    (*d*) Is worker trained under competent functional instructors as to best method of performing work?
        (1) Are they trained in separate shop, or regular shop?
        (2) Are definite assignments furnished by instructors?
8. How many Employees are on Payroll, by Months, for Years 1918, 1919 and 1920? Secure in sufficient detail to derive relative quantitative values of unemployment.
    (*a*) What efforts are being made to overcome seasonal fluctuation?
    (*b*) How many foremen employed?
        (1) At present?
        (2) In normal times?

K. Organization (*Cont.*)

(*c*) Same as next above but as to "men employed":
Proportion of foremen to workers is useful if obtained for several plants in same industry.

9. Are Records of Discharges and Layoffs kept and Tabulated by Causes?
    (*a*) What is the amount due to
        1. Incompetence?
        2. Temperament?
        3. Physical condition?
        4. Lack of work?
        5. Wages?
    (*b*) Are incompetent workers given training or tried at other work before discharging?
10. Practice of Temporary Shutdowns.
    (*a*) For what reasons?
        1. Inventory.
        2. Wage agreements.
        3. Because of unbalanced production.
        4. Fluctuations in volume of business.
        5. Other causes.
    (*b*) How many employees were affected by each?
    (*c*) For what period of time?
    (*d*) What was the loss in output and money value thereof during the period of shutdown?
11. Are Quits Followed up and Investigated?
    (*a*) State number of quits due to different causes during 1918, 1919 and 1920 respectively (home conditions, working conditions, availability of plant, etc.).
    (*b*) If figures are not available list causes according to relative order of importance.
12. What was Labor Turnover for 1918, 1919 and 1920?
    (*a*) How is it figured?
    (*b*) What proportion of new employees made good?
    (*c*) Has effect of labor turnover on production and cost been determined?
13. How is Wage Scale Determined?
    (*a*) Is it based on
        1. Union scale?
        2. Competitive labor market?
        3. Arbitration or agreement?
        4. Living costs?
    (*b*) What is the overtime rate in production to day rate?
    (*c*) Are workers paid day rates or on basis of piece work, task and bonus or other forms of financial incentives?
    (*d*) If piece work or bonus how is rate determined?
    (*e*) Are there production standards for day work, whereby relative performance of workers is determined?
14. What are the Hours of Labor per Day and Week?
    (*a*) How or by whom determined?
    (*b*) How many shifts?
    (*c*) Are any productive workers regularly given overtime?
    (*d*) Estimate overtime in man-hours per month for productive work.

K. Organization (*Cont.*)

15. Is Shop Open, Non-union, or Union?
    (*a*) If Union, what is agreement with reference to apprentices?
16. Is there any Form of Shop Representation?
    (*a*) By whom initiated and why?
    (*b*) State plans.
    (*c*) When was it instituted?
    (*d*) What are extent of powers?
    (*e*) What are comments of the management as to the effectiveness?
17. During the Past Five Years what Labor Difficulties have been Experienced Due to Strikes and Lockouts? Obtain the following information in each case:
    (*a*) Date on which strike or lockout occurred.
    (*b*) Date ended.
    (*c*) Cause.
    (*d*) Length of time previous to strike or lockout in which production was affected.
    (*e*) Length of time subsequent to strike or lockout before production return to normal.
    (*f*) In what departments did strike or lockout occur?
    (*g*) How many employees in these departments were affected?
    (*h*) How many employees in these departments remained in?
    (*i*) How many employees in other departments were laid off due to lack of work?
    (*j*) How many new employees were employed during strike?
    (*k*) What was the average labor force during strikes or lockouts compared with that preceding it?
    (*l*) What was the loss of production during strike or lockout, measured in units of product or assemblies?
    (*m*) What was the property loss, if any?
    (*n*) How settled?
18. What Had Been the History of Labor Difficulties Due to Stoppages (Unsanctioned Strikes)?
    (*a*) Date on which stoppage occurred.
    (*b*) Date ended.
    (*c*) Cause.
    (*d*) In what sections did stoppage occur?
    (*e*) How many employees in these departments were affected?
    (*f*) How many employees in other sections were laid off owing to lack of work?
    (*g*) What was the loss of production during stoppage, measured in units of product or assemblies?
    (*h*) How settled?
19. Is Personnel Function Headed Up?
20. What is the Cost per Year Chargeable to Accidents? (As measured in hospital charges, compensation insurance and damages awarded and wages paid during incapacity.)
    (*a*) What was the total number of accidents of every nature for years 1918, 1919 and 1920?
    (*b*) How many were fatal?
    (*c*) How many of serious permanent nature?
    (*d*) What was the average time lost through incapacity?
    (*e*) Is there a definite safety function and how does it operate?
    (*f*) What results are accomplished?
    (*g*) Are accidents closely followed up in homes and hospitals?

K. Organization (*Cont.*)

(*h*) Are efforts made to place permanently or temporarily disabled workers on suitable jobs?
(*i*) What reduction in insurance rate has been accomplished during 1918, 1919 and 1920, by accident prevention measures?

21. What is the Percentage of the Payroll Expended in So-called Welfare Work?
(*a*) Is there a Welfare Department, and if so, its scope?
(*b*) What Welfare Work has been attempted and discontinued, and why?
(*c*) What are the locker facilities?
(*d*) What are the toilet facilities?
(*e*) Is there a Benefit Association?
(*f*) Is there a restaurant for employees?
(*g*) Are there rest rooms?
(*h*) Are there rest periods?
(*i*) Are there recreation rooms?
(*j*) Is provision made for investigation and betterment of unfair conditions?
(*k*) To what extent do workers make suggestions and through what channels?
(*l*) To what extent do operatives benefit by suggestion?
(*m*) Is there a plant paper?

T. Technical

1. In what Way does the Plant Management Enter into Organized Relationship?
(*a*) With its industry?
(*b*) With similar industries?
(*c*) With inter-dependent industries?

2. Is there a Layout of Plant?
(*a*) Is it for insurance purposes only?
(*b*) Does it show the various departments, machines and work places?
(*c*) Does it show flow of materials or work?
(*d*) When was it made?
(*e*) Is it kept up to date?
(*f*) What means or responsibility exist to keep it up to date?
(*g*) Are changes in layout instituted by recommendation of foreman or as a result of staff study?
(*h*) *Square feet of floor space.*
(*1*) *Operating.*
(*2*) *Storage.*
(*3*) *Administrative* (*office*).
(*i*) *Describe source of power—Water? Steam?*
(*1*) *Manufactured.*
(*2*) *Purchased.*
(*j*) *Are automatic sprinklers in operation?*

3. Is there an Equipment Inventory?
(*a*) Is record of repairs, replacements and depreciation of individual machines or groups made and maintained?
(*c*) Is each piece of equipment numbered?
(*c*) Is inventory kept up to date?

4. Are there Standard Specifications for Equipment for the Various Operations?
(*a*) Give results of savings due to standardization of equipment.

T. Technical *(Cont.)*

(*b*) Have there been important changes in equipment, machinery and tools, during the last twenty years, which have improved efficiency in your industry? If so, state in a general way what these changes were.
(*c*) If special machinery and equipment have been developed, what savings have resulted?
(*d*) If automatic or semi-automatic equipment has been installed, what savings have resulted?
(*e*) Are there slide rules or charts covering speeds and feeds?

5. Is there a Separate Maintenance Department?
(*a*) To whom is it subordinated?
(*b*) Is equipment maintained on a basis of periodic inspection and repair?
(*c*) What savings have resulted by this?

6. Are Tools Standardized?
(*a*) Are drawings or gages used?
(*b*) Who is responsible for design of or standards for tools?
(*c*) Is there a department for making tools?
(*d*) Who grinds and sharpens tools or is responsible for their condition for use?
(*e*) Is tool room well equipped?
(*f*) Is tool room neat, orderly and under effective control as to tools, in and out?
(*g*) Does any conscious relationship exist between the quantity of tools and the machine equipment?
(*h*) What savings have been accomplished through standard methods?

7 Product Design and Standardization.

The intent of these questions is to suggest means to develop fully the lack of standardization of designs and the evils incidental thereto. This is an important feature, and should be developed as much in detail as possible.

Give separate answers on product according to division stated in answer to question D–8.

(*a*) State the number of designs or models of product. Show the effect of this variety upon scale of production. Obtain data showing average size of manufacturing lot.
(*b*) Is there a Designing or Engineering Department?
(*c*) Are specifications of product a matter of record?
(*d*) Are there drawings covering all products?
(*e*) Are there material lists covering all products?
(*f*) Are parts covered by single drawings or several parts grouped in one drawing?
(*g*) Are stock parts entering into manufactured products standardized? (Screws, bolts, nuts, etc., in metal trades; sewings and findings in shoe and clothing trade; inks, glue, bindings, sundries in printing, etc.)
(*h*) Are products of different construction or similar construction, with small variation?
(*i*) Are similarly constructed products made of different quality or grade of materials?
(*j*) To what extent is change of design due to following:
1. Customer?
2. Designing or Engineering Department?
3. Sales management?
(*k*) Are manufactured parts interchangeable?
(*l*) List in groups the manufactured products sold or used for the same purpose.
(*m*) Number of types or styles made.

T. Technical (*Cont.*)

(*n*) Average number of types added per year 1912–20 inclusive.
(*o*) Average number of types discontinued per year 1912–20 inclusive.

8. To what Extent are Various Operations Standardized:
   (*a*) As to "work content"?
   (*b*) As to work places and their arrangement?
9. Are Motion-sequences for each Operation Standardized?

U. Utilization

1. Is any Effort made to Establish a Progressive Budget? The extent to which a conscious effort is made to relate anticipations of finance, sales and labor conditions with production.
   (*a*) Is the normal capacity known in hours and product and is there a standardized overhead?
   (*b*) Is anticipated business compared with normal? (The difference showing anticipated gain or loss.)
   (*c*) Is money value of manufactured product inventory based on actual cost, standard cost or selling price?
2. Is Policy to Make-and-sell or Sell-and-make? In so far as possible secure data whereby advantages and disadvantages are portrayed.
3. Is there any Record of Idle Machine Time?
   (*a*) Is it computed in money-hours or man-hours?
   (*b*) If so, obtain idle time data for following:
      1. Awaiting work.
      2. Awaiting worker.
      3. Awaiting material.
      4. Awaiting tools.
      5. Repairs.
      6. Lack of work.
   (*c*) Have machine rates been determined and if so, how? Do you use these as a guide in fixing selling price, particularly to secure business in dull times?
   (*d*) Give amount and percentages of idle time, by months, for years 1918, 1919 and 1920, commenting on causes of peaks and depressions.
   (*e*) State total cost of idle time in 1918, 1919 and 1920.
4. Is Planning Function Centralized?
   (*a*) Is product manufactured on individual order, a group of orders, or in quantities?
   (*b*) If wholly or partly in stock quantities, are quantities determined on a maximum or minimum stock record or a period schedule?
   (*c*) How far ahead is work planned?
   (*d*) Are standards of performance available from which work is planned?
   (*e*) Are performance standards superficial or based on study?
   (*f*) Do performance standards show:
      1. Set up times?
      2. Production per hour?
      3. Elements from which built up?
   (*g*) Are there charts or sheets showing the various operations, their sequence, and the equipment to be used?
   (*h*) Do these charts show alternatives?
   (*i*) Are there written standard instructions for each operation?

U. Utilization (*Cont.*)

(*j*) Are production instructions in form of drawings, language, or both?
(*k*) Are there records showing stock on hand and available?

5. Are Assignments made with Reference to Worker or Work Place?
   (*a*) If worker, how is machine or work place capacity controlled?
   (*b*) If work place, how is productive time of worker controlled?
   (*c*) Are the following records maintained:
      1. Work ahead of worker or work place, for which materials, tools and facilities are on hand and in readiness?
      2. Workers' reports on lots or jobs?
   (*d*) Who makes tool assignments?
   (*e*) Are tools assigned to standardized work places?
   (*f*) Is there a record of tools not in use or available?
6. Is there a Time Card for each Worker, each Job, each Day?
   (*a*) Is it made out in advance and by whom?
   (*b*) Do clerks visit work places to obtain time?
   (*c*) Do tickets or time cards show elapsed time?
   (*d*) Is time determined by time stamp?
   (*e*) Do tickets or time cards show number of pieces completed?
   (*f*) What is the authority for issue of materials?
   (*g*) How is material issued to work place?
   (*h*) Is movement of material to work place controlled by planning department?
7. Are Cost Methods "Tied in" with Financial Books?
   (*a*) Are costs figured on
      1. Each job or lot?
      2. On general overall averages or trial jobs?
      3. By combining unit standards of operation or assembly?
      4. By what method?
   (*b*) Are material costs figured on
      1. Purchase price?
      2. Average purchase price?
      3. Standard price?
      4. Market price?
   (*c*) To whom are production costs made available?
   (*d*) Are Superintendents or Foremen held responsible for costs in their department?
8. Is there any Record of Idle Workers' Time?
   (*a*) Is it computed in money or man-hours?
   (*b*) Are causes shown?
      1. Awaiting work?
      2. Awaiting tools?
      3. Awaiting materials?
      4. Personal necessities?
      5. Awaiting machine repairs?
   (*c*) State available figures for 1918, 1919 and 1920.
   (*d*) Has any analysis been made as to relative proportion of causes? If so, give analysis.
   (*e*) Give loss of earnings of employees, caused by idle time.
   As to Average Mechanic:
      (1) *Per cent of total year he works?*
      (2) *Per cent of total year idle through lack of work?*

U. Utilization (*Cont.*)

(3) *Per cent of total year idle through other causes than lack of work?*

(4) *Are these figures taken from actual records or from memory?*

9. Is any Attempt Made to Compare Production Performance with Production Standards? Give comparative factors, if obtainable.
   (*a*) With reference to job.
   (*b*) With reference to worker.
   (*c*) With reference to department or group.
   (*d*) With reference to equipment.
   (*e*) What is the procedure when an operative or a group of operatives deliver less than standard production?
   (*f*) *Are definite production standards (for worker to attain each day) provided for various kinds of work?*
   (*g*) *Are workers classified by relative capacity for various jobs?*
   (*h*) *Are they shifted according to their classifications?*
   (*i*) *How far is labor classified between "skilled" and "unskilled" to avoid paying former for doing latter work?*
   (*j*) *What Reccrd of Foreman's Qualifications, and how utilized?*
   (*k*) *What Record of Workers' Qualifications, and how utilized?*
10. Has Production per Man-Hour Increased or Decreased Since 1914, and How Much?
   (*a*) *Taking 1912 labor as 100% efficient, give efficiency since 1912–13–14–15–16–17–18–19–20.*
   (*b*) *List three chief causes in order of importance for increase or decrease of workers efficiency.*
   (*c*) Has there been marked change in efficiency since middle of 1920?
   (*d*) (1) *How great?*
   (2) *What cause is attributed?*
   (*e*) *What is degree of labor wastc?*
   (1) *Actual loss of time, as idle time—"out of a job"?*
   (2) *Labor waste while actually employed?*
   (*a*) *Deliberate curtailment of production?*
   (*b*) *Misfits and no actual means for measuring "actual output" against "production standards"?*
   (*c*) *Skilled labor doing unskilled work?*
   (3) *Labor troubles (strikes, lockouts, etc.)?*
11. Do All Purchases Clear Through a Purchasing Agent?—Give answer in detail with all exceptions.
   (*a*) Are all expenditures covered by proper authorization?
   (*b*) Who is responsible for quantities purchased?
   (*c*) Are quantities based on maximum and minimum stocks?
   (*d*) How are these maximum and minimum quantities determined?
   (*e*) Are unstandardized materials purchased in relation to any production schedule?
   (*f*) What bearing does current market price have on quantities purchased?
   (*g*) Who is responsible for quality or grade of material purchased?
   (*h*) Are purchases made to conform with definite specifications or with certain tests?
   (*i*) Is test or examination made on receipt of material?
   (*j*) What co-ordination exists between purchasing and planning function as to time required or allowed to secure materials?

U. Utilization *(Cont.)*

(*k*) What method is used in following up purchases to secure delivery within the prescribed time?
(*l*) What records are maintained of vendors, prices and quotations?
(*m*) Estimate from stores record in terms of money or units of quantity, the proportion of material not issued within six months and over a year.
(*n*) To what extent are storekeepers permitted to order?
(*o*) *Average days required for delivery of raw materials.*
(*p*) *What is material turnover:*
(1) *Times per year?*
(2) *From Receiving to Shipping?*
(*q*) *State respective quantities and values of chief items comprising* 60 *to* 90 *per cent of total material purchases; distinguishing* direct *and* indirect *material.*

12. What Control Exists of Stock Receipts, Issues and Returns?
(*a*) How many stock records are maintained?
(*b*) What is their character?
(*c*) Where kept?
(*d*) How are quantities in stock ascertained?
(*e*) How are quantities in stock verified?
(*f*) What are the difference between record and actual count?
(*g*) How are these differences adjusted?
(*h*) For what work period are stocks kept on hand?
(*i*) How does value of stores on hand compare with value of daily output?
(*j*) What control exists of "dead" stock (stores, finished product, finished parts)?
(*k*) How is dead stock disposed of?
(*l*) Estimate loss due to dead stock over three years' period.
(*m*) *What is loss on materials used?*
(1) *Measured or weighed.*
(2) *Unaccounted for.*

13. What are Material Storage Conditions?—To be answered with reference to raw materials, finished parts, finished products, and processed material.
(*a*) Where are storerooms located with reference to production departments?
(*b*) Are storerooms neat and orderly?
(*c*) Is material stored on floor, racks, fixed or movable containers?
(*d*) Is the material in the storerooms arranged or indexed so as to be quickly found?

14. What Type of Internal Transportation Exists? Explain in detail for different materials.
(*a*) Narrow gage trucks.
(*b*) Lift trucks.
(*c*) Wheel trucks.
(*d*) Tote boxes.
(*e*) Movable racks.
(*f*) Human arms.
(*g*) *What means are provided for material transportation?*
(*h*) *To what extent are gravity-transport devices used?*
(*i*) *Describe railway and side-track facilities.*
(*j*) *What degree of co-operation by railroad representatives, as to car-placing and demurrage?*
(*k*) *Is any local organization (e.g. Board of Trade) active in obtaining improvements in transport service?*

U. Utilization (*Cont.*)

15. Is Raw Material Subjected to Examination or Test on Receipt?
    (*a*) By whom are the tests made?
    (*b*) How are requirements determined?
    (*c*) What is the percentage of rejections?
    (*d*) What saving may be traced to these?
16. Is Inspection of Work in Process Made?
    (*a*) At what states or after what operations?
    (*b*) Is there a separate inspection department that determines inspection standards? If not, how are they determined?
    (*c*) Who inspects processed material?
    (*d*) To whom are the inspectors responsible?
    (*e*) Do prints exist showing limits and tolerances?
    (*f*) Are instructions to worker written or oral?
    (*g*) Who instructs worker regarding quality or workmanship?
    (*h*) Are operatives required to remedy damages without compensation?
    (*i*) Is any record kept of kind and quantity of rejections?
    (*j*) Evaluate rejections in money and percentage of output, if possible.
    (*k*) Have any quality campaigns been conducted? If so, describe and give results.
17. How is Finished Product Inspected?
    (*a*) By whom?
    (*b*) To whom is inspector responsible?
    (*c*) Who determines standards and tolerances?
    (*d*) Are written specifications furnished or available or are they oral?
    (*e*) How are rejections replaced or repaired?
    (*f*) Is any record kept of kind and quantity of rejections?
    (*g*) Evaluate rejections in money and percentage of total output, if possible.
18. What is the Amount and Character of the Inspection Equipment?
    (*a*) To what extent is it used?
    (*b*) When was it first used?
    (*c*) If possible, get data or estimate of the savings effected in cases where inspection equipment has been put to use.
19. *Amount of Material in Process (Lbs. and $) Estimated?*

C. Conclusions

1. Are Generally Accepted Economic Laws Violated?
    (*a*) Give examples.
    (*b*) What is effect of these violations?
2. In the Opinion of the Officer Interviewed what are the Most Important Causes of Waste in this Business or Industry?
3. In General Cost Comparisons what Unit of Comparison is Used?

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY PLANT NO. EST. BY DATE

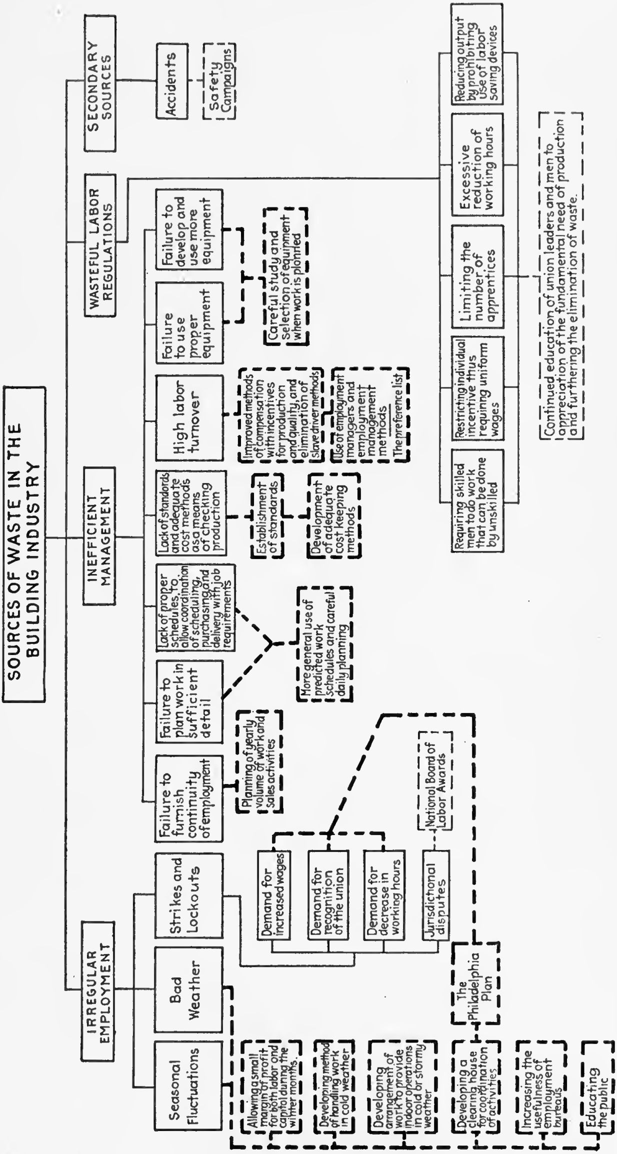
KEY

① + ⑤ + ⑨ = ⑬	Excellent = 0% Waste	Poor = 60% Waste	a + b + c = d = 100%
④ + ⑧ + ⑫ = ⑭	Good = 20% " Fair = 40% "	Bad = 80% "	e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES												TOTAL WASTE	
		MANAGEMENT				LABOR				OUTSIDE CONTACTS					
		Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1														
	K2														
	K3														
	K4														
	K5														
	K6														
	K7														
	K8														
	K9														
	K10														
	K11														
	K12														
	K13														
	K14														
	K15														
	K16														
	K17														
	K18														
	K19														
	K20														
	K21														
	TOTAL													a	e
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1														
	T2														
	T3														
	T4														
	T5														
	T6														
	T7														
														b	f
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1														
	U2														
	U3														
	U4														
	U5														
	U6														
	U7														
	U8														
	U9														
	U10														
	U11														
	U12														
	U13														
	U14														
	U15														
	U16														
	U17														
	U18														
	TOTAL													c	g
GRAND TOTAL														d	h

PART II

ENGINEERS' FIELD REPORTS


SOURCES OF WASTE IN THE BUILDING INDUSTRY
IRREGULAR EMPLOYMENT
INEFFICIENT MANAGEMENT
WASTEFUL LABOR REGULATIONS
SECONDARY SOURCES
Seasonal Fluctuations
Bad Weather
Strikes and Lockouts
Demand for increased wages
Demand for recognition of the union
Demand for decrease in working hours
Jurisdictional disputes
National Board of Labor Awards
The Philadelphia Plan
Allowing a small margin of profit for both labor and capital during the winter months.
Developing method of handling work in cold weather
Developing arrangement of work to provide indoor operations in cold or stormy weather
Developing a clearing house for coordination of activities
Increasing the usefulness of employment bureaus
Educating the public
Failure to furnish continuity of employment
Planning of yearly volume of work and sales activities
Failure to plan work in sufficient detail
Lack of proper schedules to allow coordination of scheduling, purchasing and delivery with job requirements
More general use of predicted work schedules and careful daily planning
Lack of standards and adequate cost methods as a means of checking production
Establishment of standards
Development of adequate cost keeping methods
High labor turnover
Improved methods of compensation with incentives for production and quality, and elimination of slave driver methods
Use of employment managers and employment management methods
The preference list
Failure to use proper equipment
Failure to develop and use more equipment
Careful study and selection of equipment when work is planned
Requiring skilled men to do work that can be done by unskilled
Restricting individual incentive thus requiring uniform wages
Limiting the number of apprentices
Excessive reduction of working hours
Reducing output by prohibiting use of labor saving devices
Continued education of union leaders and men to appreciation of the fundamental need of production and furthering the elimination of waste.
Accidents
Safety Campaigns

CHAPTER V

THE BUILDING INDUSTRY

By Sanford E. Thompson

The critical condition of the building industry following the war—the shortage of housing, the lack of new construction—has been due primarily to high costs of construction. Neither the workman nor the capitalist can afford to buy at prices two and a half times above their former level.

This report, however, is not concerned with those temporary conditions, which are partially righting themselves as costs are being reduced, except as they tend to emphasize the fundamental principles. The facts of value are those which bring out the causes of waste that are continuously resulting in irregular employment, dissatisfaction, and unnecessarily high costs. It is by studies of such facts—it is through the tracing of hindrances due to ineffective management or to labor conditions—that the means for correcting can be found and put into effect.

Greater co-operation between the workmen and the employers is an absolute essential. This co-operation must be attained before we can approach the elimination of labor difficulties. Such co-operation, however, is impossible without the removal of causes of friction and the working out of plans to this end.

Primary Causes of Waste.—The chief sources of waste in the building industry are as follows:

I. Irregular Employment.—The building trade workman, as shown by actual records, is busy on the average about 190 days in the year, or two-thirds of his time. The seasonal nature of employment in the building industry is shown in Figure 9, page 63. A few contractors, individually or associated, are attacking this problem with effective results. The public also must be educated to the need of a sensible distribution through the year of its construction demands and requirements. Idleness, however, is not due entirely to seasonal demands; strikes and lockouts are appreciable causes.

II. Inefficient Management.—Haphazard management in planning and controlling work and lack of standards, which often double the labor cost, characterize most construction undertakings. Here, again, a few builders, recognizing the waste in money and man power, are adopting methods that approach modern factory management.

III. Wasteful Labor Regulations.—Union regulations in the past have produced enormous losses through direct or indirect restriction of output. Workmen and contractors, however, are beginning to appreciate—the men often before the employers—that reduced output reacts in tremendous fashion upon themselves.

Secondary Causes of Waste.—Customs or conditions prevailing throughout the industry are secondary sources of waste. In some construction trades accidents involve losses up to 10% of the labor cost in addition to the human loss of lives and energy. The average loss, computed from insurance statistics, is about $2\frac{1}{2}$% of labor cost. Here also certain contractors have found it possible to cut their accidents in half through special efforts.

Another of these secondary causes is poorly designed equipment which frequently retards construction in an extensive degree and permits waste of materials.

Extent of the Building Industry.—Building, including all trades and common labor incidental to it, contributes to the wealth of the nation more than $3,000,000,000 per year, this estimate being based on reports issued by the F. W. Dodge Company. This figure does not include repair and miscellaneous work, which would swell the total by a large percentage. Yearly averages for the past six years show that the activities of the industry are expended upon

Residential buildings	32%
Industrial buildings	18%
Miscellaneous	50%

It is estimated from the last issued United States Census that some 3,000,000 mechanics and laborers were employed in the building industry in 1920—about 7% of all persons employed in gainful occupations.

Relative Number of Men in Different Trades.—Percentages of different classes of labor in the building trades are shown in Figure 1. These percentages include both union and non-union workers.

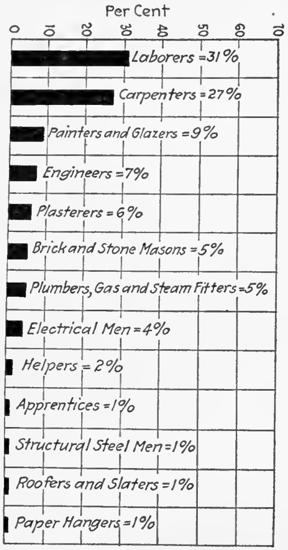


Fig. 1.—Per Cent of Different Classes Employed in Building Trades. (Figured from U. S. Census, 1910.)

Peculiarities of the Building Industry.—Unlike manufacturing operations each building project requires special work, both architectural and structural. Buildings are erected for numerous purposes and designs are tempered to suit the fancy of architects and owners. Each building, therefore, may be compared to a special order with new specifications going through a factory. Yet this variety can scarcely be termed uneconomic or wasteful since from the artistic viewpoint the extra expense of diversity of architecture and types of construction is warranted. Standardization in housing has been attempted, but the field is very limited. Standardization of particular details of construction has been successful and has resulted in appreciable saving.

Another striking fact about the building industry is that inasmuch as small buildings require so little capital or credit, and apparently so little technical ability, the field is full of small contractors, many of whom operate for a few years and then fail. In Cleveland, Ohio, for example, out of 4,000 contractors perhaps not more than 400 are needed. From these small firms the range runs up to the highly capitalized company with yearly business in the millions, employing thousands of workers and having a trained technical organization.

The Cost-plus Contract.—The ordinary form of lump sum contract places on the contractor the entire burden of minor defects in contract or plans and also other hindrances over which he has no control. The question of " extras " is also a constant source of disagreement.

The cost-plus contract developed during the past twenty years takes away a part of the element of risk from the contractor. This form of contract was largely utilized during the war. Although its use increased the expense, it unquestionably assisted greatly in prosecuting the war with vigor.

The lump sum contract serves to insure the owner against unauthorized expenditures beyond what has been planned for. The burden being on the contractor, he naturally exercises special care and skill in the preparation of his estimates and also in providing a means to keep within his estimates.

With the ordinary cost-plus contract the greater the cost, the greater the profit to the builder, while the burden of expense is thrown on the owner. The builder, therefore, must be of extraordinarily high ability and handle the work from a professional standpoint rather than to get what he can. Provision in the contract for incentives for reduction of cost and time may remove many of the uncertainties of the owner.

Abnormal Conditions Today—Shortage of Housing.—Certain striking features in the situation today, which may be considered briefly at this point, are more or less temporary in nature, and are to be charged to the abnormal conditions caused by the war.

The outstanding fact in the building industry during recent months has been the lack of work. The loss in wages at present from this cause probably amounts to half a billion dollars per year.

In Figure 2 the values of the various classes of construction work for the entire country from 1915 to 1921, are represented as percentages of

1915 values. Actual footage constructed is represented also. It will be noted that while the value of production in succeeding years greatly exceeded the 1915 figures, the square footage or real measure of value approached the 1915 figures in 1918, and the 1921 total estimated on the basis of the average for the first months of the year will fall far behind 1915. The increase in the unit cost per square foot is indicated by the difference between the curve and the height of the various columns. The total shortage of housing in 1921 is indicated in the lower curve of Figure 2, and amounts to 53% of the total footage constructed in 1915. To this percentage must be added, if we consider the footage constructed in

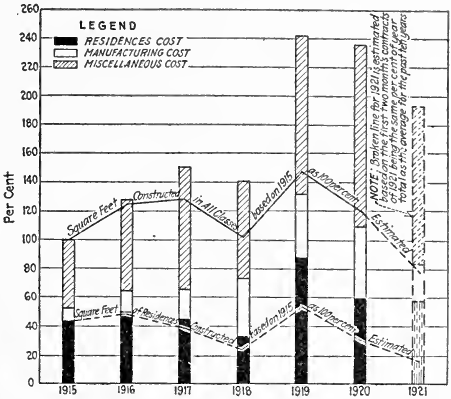


FIG. 2.—Per Cent of Construction Work in Various Classes for the Entire Country 1915 to 1921 Based on 1915 as 100 Per Cent

1915 as equal to the requirements of that year, $7\frac{1}{2}\%$ which represents the increment required to cover the increase in population. Figure 3 represents the housing shortage existing in the city of Philadelphia.

The need for building is most evident. The costs are so high, however, that the householder cannot afford to buy, nor can the banker loan money because of the danger of loss through the inevitable fall in prices.

Abnormal Cost of Financing.—The high cost of labor and materials in 1920 and 1921 prohibited bankers from loaning money on ordinary building and dwelling-house construction. They reasoned, and correctly, that the price of materials and labor would drop so that buildings erected at a later date would cost less, thus causing a fall in the selling prices. Added to this have been the income tax conditions, so that the funds which were at one time available for mortgages have been forced into tax-exempt securities. Notwithstanding, therefore, the shortage of housing and the need for new construction, the actual work going on has fallen to a remarkably small figure and this in turn has been reflected in unemployment.

In certain cases advantage has been taken of the conditions. The Operatives' Builders Association of one of our large cities, in a pamphlet recently published, states that it is generally necessary to pay a mortgage broker a commission of from 2 to 5% for placing well secured mortgages, while for second mortgages placed with building associations, it has become a custom to pay a commission of 5 to 10%.

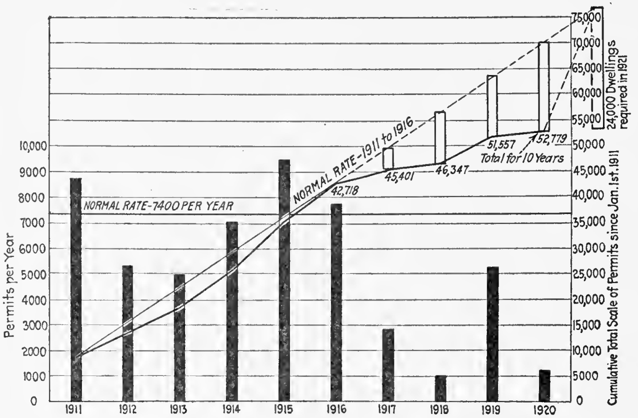


FIG. 3.—Philadelphia. Two- and Three-story New Dwelling Permits 1911 to 1920 Incl., Showing a Shortage of 17,000 Houses on January 1, 1921.

53,000 permits in 10 years, population increase 350,000 or 35,000 per year.

Average number people per home in Philadelphia = 4.7.

35,000 ÷ 4.7 = 7447 permits per year.

Average 1911–1916 = 6786.

1917–1920 = 2515.

Philadelphia needs a 1921 home building program of 24,000 homes to keep pace with her rate of progress as a "City of Homes."

Curve reproduced from curve made by Wm. B. Ferguson and W. B. Hays, Consulting Engineers, Phila., Pa.

Again we have the statement of a contractor operating in a Southern city: "With the present rate of 6%, no National Bank is going to take business of this character without making a profit. In order to make the profit, they must charge a bonus or a commission, which, in both cases, is usually $2\frac{1}{2}$% and where they find it possible, they charge both, which makes the money cost the borrower not less than 11%. These loans are of course on a four months' basis and the same bonus and commission is charged for renewal. The cost to the borrower would be, therefore, 6% for the use of the money, plus the bonus and commission for the original loan and two renewals at 5% each—a total of 21% per annum."

Inefficiency of Labor.—Much has been said in 1921 of the inefficiency of building labor during the last few years. However, except where effective management with well-defined standards has been in operation, there have been similar complaints throughout the country in all industries. This inefficiency has been due to abnormal conditions. Briefly, these conditions may be outlined as follows:

(*a*) The war necessitated the calling into the ranks of skilled workers and into the foreman class men unfitted by character or training for their jobs. The demand continued to exceed the supply, resulting in bidding for men and boosting of wages.

(*b*) Because of the unprecedented demand, organized labor forced concessions not only as regards increases in wages, which were usually justified by the increased cost of living, but also as regards working rules which led in many cases to curtailment of production. The speed needed on government work to win the war, with the lessened care for cost engendered by the cost-plus contract, resulted in less effective operation. The men naturally became accustomed to this inefficient method of working and it furnished in one sense a standard for future efforts.

Relative production or labor efficiency during the last few years, based on careful estimates of contractors who have actually recorded data, is shown by the curve in Figure 4. The increase in wages and in the cost of living in Massachusetts are also shown.

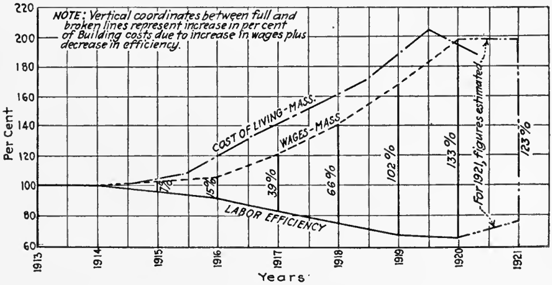


Fig. 4.—Increase in Cost of Living, Increase in Labor Costs, and Decrease in Efficiency of Labor, Using 1914 as a Base.

With the depression in business, however, and the lessened demand for all kinds of labor, the average production in all industries is again approaching normal. Certain contractors are again basing estimates on the assumption that labor is normally efficient. The improvement is in part due to the weeding out of misfits in both labor and management. The diagram, Figure 5, shows how jobs, started respectively in March, May and November, 1920, showed increased efficiency of the men, as indicated by saving in cost below the estimate.

FIG. 5.—Tendency of Labor Efficiency to Increase as the Supply Increases. Jobs Nos. 1, 2 and 3 Similar Concrete Jobs.

Job No. 3 started in November, 1920, when labor had become plentiful, due to falling off of work so that old employees could be utilized.

The Causes of Waste Analyzed.—The principal sources of waste in the building industry, already noted, may be set down specifically as follows:

I. *Irregular employment, due to*:
1. Seasonal fluctuations.
2. Bad weather.
3. Strikes and lockouts.

II. *Inefficient management*:
1. Failure to furnish continuity of employment.
2. Failure to plan work in sufficient detail.
3. Lack of proper schedules to allow proper coordination of scheduling, purchasing, delivery, with job requirements.
4. Lack of standards and adequate cost methods as a means of checking production.
5. High labor turnover.
6. Failure to use proper amount or type of equipment.
7. General failure to develop and use a greater amount of mechanical equipment.
8. Waste of material through careless handling and improper plant operations.

III. *Wasteful Labor Regulations*:
1. Requiring skilled men to do work that could be performed by unskilled.
2. Restricting individual incentive through requiring uniform minimum wages.
3. Limiting the number of apprentices.
4. Excessive reduction of working hours.
5. Restricting output by prohibiting the use of labor-saving devices.
6. Jurisdictional regulations.

In addition to these three main groups, there are secondary sources of waste which are a result of customs or conditions prevailing throughout the industry. This group is as follows:

1. Failure of architects to furnish check plans and specifications.
2. Duplication of labor in estimating and often in designing.
3. Lastly, accidents which are particularly important in the building industry because of the extra-hazardous nature of the work.

I. IRREGULAR EMPLOYMENT

Estimated Loss.—The large fluctuations in the number of men employed by representative contractors, indicating also the great fluctuation in the volume of business carried on, are shown in Figures 6 and 7. An average of all of these fluctuations is plotted at the bottom of Figure 7. The average curve follows in a general way the individual curves and indicates the extent of unemployment during the various periods. In normal times when a man is released from one job, he seeks employment with another contractor. The curves, therefore, do not necessarily follow the employment of any one group of men. It is not unusual for a man to be employed by several contractors in a year. Unemployment due to all causes in the building trades in Massachusetts is further shown in Figure 8. If we assume these figures to be representative of the entire country, and if one-half of this unemployment could have been eliminated, the value to the building industry or its wealth to the country would have been increased as follows:

1915	$106,000,000
1916	91,000,000
1917	113,000,000
1918	85,000,000
1919	141,000,000
1920	192,000,000

Lost Time in Different Trades.—Representative average conditions in the building trades in Philadelphia and vicinity are shown in chart in Figure 9. The lost or wasted time exclusive of Sundays, Saturdays, and holidays is shown clearly by the heavy black lines, one line for each trade. The values also are listed in the table on page 64 and the percentages of lost time are given.

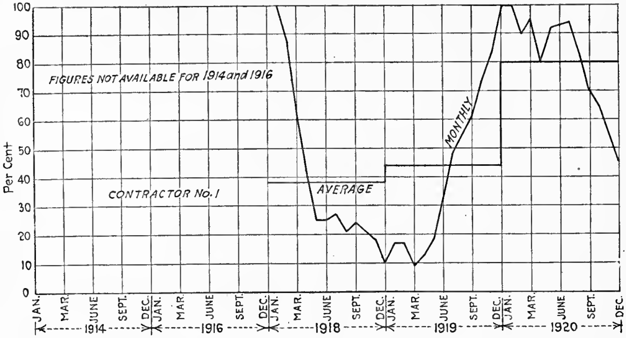


Fig. 6a.—Monthly Fluctuation. Number of Men Employed in Building Trades for Years 1914–1916–1918–1919–1920. Figures Taken from Typical Contractor's Records.

Fig. 6b.—Monthly Fluctuation of Labor Employed in Building.

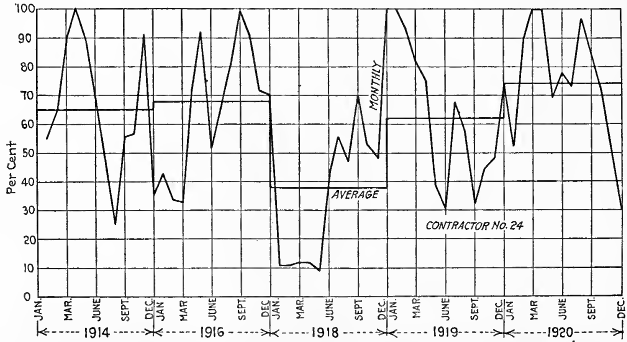


Fig. 6c.—Monthly Fluctuation of Labor Employed in Building Trades.

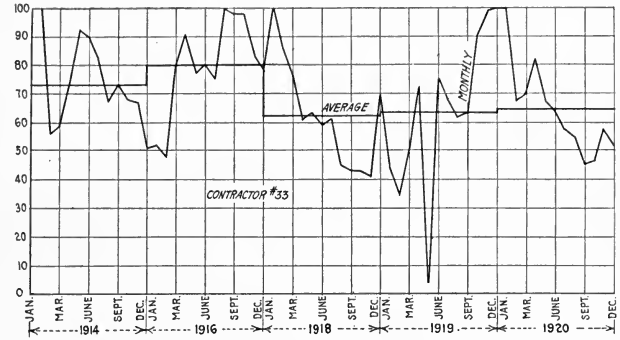


FIG. 7*a*.—Monthly Fluctuation of Labor Employed in Building Trades.

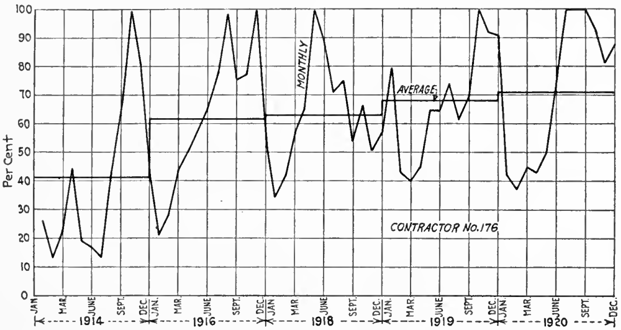


FIG. 7*b*.—Monthly Fluctuations of Labor Employed in Building Trades.

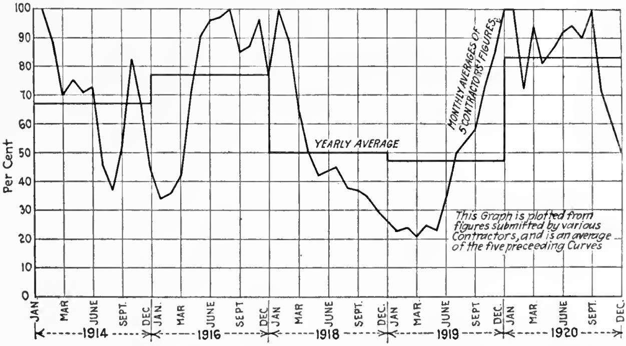


FIG. 7*c*.—Monthly Fluctuations of Number of Men Employed in Building Trades, by Per Cent. The Greatest Number Employed in any Particular Year is Taken as 100% for that Year.

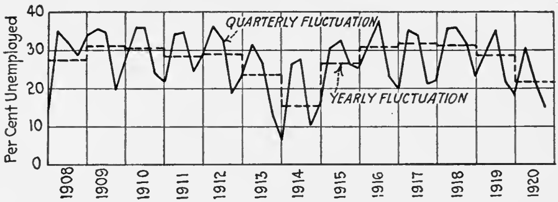


FIG. 8.—Graph Showing Unemployed in Building Industry, by Quarters for 1908 to 1920 Inclusive.

(Figures compiled by Massachusetts Bureau of Statistics.)

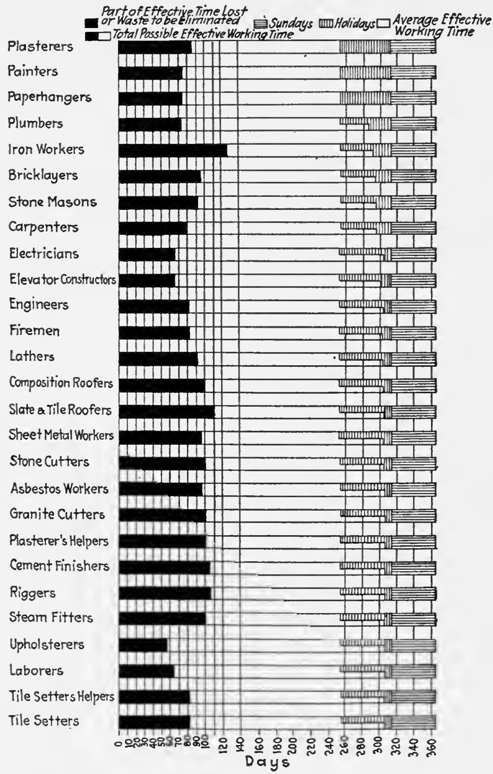


FIG. 9.—Representative Average Conditions in Building Trades in Philadelphia and Vicinity.

Table Showing Actual Days Worked in Comparison with Effective Working Days Possible for Various Trades

Trade	Effective Working Days Possible	Average Days Worked Per Year	Per Cent of Time Lost
Plasterers	254	170	33
Painters	254	182	28
Paper Hangers	254	182	28
Plumbers	271½	200	26
Iron Workers	273½	150	45
Bricklayers	275	182	34
Stone Masons	275	185	33
Carpenters	280	200	29
Electricians	280	216	23
Elevator Constructors	280	216	23
Engineers	280	200	29
Firemen	280	200	29
Lathers	280	190	32
Composition Roofers	280	182	35
Slate and Tile Roofers	280	170	39
Sheet Metal Workers	280	185	34
Stone Cutters	280	180	36
Asbestos Workers	281	185	34
Granite Cutters	281	180	36
Cement Finishers	281	176	37
Plasterers' Helpers	281	180	36
Riggers	281	175	38
Steamfitters	281	180	36
Upholsterers	281	225	20
Laborers	281	217	23
Tile Setters' Helpers	282	200	29
Tile Setters	282	200	29
Average	275	189	31

Saturday half-holidays or full holidays, as the case may be, are not included.

The days at work, by these records, average 189 per year for the various trades. The average of estimates reported to us by various contractors is 210 working days per year. These figures are as nearly equal as can be expected. Over half of the lost time, it is estimated, is due to bad weather and the balance chiefly in waiting for or looking for work.

Distribution of Lost Time through the Year.—The chart showing the average monthly and yearly distribution of bricklayers' time is shown in Figure 10. Note the heavy black lines showing lack of employment in the winter months. The difference in the lengths of the months is indicated by the jogs at the bottom of the chart.

Extreme Example of Labor Turnover.—One man, in the course of $5\frac{1}{2}$ years, worked for 76 different contractors and was hired 108 times. His experience was as follows:

1913—Worked for 9 different contractors, hired 12 times—9 months.
1914—Worked for 11 different contractors, hired 18 times.
1915—Worked for 18 different contractors, hired 28 times.
1916—Worked for 19 different contractors, hired 22 times.
1917—Worked for 11 different contractors, hired 14 times—9 months.
1920—Worked for 8 different contractors, hired 13 times.

This condition must certainly keep in the mind of a man the thought of where the next job will be, and the worry and uncertainty must be reflected in his daily output.

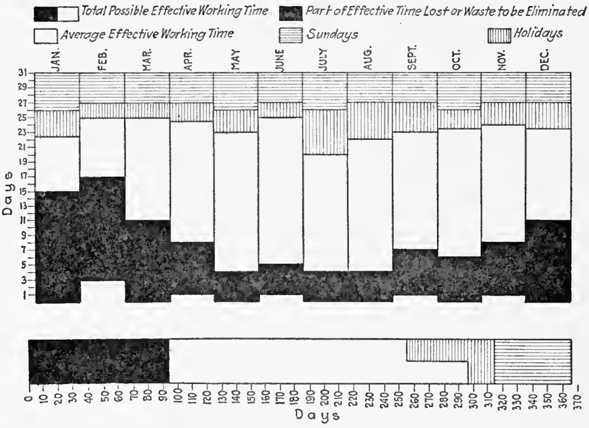


FIG. 10.—Monthly and Yearly Distribution of Bricklayers' Time.
(Representative Average Conditions in Philadelphia and Vicinity.)

Contractors have given the effect of labor turnover little consideration In construction work this is particularly hard to determine, especially as the actual percentage of turnover constantly varies as the building progresses and the number of men is increased and then diminished. Men quit because of the type of work, risk involved, unfair treatment by foremen, and so on. They are discharged because of lack of work, incompetence, laziness, causing trouble, or because better men are available. The labor turnover and service record of one contractor, based on an average of four years, 1917, 1918, 1919, and 1920, is shown in Figure 11, with causes of quitting. This is given more in detail and for each year in tabular form in Figure 12. The losses both to employers and to men by this enormous turnover are evident.

We believe these figures to be fairly typical of conditions which existed during the years mentioned. The lower values indicate what may be

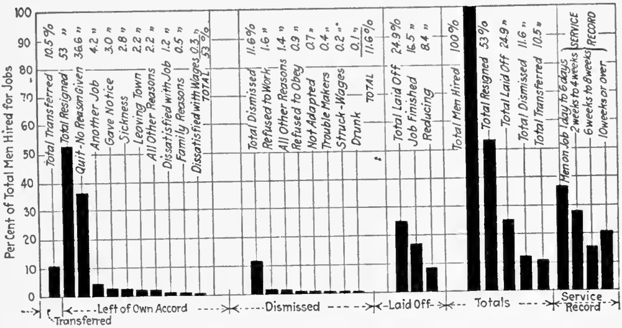


FIG. 11.—Labor Turnover and Service Record of One Contractor. Average of Four Years 1917 to 1920.

expected in more normal years. Note the high percentage of men quitting of their own accord, as compared with those dismissed and laid off. Since labor is responsible in a large measure for the number dismissed due

LABOR TURNOVER

	Column No.	1 Max. number of men on job	2 Men transferred to job	3 Total men hired for job	4 Total men hired ÷ max. number on job	5 Transferred	6 Quit-no reason given	7 Another job	8 Sickness	9 Family reasons	10 Dissatisfied with job	11 Leaving town	12 Gave notice	13 Dissatisfied with wages	14 Enlisted-draft	15 All other reasons	16 Total resigned
						EXITS	Left of Own Accord										
1917	Total	2812	1143	7181	2.54	1882	2174	321	139	91	78	120	51	38	103	91	3206
	Per Cent			100		26.3	30.3	4.5	1.9	1.3	1.1	1.7	0.7	0.5	1.5	1.3	44.7
1918	Total	3044	660	23616	2.93	899	10589	503	685	27	173	223	1070	74	372	100	13816
	Per Cent			100		3.8	44.8	2.1	2.9	0.1	0.7	1.0	4.5	0.3	1.6	0.5	58.6
1919	Total	2611		7336	2.81	1021	2520	240	122	55	96	174	200	15	0	130	3552
	Per Cent			100		13.8	34.4	3.3	1.7	0.7	1.2	2.4	2.7	0.2	0	1.8	48.4
1920	Total	[illegible]		[illegible]	[illegible]	[illegible]	4671	1133	498		253	651	278			764	8248
	Per Cent			100		12.0	28.7	7.0	3.1		1.5	4.0	1.7			4.7	50.7
Average for 4 Years		[illegible]		[illegible]	2.95	[illegible]	[illegible]	549	361	43	150	292	400	32		271	7205
Per Cent				100		10.5	36.6	4.2	2.8	0.5	1.2	2.2	3.0	0.3		2.2	53.0

	Column No.	17 Incompetent	18 Refused to obey	19 Trouble maker	20 Drunk	21 Not adapted	22 Refused to work	23 Struck-wages	24 All others	25 Total dismissed	26 Reducing	27 Job finished	28 No stock	29 Total laid off	30 Total dismissed and laid off	31 1 to 3 days	32 4 to 6 days	33 2 weeks	34 4 weeks	35 6 weeks	36 10 weeks	37 10 weeks or more
		EXITS — Dismissed									Laid Off					LENGTH OF SERVICE ON JOB — Days		Weeks				
1917	Total	415	95	23	14	17	73	12	148	797	290	984	10	1295	2092	1351	980	1359	1219	750	458	1067
	Per Cent	5.8	1.3	0.3	0.2	0.2	1.0	0.2	2.1	11.1				17.9	29.0	18.9	13.5	18.9	17.0	10.4	6.5	14.8
1918	Total	1376	196	161	29	108	513	66	314	2779	2451	3666	4	6121	8900		9683		5601		2866	5461
	Per Cent	5.8	0.8	0.7	0.1	0.5	2.1	0.3	1.4	11.7	10.3	15.6		25.9	37.6		40.9		23.6		11.6	23.9
1919	Total	522	42	57	7	79	54	7	29	797	321	1632	13	1966	2763		2157		2362		1707	1110
	Per Cent	7.1	0.5	0.8	0.1	1.1	0.7	0.1	0.4	10.9	4.4	22.2	0.2	26.8	37.7		29.4		32.2		23.2	15.1
1920	Total	1149	178			169	125		288	1909	1459	2709		4168	6077		5785		4405		2520	3583
	Per Cent	7.0	1.1			1.0	0.8		1.8	11.7	9.0	16.6		25.6	37.3		35.5		27.0		15.5	22.0
Average for 4 Years		865	100	60	12	93	191	21	195	1570	1130	2248	7	3387	4958		4989		3735		2075	2805
Per Cent		6.3	0.9	0.4	0.1	0.7	1.6	0.2	1.4	11.6	8.4	16.5		24.9	36.5		36.6		27.4		15.4	20.6

FIG. 12.—Labor Turnover.

to such causes as incompetence and disobedience (see Figure 12), a large percentage of the figures shown in column 25 should be added to the per cent quitting, which represents the largest waste factor in labor turnover. It must be borne in mind that the large floating element found in the building industry is a problem which confronts the contractors, and is responsible in part for the high number of resignations shown in column 16. The contractor's direct responsibility for men laid off is indicated in column 29.

Lack of Employment Managers.—Employment managers are rarely employed even upon the largest jobs, and "hiring and firing" is at the will of the foreman or superintendent. Good men are lost through lack of sympathy on the part of the foreman, or ill will is often developed in the workman by the foreman's lack of tact in directing the gang.

Reducing Seasonal Unemployment.—Although efforts toward reducing seasonal unemployment have been local and often spasmodical, recent developments and conferences have shown the possibilities of vast improvement. The means of bringing about a reduction of seasonal unemployment may be outlined as follows:

1. Allowance of a small margin of profit for both labor and capital during winter months.
2. Development of methods of conducting the work in cold weather.
3. Arrangement of work to provide indoor operations in cold and stormy weather.
4. Organization of a clearing house for co-ordination of activities.
5. Increasing the usefulness of employment bureaus.
6. Educating the public.

Contractors must prove to the public that they can carry on operations during the winter period as economically and substantially as during other periods of the year. To do this, contractors, labor, transportation, and material men in a locality must get together and, after joint study of the situation, agree to reduce profits and wages sufficiently to offset the increased cost of carrying on work in winter months. Much can be developed to improve conditions. Even now concrete work is carried on in winter with proper precautions. It is now common practice to use a staging enclosed in canvas for bricklayers working in the winter time.

With such practices in operation the contractor can figure on work at the same price throughout the year, thus stimulating winter construction and lessening unemployment due to this seasonal feature.

A plan covering the features outlined above has been presented by A. P. Greenfelder, Chairman of the Committee on Methods, to the Associated General Contractors of America for consideration.

A few contractors by thorough organization, by developing a sales department, and by making a specialty of repair work along with regular construction, have found it practicable to maintain an appreciable part of their force continually through the year. Most contractors, on the other hand, pay absolutely no regard to the worker as an individual. Men are taken on as required, and discharged at a minute's notice.

A General Bureau for Clearing Work.—The crying need is for more effective coordination of activities. The "Philadelphia Plan," developed by the Building Trades Council under the leadership of D. Knickerbacker Boyd, advocates the establishment of a central bureau through which voluntarily all construction programs in the territory should be cleared, including national, state, municipal, and private work. This bureau would furnish a means for coordinating activities so that different jobs would dovetail in with one another, and would assist in allocation of materials. A constant labor survey would be one feature of the project, while employment bureaus would assist in the placing of applicants to the best advantage. An important feature of this plan is the stress laid upon the education and training of the workmen in the various trades. Such education and training results inevitably in increased production and increased efficiency. A part of the program has been under way since the fall of 1920.

The education of the public is vital to a sensible distribution of work throughout the year. This applies equally to industrial, public, and residential construction and to household repairs and maintenance. Instead of crowding our main construction work into seven or eight months, all that can be deferred from the busy to the more idle season should be so scheduled. Owners making interior repairs or slight additions should be encouraged to have this work done in the off-peak season. Old buildings to be demolished to make room for new ones should be torn down in cold weather in advance of the new construction, instead of waiting, as is often done, until the new building ought to be under way.

Real estate dealers lease apartments usually in October and do all redecorating work and repairing at this time. An architect in New York City has stated that some 25,000 painters and paper-hangers are needed during this brief period, while normally only 5,000 men are required.

With a central bureau, under the auspices of the employers, the workmen, and the public, these and many other things would be studied with effective results.

Waste From Strikes and Lockouts.—The strike is one of the great economic wastes to be found in the building industry. The waste to the men engaged, the contractor, and the public is hard to estimate.

The major causes of strikes are occasioned by demands for increase in wages, recognition of the union, decrease in working hours, and by jurisdictional disputes.

Incidental to these causes and often aggravating them are the working conditions, while in almost every case the prime factor is the lack of understanding and failure of the employers and the workers to get together.

As shown in the table on this page, the number of strikes and lockouts occurring in the building trades increased from 275 in 1914 to 442 in 1919, an increase of 60%. This increase is accounted for in part by the greater demand for labor in 1919, which inevitably makes the requirements of workmen more exacting and arbitrary. Of the 1919 figure, 442, only 18 or 4% are listed as lockouts, so that the waste due to lockouts is relatively small.

STRIKES AND LOCKOUTS IN THE BUILDING INDUSTRY IN THE UNITED STATES

(Information from U. S. Bureau of Labor Statistics.)

Strikes

Building Trades	1914*	1915	1916	1917	1918	1919
Carpenters	35	42	73	98	76	84
Plumbers and Steamfitters	83	34	52	53	71	53
Paper Hangers and Painters	61	20	45	41	58	75
Sheet Metal Workers	13	21	20	32	45	17
Building Laborers and Hod Carriers	...	...	53	72	27	48
Inside Wiremen	9	20	32	33	45	29
Structural Iron Workers	...	...	23	15	19	12
All others	74	67	78	103	75	124
	275	204	376	447	416	442

Lockouts

Building Trades	1914*	1915	1916	1917	1918	1919
Carpenters	...	8	2	3	3	4
Plumbers and Steamfitters	...	9	1	4	3	1
Paper Hangers and Painters	...	4	...	4	1	3
Sheet Metal Workers	...	2	1	2	...	...
Building Laborers	...	...	1	2	...	...
Inside Wiremen	...	...	4	2	4	1
Structural Iron Workers	...	...	1	...	...	1
All others	...	4	8	4	5	8
		27	18	21	16	18

* Includes Lockouts.

Preventable Waste.—In the year 1920, according to the Massachusetts Department of Labor and Industries, 138,519 working days were lost in the State due to strikes. If we apply the Massachusetts rate to the entire industry it would represent a waste of some 3,000,000 days per year. As an illustration of the wastefulness of strikes, attention is called to the labor trouble in the city of Boston during the first four months of 1921 involving 20,000 building mechanics.

In the following table is represented the experience of the labor unions in another large city.

TIME LOST DUE TO GENERAL STRIKES—BUILDING TRADES, PHILADELPHIA

Trades	1916	1917	1918	1919	1920
Asbestos Workers	....	Only one	strike in	10 years.	
Electrical Workers	0	0	0	10 days (500)	0
Stone Masons	....	No time	lost in 10	years.	
Engineers and Firemen	....	No time	lost in 10	years.	
Plasterers	....	No time	lost in 15	years.	
Plasterers' Helpers	....	No time	lost in 15	years.	
Cement Finishers	6 weeks (150)	0	2 weeks (150)	0	4 weeks (300)
Painters and Paper Hangers	0	0	4 weeks (3,000)	0	0
Plumbers and Steamfitters	0	9 weeks (1,000)	0	0	0
Riggers	7 weeks (200)	4 weeks (200)	4 weeks (200)	3 weeks (300)	4 weeks (300)
Slate and Tile Roofers		No time	lost since	1911.	
Sheet Metal Workers	2 weeks (150)	0	0	9 weeks (400)	0
Tile Setters	....	No	strikes in	10 years.	
Carpenters	0	0	0	0	2 weeks (7,000)
Laborers	0	0	0	0	5 weeks (8,000)

NOTE: Numbers in parentheses show number of men involved but it must be remembered that usually it is a diminishing number and the full number does not apply to the entire period.

If the greatest cause, the demand for an increase in wages, could be eliminated, strikes as a factor of waste would shrink into insignificance. The remedy that suggests itself is co-operation. Management and labor must forget the sore spots of past conflicts and through whole-hearted cooperation fix by proper studies a minimum wage to correspond with a standard amount of production, with additional compensation for additional output. This would furnish an incentive to the men and would give recognition to deserving mechanics. Unions must co-operate to the extent of eliminating the minimum flat rate for all mechanics of a trade, and to the extent of modifying the restriction that forbids mechanics to accept piece work. With definite standards fixed and with the co-operation of both parties fair incentives can be introduced.

The Philadelphia Plan.—The most encouraging sign in the elimination of the above causes of waste is found in what is known as the "Philadelphia Plan" put forth by the labor element of that city. This is as follows:

(*a*) The organization through associations, groups, or committees, where such do not now exist, of each employing branch of the building industry in number at least equal to the nineteen represented in the Council of the Associated Building Trades plus one more constituting the carpenters not at present associated, and one for each group or committee of workers desiring representation.

(*b*) The joining together of all these associations, groups, or committees into a permanent, well organized Building Trades Employers' Association with offices or officers.

(*c*) The appointment in each branch of the building industry of committees of employers. These committees to consist of one main committee in each branch. This committee to be divided into, say, four sub-committees of about three members each to meet with and function with like committees from the Council of the Associated Building Trades or with committees of any branch of labor in the building industry not organized or not connected with said Council.

Each of the sub-committees suggested, if consisting of six members as indicated, to have a seventh member as chairman, which member shall be an Architect or an Engineer selected by vote of the other six members. The chairman of the main committee in each industry and a secretary to be selected from among the chairmen of the sub-committees.

(*d*) The sub-committees of the main committee now suggested for your consideration and for later joint deliberation are:

1. Committee on Education of Apprentices;
2. Committee on Information for Journeymen;
3. Committee on Working Conditions;
4. Committee on Materials;

Heading up committee to constitute the tribunal or council of the building industry for the Philadelphia territory:

To consist of one representative from each of the main committees in the employers' organizations or groups, not less than nineteen, each selected by vote of the main committee in each branch of the industry:

And of one representative similarly chosen from the organization or groups of the employed,—not less than nineteen in all.

The officers of this tribunal would, it is suggested, consist of a chairman, two vice-chairmen, a recording secretary—who would also act as treasurer—and a corresponding secretary.

The offices would be filled as follows: The two secretaries to be the secretaries of the Building Trades Employers' Association and of the Council of Associated Building Trades; the two vice-chairmen to be respectively the presidents of these two organizations; the chairman to be an architect selected by the entire committee.

This tribunal or council would become the strategic board for the consideration and possible solution of all problems affecting the building industry as a whole and their relation to all factors in the community. It would have power to elect and delegate certain authority to an executive committee; to formulate rules of procedure, and to assign to any subcommittees of the tribunal certain prescribed duties. Among these would be the adjustment of matters relating to conditions which might lead to strikes, lockouts, and other economic ills.

II. WASTE IN MANAGEMENT

It has been shown that many of the factors classed as "labor wastes" originate in a greater or lesser degree from inefficiency of management. As it is impossible to maintain an absolute division, these and other sources of waste are again discussed below, but as arising from strictly management sources.

The problems of construction management involve not merely the taking of the contract, the purchase of materials, the engaging of foremen to handle the work, they involve to a still greater degree the arranging of the work of the different trades, the scheduling of the operation and of delivery of material, the planning of the work of individuals and groups of workmen, the design and maintenance of the proper equipment, the maintenance of cost records, the knowledge of what constitutes a day's work, definite policies of employment and the payment of the workman in accordance with the performance. All of these things are essentials in well-managed construction operations.

Lack of Forethought.—Attention has been called to the individuality of each contract and the need for special plans to handle each one. The individual contract receives insufficient forethought. The need for advance analysis of all details of the job is little appreciated. The nature of the work itself, the relation of one class of work to another, the need for indicating the best and most economical time for starting one class of work following another, the necessity for providing proper materials in required amounts at certain times, all show the necessity for planning in advance of performance.

Advance planning is conducive to expediting performance, amd is a means of insuring performance within the contracted time. Yet it is a rare exception to find a construction job planned to co-ordinate the various divisions of work with the necessary materials.

The Progress Schedule.—As indicating what can be done, we have in mind a contractor—not representative of the class as a whole, we regret to say—who after making a thorough study of conditions as to both the material market and the site, draws up in conjunction with the engineer and the man who is to handle the work in the field, a detailed progress schedule on which all future operations are to be based, such as that indicated in Figure 13. The schedule is checked daily and lived up to. On the basis of this progress schedule a material schedule is drawn up on which is indicated dates the various quantities should be taken off, dates to order materials, outside shipping date, and dates on which the various materials should be delivered to the job. The purchasing department has a follow-up, which functions to assure all concerned that the dates in this schedule are maintained. The field superintendent is kept in touch with all items by ticklers containing latest information as to shipment, etc., which must be returned immediately upon receipt with notations as to record of shipment and receipt of material; thus all functions are coordinated and rarely is a job delayed or held up for want of materials.

The effectiveness of this method was fully demonstrated during the past four years when the demands for material was unprecedented. This contractor was spoken of as being "lucky" and "fortunate" because jobs went along with normal and even, at times, abnormal speed, whereas the well-balanced condition was due wholly to thorough planning.

In contrast with this method is that of the average contractor whose only dates ordinarily are those of starting and finishing, and who largely regulates deliveries of materials by visits to the job, or through advices received from the job superintendent, stating that he will need this or that at such a time. Such a method of planning must result in delaying the job for want of material or at other times in burdening the job by an over-supply of material. Frequent lay-offs result in dissatisfaction of the workmen, loss of good mechanics, and higher labor turnover.

A few contractors are following plans somewhat similar to those outlined above. In a very large office building in process of erection a definite schedule is laid out of two stories per week. Brickwork is run up at this rate, the rest of the work following at the same pace. The total man-hours each day for each trade is carefully divided into classes of work and daily unit cost records are maintained.

Going further back, certain contractors have built up sales organizations along lines similar to those in the manufacturing industries, and fix an advertising sales budget each year. Contractors undoubtedly must be educated to set aside a large percentage of their profits to be used in the building up of off-peak business.

Need of Planning on the Job.—Daily planning, such as is used in modern factory management, has been applied only to a limited extent in the building industry. Contractors are prone to leave the planning of their work to their superintendents or often to their foremen, with very little means to co-ordinate the work of the various gangs. Again, it is to be observed that "rule-of-thumb" methods are still employed by a large

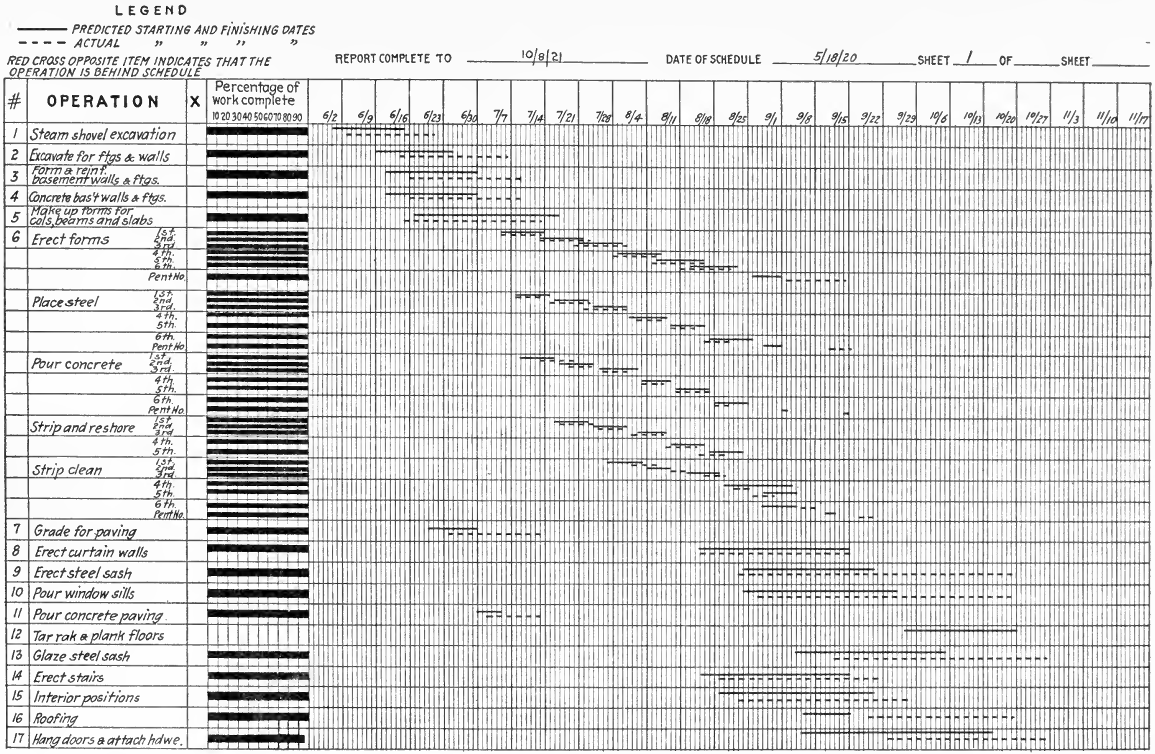

LEGEND
PREDICTED STARTING AND FINISHING DATES
ACTUAL " " " "
RED CROSS OPPOSITE ITEM INDICATES THAT THE OPERATION IS BEHIND SCHEDULE
REPORT COMPLETE TO 10/8/21
DATE OF SCHEDULE 5/18/20
SHEET 1 OF SHEET
#
OPERATION
X
Percentage of work complete
10 20 30 40 50 60 70 80 90
6/2 6/9 6/16 6/23 6/30 7/7 7/14 7/21 7/28 8/4 8/11 8/18 8/25 9/1 9/8 9/15 9/22 9/29 10/6 10/13 10/20 10/27 11/3 11/10 11/17
1 Steam shovel excavation
2 Excavate for ftgs & walls
3 Form & reinf. basement walls & ftgs.
4 Concrete bas't walls & ftgs.
5 Make up forms for cols, beams and slabs
6 Erect forms 1st. 2nd. 3rd. 4th. 5th. 6th. Pent Ho.
Place steel 1st. 2nd. 3rd. 4th. 5th. 6th. Pent Ho.
Pour concrete 1st. 2nd. 3rd. 4th. 5th. 6th. Pent Ho.
Strip and reshore 1st. 2nd. 3rd. 4th. 5th.
Strip clean 1st. 2nd. 3rd. 4th. 5th. 6th. Pent Ho.
7 Grade for paving
8 Erect curtain walls
9 Erect steel sash
10 Pour window sills
11 Pour concrete paving
12 Tar rak & plank floors
13 Glaze steel sash
14 Erect stairs
15 Interior positions
16 Roofing
17 Hang doors & attach hdwe.

FIG. 13.

number of contractors in carrying on their work, the materials on hand governing the order of operations to a large extent. We find an occasional contractor who definitely plans the work for each day and in addition arranges for daily conferences of foremen and superintendent, or planning man, to discuss the operation schedules for the following day and insure co-ordination. On form construction and certain other phases of the work, modern shop methods are followed. Frequently labor costs are cut appreciably, notwithstanding the extra clerical work involved. The advantages of such plans are obvious, for the men move at the finish of an operation automatically to another, and materials are at hand for the work; thus costly conflicts between trades are avoided, and time ordinarily wasted by gangs in waiting for the foremen to determine their next move and to locate materials is saved. Again, on those well planned jobs a " knitting list " of jobs to be done in bad weather is maintained, which tends to reduce lay-offs on account of the weather.

It is the opinion of the chief engineer of a large contracting concern whose company now plans its work probably to a greater extent than any other, that there is still a vast field for the further application of intensive planning, which will result in the saving of much labor now wasted.

Cost Keeping Methods Inadequate.—Scarcely two contractors have similar methods of keeping account of costs. Few keep accurate enough records of work accomplished by the workmen to furnish an approximation of the unit costs from day to day. The economies to be derived from accurate cost records have been recognized by a few contractors who will be found among the leaders in the industry. These contractors by maintaining standards for the various subdivisions of the work and by utilizing the time-keeping system, have a check on the time spent by the various workmen on any operation.

Knowledge of a " Day's Work."—In a recent hearing a claim was made by a contractor that a bricklayer laid 1500 brick before the war, and was laying 500 in 1921. This was answered very properly by representatives of the workmen that, without more exact knowledge, variations in the kinds of walls make comparisons like this absurd. Yet it has been the experience of the author of this report that it is possible to obtain data on actual accomplishments in all kinds of construction which will furnish an accurate guide to what a man should accomplish under working conditions, with due allowance for rest and delays. It is such information that will eventually make it possible to put building construction on a really manufacturing basis.

Studies of the building trades were begun by the late Frederick W. Taylor and by Sanford E. Thompson in 1894. Analyses were made of the different operations by determining the time of the individual units, such, for example, as spreading mortar for brick, laying one brick to line, stretching line, etc. With these as a basis, allowing a proper percentage for rest, it was found possible by combinations actually to determine a fair day's work under all variations of design and types of construction. Contractors, however, have not attained the point reached in certain other industries in establishing standards of production based on thorough job analysis with time study.

Results of Standardization.—In a few cases—few because of lack of proper facts—incentives have been given to the workmen to accomplish more work and to earn more money. In one concern, through the use of such methods, combined with scheduling and planning, the workmen actually increased their efficiency during the early years of the World War, when other concerns were producing way below normal. Standards employed by most contractors have been determined simply by past performance without accurate study of times, and are of small value. The economic advantages of properly determined standards are great and are warranted even if for no other purpose than to serve as a foundation on which employer and employee can build up a proper wage scale. A firm making a specialty of tile setting in Cleveland, as a step forward adopted a premium plan by which employers would divide with the employees the saving in labor cost below the standard. There has been nothing but co-operation in this plan from the employees and their union. The Employers' Association, however, objected and hindered the development of the plan.

In this connection it must be emphasized that standards of production cannot be guessed at. With indisputable facts as a basis, workmen, whether union or non-union, are recognizing the value to themselves of gaging pay by output. Unions in certain other trades, particularly the needle trade, are definitely co-operating along these lines. In Montreal, Canada, for example, very definite and satisfactory results have been attained in this way. These are simply indications of what the building industry, as well as others, must come to recognize.

Example of Organizing Methods in Dwelling Construction.—An interesting example of the practical use of standards is afforded by a group of dwelling houses built under the direction of the author. Careful standards were determined, based on accurate time and job analysis on all of the applications of carpenter work for this group of houses, of which no two were alike in design. It was found possible to determine accurately in advance by means of time study data the time it should take a good workman, with proper allowance for rest and delays, to frame, erect, board, lay the floors, and put on the finish. The regular union rate was paid and in addition to this a bonus of 20% was paid for doing the work in the time specified. Later, on request of certain exceptional workers, the base rate of these first class men was raised, still paying the 20% bonus on the higher rate.

At first the plan was looked upon with suspicion, the men believing that the work was simply piece work under a different name, and that the employers would use the results to their disadvantage. Gradually, however, this suspicion subsided as the men were convinced that the standards were not made up from mere averages or guesses, but worked up from units so as to cover all possible conditions.

As a result of this work, unit costs were reduced, the earnings of exceptional men increased 40%, while average men received 20% in addition to their former pay. In handling this work it was necessary to institute a certain amount of planning and scheduling similar in character to that already described for another contractor on a preceding page, in order to keep the operations moving smoothly.

Methods of this kind have proved themselves to be practicable on the erection of manufacturing buildings, on groups of dwelling houses, and on various other forms of construction work. One of the principles of the Associated General Contractors is: "as an incentive to greater production, make provision for increasing compensation whereby men of extra skill and knowledge may add to their regular wage."

Incentive for Production and Quality Needed.—But little is accomplished in this world of ours without some definite incentive. This incentive may be a moral desire for accomplishment, it may be an aim for advancement, or it may be the pay envelope, which after all, is the means for ethical as well as material progress. The negative incentive, the slave driver method, reached its widest use in construction operations. Unfortunately it still exists in many quarters. "Damn you, get busy!" "Get to hell out of here!" "Go get your money!" are expressions we still hear. But this type of management is passing. It must not be replaced by a "go-easy" policy which takes all the stamina and character and individuality out of a man, but by well-defined methods, such as definite records of accomplishment, scales of wages based upon quality and quantity of work done, or bonuses for coming within the required standards of quality and production. All of these devices, however, are worthless without determination of standards, knowledge of a proper day's work, and control of the work and materials as above described.

Inadequate Employment Management.—As already noted, scarcely a building concern, even the largest, employs a man whose distinct duty it is to engage workmen, take an interest in their welfare, and advise with reference to discharges and other personnel features. A few who are making attempts along these lines find themselves well repaid. In most building construction the superintendent and various foremen have the entire responsibility for "hiring and firing" the men directly under them.

As shown by the diagrams in Figure 12, the high percentage of quits could be appreciably reduced by better employment methods. In the building industry references or evidences of a workman's ability are rarely demanded. As a result men are employed and after a period of inefficiency, in many cases resulting in considerable loss by spoiling materials, they are discharged, only to repeat the performance elsewhere, frequently on another job for the same contractor. In one case a man who claimed to be a plasterer, bricklayer, and a finisher was tried at each of these jobs without properly qualifying and at the expense of the contractor. The contractor excused himself on the grounds that men were urgently needed, and that everyone must be given a trial.

Preference List.—One contractor places men of proved ability on a preference list to which additional names are added from time to time. These men are kept in practically constant employment, even if it is necessary to lay off a man not on this list. This results in attracting men of proved ability and also forms a well-defined incentive to other men to prove their ability so as to get on the list. Turnover expenses are reduced and the quality of work advanced. This concern keeps close record of all men employed, with their rating, so that in time of increased business these men may be drawn upon, thus cutting down the process of "hiring and firing."

Lack of Proper Equipment.—Contractors, by failure to make thorough studies to determine the amount, type, and best location of plant and equipment, add another contribution to waste.

A large percentage of the contractors hold that they do make studies of plant requirements, and then perfect their layouts after the job is in operation if they are found uneconomical. A contractor operating in a New England city found on a visit to a job, supposed to have been carefully laid out, that the concrete mixer in operation was not the proper type. Not having one in stock he wired New York and had one sent by truck to prevent delay to the job. This proved to be worth the expense. The plant on this job evidently was not thoroughly studied. In the majority of cases like this the plant is not changed but continues to operate inefficiently. It is becoming more and more common on large jobs to prepare drawings of the design of the plant. Unless the engineers, in making such designs, however, collaborate with the practical superintendent, details are apt to be poor. For example, on one job to which the attention of the author was directed, a concrete plant satisfactory in general pan was designed by engineers, but in operation it was found that the shape of the sand bins necessitated frequent leveling of the piles. The outlet gates also were so designed and placed that three men instead of one were required to fill the material cars with sand and gravel. The detail of the design of the cement shed was such as to require three times as many men as should have been needed to handle and empty the cement.

Concrete equipment, even when properly built, is frequently installed with bad judgment and without definite planning, so as to increase greatly the number of workmen required. The slope of the chutes is frequently so flat as to require sloppy concrete of unsatisfactory quality. Hoppers are arranged without regard for convenient access of barrows. Tools and small equipment are neglected.

It is not hard to find large operations where reinforcing steel is cut by hand instead of with power shears. Again, the lack of foresight of contractors in not properly planning the storage of material is evident.

The possibilities of savings by the application of more plant engineering are enormous, since the cost of all operations is affected by the equipment used in handling materials, the location of this equipment, and the efficiency with which it is utilized. General failure of the industry as a whole to develop and use a greater amount of mechanical equipment is an established fact. Greater strides have been made in almost every other industry in the application of mechanical means as labor-saving devices and production stimulants. Contractors would do well to realize this and by direct interest develop this side of the industry.

Employers will do well to recognize the possibilities of assistance from the workmen in the development of labor-saving equipment and methods. Although in certain cases unions have objected to labor-saving devices, this is a wrong principle.

With the larger education now taking place, it will be relegated to the past like restriction of output. The workmen have an opportunity to co-operate in the development of equipment and methods which will lighten the work, improve quality and make for production.

III. WASTEFUL LABOR REGULATIONS

Waste attributable to labor in the building industry arises from many sources and the amount of waste fluctuates with the demand for labor. Interesting evidence of this fluctuation is contained in Figure 14, which compares the cost of labor on seven different jobs by one contractor. The basis of each group, or the 100% line, is the estimate of cost. All the buildings were constructed in the same year, during the war, and were similar in general type. The difference in cost, therefore, may be laid directly to labor conditions. The heavy black lines represent union trades employed on the operations indicated, while the cross hatch lines represent non-union trades employed. In these cases it is evident that the union labor was much less efficient than the non-union labor. The object of the chart, however, is to show the possibilities in eliminating waste of labor and increasing production. With thorough co-operation of unions with employers and the development of the old guild spirit, which tends to give a man pride in the quantity and quality of his work, there is the possibility of increasing production and by these means of maintaining high wages, yet with a resultant lowering of costs. Lower labor costs, as we have emphasized, mean more building and more continuous employment for the worker.

Hours of Labor and Wages.—For mechanics or skilled labor, the 8-hour day is almost universal, while laborers work 9 hours. In certain localities and in certain trades, instead of a half-holiday Saturday the men require a whole day, and thus put in only 40 hours per week on jobs.

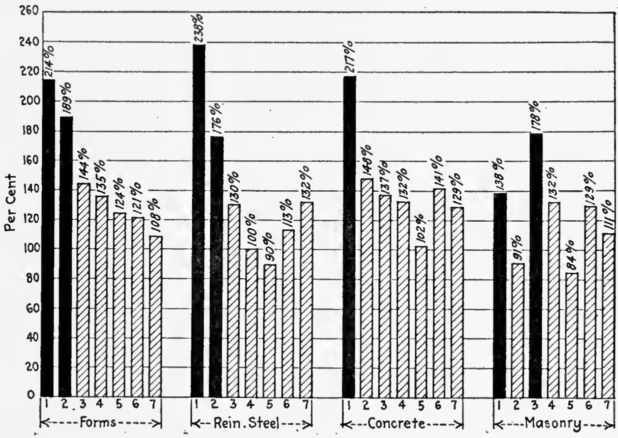


FIG. 14.—Labor Costs of Seven Similar Concrete Buildings, in Per Cent of Estimated Labor for Trades as Indicated.

Where time is an object, it is necessary to pay time and a half for a half-day Saturday.

The increase in wages in different trades during the past eight years in comparison with the cost of living is shown in Figure 15.

Labor Organization.—The building trades, because of the scattered nature of their work and its miscellaneous and seasonal character, particularly need organizations that will assist them in maintaining their rights and obtaining a square deal. The trade unions tend to relieve the contractors of their responsibility, as they act in a measure as employment agencies. They are also supposed to vouch for the ability of their men, but, unfortunately, the ability of union men is as little known as that of non-union men, and does not obviate the need of complete employment records.

Particularly during the demand for men in the past few years, unions have necessarily taken in those having little skill or ability, and these still retain their union cards.

Union Rules.—Some of the union rules affecting work are justified in furthering quality and workmanship. Many are absolutely wrong

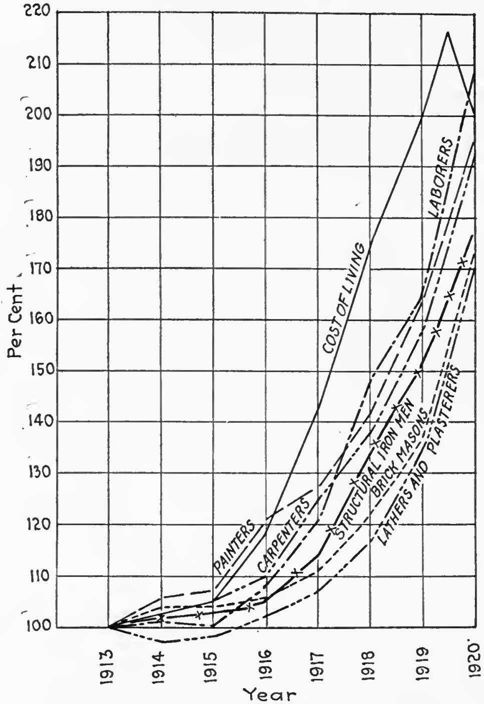


FIG. 15.—Per Cent Increase in Cost of Living and Wage Scales, Paid in Various Trades in Building Work.

Figures from U. S. Bureau of Labor Statistics which cover thirty-two cities in the entire country. The figures plotted being an average of all cities.

and uneconomical and show the lack of recognition of the fundamental principles of economics, which require that a man give his best in order to receive fair returns. Many unions have exceeded the limits of fairness, and partly because of the leaders' lack of appreciation of the fundamental need for high production, have formulated by-laws, and, in individual cases, have formulated demands that have been a tremendous factor, directly or indirectly, in the restriction of output. This has resulted in increase in cost and reduction in the demand for building. It represents, in fact, one of the great sources of waste in the building industry. This policy has reacted, resulting in widespread opposition to unions. In fact, some of the most successful building contractors employ non-union labor because of their opposition to unjust union rules and requirements.

In considering this question it must be recognized that the unions are by no means alone in their restriction of output. The contractors and builders and supply dealers affect the situation to as great a degree indirectly by maintenance of high prices, collusion in bidding, and unfair practices. Collusion between unions and employers also has sometimes raised prices unduly.

Examples follow showing simply what must be guarded against and eliminated from the rules and by-laws of certain local unions if the workmen are to make progress and share in the general development which is taking place.

Requiring Skilled Men to do Unskilled Work.—Below are given some examples of union regulations which have required skilled men to do unskilled work:

1. Carpenters' helpers are prohibited from using carpenter tools, requiring carpenters to do such work as stripping forms from concrete. Experience shows that helpers can do this more economically and as well.
2. Brick masons insist on washing down and pointing brick work when laborers could do it more economically.
3. Structural steel workers under certain rules must bring the steel from the unloading point to the building site, thus doing laborers' work at high cost.
4. Structural steel men place reinforcing steel for concrete, whereas experience has proved conclusively that properly trained laborers can do it to as good advantage, and at greatly lowered cost.
5. Structural steel men claim the rigging on a job. For a small derrick used in footing excavation, the bucket cable had to be guided by hand and the hoisting engineer signalled by a skilled iron worker.
6. Hoisting engineers claim the right to run all types of engines, including small gas-driven pumps which require no skill. On one job a contractor had to hire a union engineer at $8.00 per day simply to start a pump in the morning, oil it occasionally, and stop it at night.
7. Union rules in general require distribution of plumbing materials above the first floor by union plumbers.

Uniform Wage.—One of the greatest fundamental causes for low output is the fact that all members of unions in the same trade are paid the same minimum wage. Occasionally as the demand exceeds the supply certain individuals are paid in excess of this, but it is exceptional. There is no incentive. As a result of records made by the author on actual construction work, it was found that in the building trades on every job there are usually a few men who do one-third more work than the average man on this same job. These men also do better work. Is it fair to these good men for them to receive the same wage as the others?

Limiting Apprentices.—Restriction of apprentices in many cases is extreme and unfair. Overtime and travel rules also tend to increase building costs unduly.

Restricting Output.—Many unions at the present time have in their by-laws no requirements for restricting output, and, as has been stated, appreciate the fact that this is contrary to good principles.

The following notes, however, illustrate what are included in certain local rules:

1. Lathers propose that 12 bundles of laths shall constitute an 8-hour day's work. Formerly the output was restricted to 16 bundles.
2. Certain painters' unions do not permit their men to use a brush wider than $4\frac{1}{2}''$ for oil paint, although for certain classes of work a wider brush is more economical.
3. Painters' unions refuse to allow their men to work on a job where a spraying machine is being used. The claim is made, with little foundation, that this is unhealthful.
4. Plumbers' and steamfitters' unions prohibit the use of bicycles and vehicles of all sorts during working hours.
5. Members of plumbers' and steamfitters' unions in some sections demand that all pipe up to $2''$ shall be cut and threaded on job.

Jurisdictional Regulations.—A potent source of labor waste is the jurisdictional practice which distributes certain types of work to different trades, frequently without regard to expense. In one case, in order to move a pump and set it up in a different location in a foundation hole, it was necessary to get a pair of steamfitters to disconnect the steam pipe, a pair of plumbers to remove the suction apparatus and replace it, a structural iron man to erect the rig to lift the pump, and an engineer to operate the valves on the pump. This took eight men for the operation, who had to be taken from other work, when one man, assisted by a laborer, could have accomplished the entire job.

Jurisdictional strikes which probably represent one-quarter of the total number are mainly quarrels between unions. Some headway has been made by the unions in the settlement of points which cause these jurisdictional disputes through the agency of the National Board of Jurisdictional Awards. This board has done valuable work, but in settling disputes doors are left open for future argument since the decisions are not founded on a sound economic basis. From the standpoint of economy and ultimate benefit to the workmen, as well as to the builder, it is important to decide which type of mechanic can handle a given operation to the best advantage rather than which of two trades shall do the work.

Suggestions from Unions.—Despite the restrictive action of many of the union regulations, there is growing evidence of willingness to co-operate. As an example of this are the following suggestions for the elimination of waste given to the author by members of the Building Trades Council which comprises twenty-six building unions in Philadelphia and is also affiliated with non-union workmen.

The waste in the sheet metal trade comes under the following heads:

1. Mistakes in estimating cause mechanics to be accused of loafing, and such unjust accusations injure the efficiency of the men.
2. Woodwork out of measurement causes the erecting mechanic to alter work which has been made up in the shop from plans.
3. Scarcity of scaffolding causes inefficiency because men cannot work to advantage without ample working space.
4. Lost time of excellent erecting mechanics because they are not given opportunity to work in shop in bad weather.
5. Lack of materials on hand when men arrive on job from shop.
6. Time lost due to wage disputes.
7. Inferior materials used cause replacements of tin roofs in from six to eight years, while if good tin were used it would last 20 years.
8. Apprentices not properly trained.

The Cement Finishers' Union suggested that considerable waste in reinforced concrete construction is due to unintelligent men supervising it. Frequently rough slabs are put in by unintelligent or incompetent foremen, requiring, because of poor levels, from $1\frac{1}{2}$ to $2\frac{1}{2}''$ of finishing material in place of $1''$ as specified.

The Steamfitters' Union referred to waste from inexperienced help, and from failure of employers to furnish men with up-to-date tools, lack of co-operation between employees and employers, and failure to deliver materials, causing delays not only to the steamfitters but to all those whose work follows. The installation of inferior heating plants tended toward consumption of an excessive amount of fuel.

Waste in slate and tile roofing results from:

1. Lack of trained apprentices because new helpers are employed for each job;
2. Handling broken material caused by punching at quarries;
3. Punching now done at quarry should be reserved to be done in the shop on rainy days, thus eliminating lost time;
4. Lost time waiting for materials;
5. Tons of discarded materials at quarries could be worked up for diamond single-lap slate, which would be available to the public at cheaper rates;
6. Waste due to using ordinary nails, which rust out in a few years, instead of galvanized or copper nails.

The Carpenters' Union referred to the time that can be saved if contractors use bolts instead of nails in the erection of scaffolding, also resulting in a great material saving.

Typical waste in painting includes:

1. Insufficient scaffolding, causing waste of time of painters in repairs on jobs.
2. Incompletion of rooms—moldings for example left incomplete, causing painter to take the time to return to the job later;
3. Changes made after work is completed;
4. Delay occasioned by waiting for the selection of colors by the owner;
5. Poor materials and insufficient tools and materials, causing the painter to waste time.

The Bricklayers' Union reports the following:

1. Use of cement mortar of 1 : 3 mix, instead of lime mortar, reduces the productivity of masons materially.
2. Mortar improperly mixed by untrained men and the quick setting features of the 1 : 3 mix keep a man continually tempering it.
3. Dumping of common brick is wasteful because of high breakage and extra cost of laying the broken brick.
4. The bricklayer may be likened to a machine. When not in use it will rust. A mason becomes soft and muscle-bound when unemployed, which tends to slow him up when again employed.

Opportunity of the Unions.—One of the principal aims of the trade unions should be to make their services valuable to the employer by developing and training the men in their organization and establishing a high standard, by assisting in the development of standardization of time, method and material. Some unions are taking the initiative in these matters, opposing restriction of output, and training and educating their members, thus producing good mechanics and furthering the elimination of waste.

Attention has already been called to the "Philadelphia Plan," worked out by the Building Trades Council of trade unions in co-operation with open shop workmen. In San Francisco there has been established a permanent Board of Arbitration consisting of three members, empowered both by the Builders' Exchange and by the Building Trades Council to go into all matters that affect wages, working conditions and costs, as well as to set wage scales in those trades in which there is a controversy at present.

IV. MISCELLANEOUS SOURCES OF WASTE

Accidents.—Approximately $30,000,000 every year represents the actual money paid to insurance companies for compensation and liability insurance. Even this enormous figure by no means represents the total loss. While state laws vary, in general an injured workman must be disabled some 7 days to two weeks before receiving an award, and then receives as compensation only about one-half his average daily earnings. The loss to the contractor is less tangible, but where a man is out a new one must be broken into a job with loss of time and frequently loss of material. In case of serious accident, also, there is stoppage of work and extended loss of time of the entire gang. In the opinion of one of the best authorities in the country the actual cost of insurance represents not more than 25% of the total economic loss, which brings the total cost due to accidents in the vicinity of $120,000,000 per year—a staggering total. As shown in paragraphs which follow, an appreciable proportion of this can be eliminated by proper care.

In the State of Massachusetts, where about 150,000 mechanics were employed in the building trades for the year July 1, 1919 to July 1, 1920, there were 5,032 tabulated accidents, representing a loss of time of 485,486 days.

In New York State about four times as many people are employed in the factories as are employed in building and construction work, yet during the four years 1910 to 1914 more fatalities due to accidents occurred in building and construction work than in factories:

Accidents in building and construction work	1641
Accidents in factories	1285

Falls caused more fatalities than any other single cause, as shown in table below:

Fall of persons	545
Mechanical power	518
Weights and falling objects	246
Heat and electricity	239
Miscellaneous	93
	1641

Causes of Accidents.—Accidents are largely caused by carelessness of the workmen, or lack of ordinary safeguards. Staging is carelessly built and inadequately inspected; runs above ground are laid only one plank wide; roughly built ladders composed of narrow cleats nailed to vertical uprights are used even on lengthy jobs in place of stairs, which the best contractors find most economical as well as safer; runs and passageways in constant use in high buildings are built without rails and obstructed with steel or lumber; overhead traveling cables are unprotected. Small attention is paid to the details of construction in these matters. Conditions which would not be tolerated in a factory for twenty-four hours are found on every job. The amount of actual saving that can be made on a large construction job by providing proper roadways and runs and inclines are but little realized by the average contractor.

Preventable Waste.—An official of a large insurance company believes that by proper safety measures the waste due to accidents can be reduced

75% to 80% in from two to five years of honest effort, and that construction labor cost can be cut 3% by these measures. Another official estimates, from actual accomplishment in safety measures, that a total of more than 12,000,000 days a year could be saved the industry by the application of safety methods.

Insurance rates in building construction are higher than in any other industry. Rates are dependent on the cost of the accidents which actually occur. Therefore, any reduction in accidents reduces the insurance paid. The morale of the workman is also improved if he knows that his employer is looking after his welfare and health

Examples of Accident Elimination.—As illustrations of what can be accomplished in reducing accidents, the experience of several companies that have taken up this matter in earnest is of interest:

1. One contractor who employs an average working force of 3,000 full-time workers, by the application of safety methods, by combating carelessness and lack of foresight, by safety bulletins, and by personal instruction cut his accident rate 50% in three months. Maintaining this reduction for the entire year will effect a saving of 4,950 working day's representing in wages saved. more than $27,000, without taking into account saving through the elimination of fatal accidents.
2. A large New England contractor whose safety precautions have long been a part of the general policy, has constantly increased his discount earned in liability and compensation insurance, until at the present time his rates in some cases have been reduced to about $4.80 against the usual $10.00 per $100 of payroll.
3. One large general contractor whose loss due to accidents equalled $2\frac{1}{2}$% of total days worked, upon installation of safety methodsr educed this to $\frac{7}{10}$ of 1%. The table below shows that for the two periods covered the severity rate decreased 75% and the frequency rate more than one-third.

	Period July 1, 1919 to July 1, 1920	Period July 1, 1920 to Oct. 1, 1920
(1) Average number of employees	3,341	3,055
(2) Total number of hours actually worked by all employees per month	835,600	764,800
(3) Number of accidents per month causing lost time longer than the day or shift on which injury was received	44	27
(4) Number of days per month lost because of accidents	2,770	640
(5) Frequency rate. Number of accidents per million hours worked	51.8	35.8
(6) Severity rate (number of days lost per thousand hours worked)	3.29	.84

This gradual reduction in accidents per one hundred employees is shown in Figure 16.

Delays from Lack of Plans and Details.—The employers and workmen are not the only offenders in delaying operations. Architects frequently cause expensive delays and occasionally complete shutdowns by failure to deliver detail plans at the proper time. Some architects leave the matter of securing details to the builder, as they feel the builder knows when these details are required. Then the builder may fail to call for them until it is too late for the architect to produce them on time, resulting in a delay. The value of a set schedule of operations placed in the hands

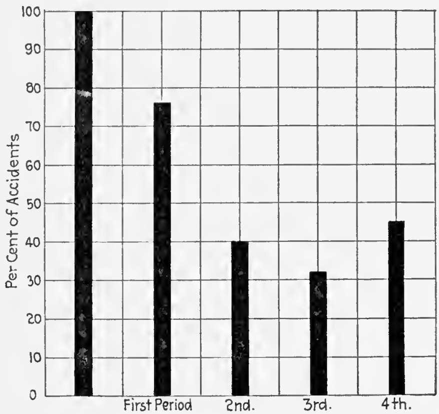


FIG. 16.—Reduction in Accidents Per 100 Employees Accomplished by One Contractor by Applying Safety Methods.

of the architect at the start of an operation forewarns the architect of the builder's need.

Design Duplication.—The waste of time and energy and money through duplication of estimates and of designs runs into the millions every year. Frequently the architect makes general designs and because of lack of knowledge or to keep the apparent cost of design low, asks all the bidders to design the structural details in order to get their quantities. Not only must the bidder include the cost of this design in his proposal, but he must allow in addition an overhead to cover the cost of various similar designs he made without getting the contract. This duplication of design is an absolute waste of money, and the owner pays the bills. It is apt also to result in designs weak at certain critical points and more expensive as a whole than those attained with thorough engineering study.

Quantity Surveys.—An equal, if not greater, source of waste is the duplication in figuring quantity by all bidders. Frequently on a comparatively small job there may be a dozen bidders. Each one takes the architect's or engineer's plans, figures the quantity of steel, the lumber, the brick, plaster, and so on. Not only is there opportunity for error, but the work of each is a duplication of the others.

The owner pays the bills in all these cases.

A joint committee of representatives of the American Institute of Architects, American Engineering Council, and the Associated General Contractors of America, has been studying the subject of quantity survey and payment for estimating.

The report of the Committee is tentative and only issued in view of the great interest in the subject. The following is an excerpt from this report:

> "When I ask fifteen men to submit bids for performing prospective construction, do I pay the successful bidder only, or do I pay for the preparation of all the bids?"

The committee has decided that the owner pays for all bids, as the contractor's "overhead" is greater because it must include the cost of estimates made on unsuccessful bids. In the end it is far cheaper for the owner to pay for a quantity survey whether he proceeds with the building or not, and it recommends:

> "1st. Architects, Engineers, and Contractors should jointly use their efforts to have established facilities for making quantity surveys in their communities," . . .

The advantages are lower cost, since the owner pays for only one quantity survey, and uniformity of bids, the contractor figuring on known quantities. It changes speculation to competition and the unit prices in the successful bid form the basis for additions or deductions in quantities.

Standardization by the Associated General Contractors.—The Associated General Contractors of America, organized in 1918, and with a membership of 750, representing 37 states, is doing excellent work through its active committees on contracts, ethics, labor and methods. The Committee on Contracts is working up standard forms of contracts for use by all contractors. The Committee on Ethics is developing and has submitted a proposed code of ethics which will do much to raise the professional standard of all contractors; the Committee on Methods is endeavoring to standardize forms of contractors' equipment leases, quantity surveys, etc.; the Committee on Labor has developed a constitution and status of industrial relations, in which are considered the rights of the employee, employer and public. In the preamble of the "Fundamental Principles of Industrial Employment Relations" is the following: "*Justice* to all interests, *Co-operation* between employer and employee, produces *Service* to the public."

Standardization of Design and of Details.—While the standardization of dwellings or other types of buildings is not generally practicable, certain details are capable of standardization, and should be introduced and made uniform in building codes. Take the thickness of walls, for example. In a recent survey made by D. Knickerbacker Boyd of some ninety cities, thirty of them required a 13″ wall for the first story and 9″ wall for the second, while the remaining thirty required a 9″ wall above the basement. Adoption of the last requirement means a saving of some $600.00 in the cost of an average house.

Even the size of the brick is not standardized. In some localities the size of brick requires for 2-brick width an 8″ wall, whereas in others it requires a 9″ wall for the same type of work.

Standardizing mill work, such as windows, doors, and other similar items entering into the average building, would reduce the waste inherent in the "made to order" policy.

Waste of Material.—It is outside the province of this assay to consider at length the waste in building due to lack of economy in design. In construction, however, a great deal of waste occurs in cutting lumber, breakage of brick, loss of mortar, and damages to materials. In scaffolding the waste of lumber is appalling. New lumber and thin boards are used until one-half of this is ruined before the finish of the job. In Europe a good builder owns thick planks and sturdy poles which he takes with him from job to job, and erects the scaffolding largely without nails. Half-hearted architects, builders, and members of the building trades can be singled out by the lack of care with which they conduct their business operations. Successful architects, builders, and workmen are those who eliminate the unnecessary elements of waste.

Encouraging Signs.—The most encouraging feature in the building industry today is the action of a few of the builders and a few groups of building trade workmen in making intensive studies of the causes and remedies for irregular employment and haphazard conditions of work. Along with this is the growing appreciation on the part of both labor and management that to build more buildings and maintain high wages it is necessary to attain greater and greater productive capacity per man. They see as proof of these facts that the 1921 depression was caused and extended by too high costs of all products, and that business, either in manufacturing or in building industries, is improving only as the costs of and the materialcost of labor are reducing. All are recognizing, in fact,

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Building* **PLANT NO.** *Composite* **EST. BY** *Thompson & Lichtner Co.* **DATE** *4-30-21*

KEY ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste, Good = 20% ″, Fair = 40% ″, Poor = 60% Waste, Bad = 80% ″; a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	Est. % Waste 2	3	Points Waste 4	LABOR Assigned Points 5	Est. % Waste 6	7	Points Waste 8	OUTSIDE CONTRACTS Assigned Points 9	Est. % Waste 10	11	Points Waste 12	TOTAL WASTE Assigned Points 13	Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Rensobility and Relationship	K1	0.25	—	40	0.10	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.25	0.10
	K2	0.25	—	60	0.15	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.25	0.15
	K3	0.25	—	40	0.10	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.25	0.10
	K4	1.00	—	60	0.60	0.00	—	0.00	0.00	0.00	—	0.00	0.00	1.00	0.60
	K5	0.50	—	80	0.40	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.50	0.40
	K6	1.00	—	60	0.60	0.00	—	0.00	0.00	0.00	—	0.00	0.00	1.00	0.60
	K7	0.50	—	60	0.30	0.50	—	80	0.40	0.00	—	0.00	0.00	1.00	0.70
	K8	10.00	—	60	6.00	2.00	—	60	1.20	3.50	—	80	2.80	15.50	10.00
	K9	0.25	—	80	0.20	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.25	0.20
	K10	3.00	—	40	1.20	1.50	—	60	0.90	0.50	—	20	0.10	5.00	2.20
	K11	0.25	—	80	0.20	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.25	0.20
	K12	0.75	—	60	0.45	2.00	—	80	1.60	0.00	—	0.00	0.00	2.75	2.05
	K13	1.00	—	40	0.40	1.00	—	60	0.60	0.25	—	20	0.05	2.25	1.05
	K14	0.50	—	40	0.20	0.50	—	60	0.30	0.25	—	20	0.05	1.25	0.55
	K15	2.00	—	20	0.40	1.00	—	80	0.80	0.25	—	20	0.05	3.25	1.25
	K16	1.00	—	20	0.20	0.50	—	20	0.10	0.00	—	0.00	0.00	1.50	0.30
	K17	3.00	—	40	1.20	3.00	—	60	1.80	0.00	—	0.00	0.00	6.00	3.00
	K18	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00
	K19	0.50	—	40	0.20	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.50	0.20
	K20	8.00	—	60	4.80	3.00	—	40	1.20	0.25	—	40	0.10	11.25	6.10
	K21	1.00	—	20	0.20	0.00	—	0.00	0.00	0.00	—	0.00	0.00	1.00	0.20
	TOTAL	35.0			17.90	15.0			8.90	5.0			3.15	a 55.0	e 29.95
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	0.25	—	20	0.10	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.25	0.10
	T2	4.50	—	40	1.80	0.00	—	0.00	0.00	0.00	—	0.00	0.00	4.50	1.80
	T3	0.25	—	40	0.10	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.25	0.10
	T4	1.00	—	40	0.40	0.00	—	0.00	0.00	0.25	—	40	0.10	1.25	0.50
	T5	0.50	—	20	0.10	0.25	—	40	0.10	0.00	—	0.00	0.00	0.75	0.20
	T6	0.25	—	40	0.10	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.25	0.10
	T7	0.25	—	40	0.10	0.00	—	0.00	0.00	2.50	—	60	1.50	2.75	1.60
	TOTAL	7.00			2.70	0.25			0.10	2.75			1.60	b 10.00	f 4.40
UTILIZATION — Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	1.00	—	40	0.40	0.00	—	0.00	0.00	0.50	—	40	0.20	1.50	0.60
	U2	0.50	—	20	0.10	0.00	—	0.00	0.00	0.25	—	40	0.10	0.75	0.20
	U3	1.00	—	80	0.80	0.00	—	0.00	0.00	0.00	—	0.00	0.00	1.00	0.80
	U4	7.00	—	60	4.20	0.50	—	60	0.30	0.00	—	0.00	0.00	7.50	4.50
	U5	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00
	U6	2.50	—	60	1.50	0.00	—	0.00	0.00	0.00	—	0.00	0.00	2.50	1.50
	U7	1.50	—	40	0.60	0.00	—	0.00	0.00	0.00	—	0.00	0.00	1.50	0.60
	U8	1.00	—	60	0.60	0.00	—	0.00	0.00	0.00	—	0.00	0.00	1.00	0.60
	U9	3.00	—	80	2.40	0.00	—	0.00	0.00	0.00	—	0.00	0.00	3.00	2.40
	U10	1.00	—	40	0.40	3.00	—	60	1.80	2.00	—	60	1.20	6.00	3.40
	U11	1.00	—	20	0.20	0.00	—	0.00	0.00	0.00	—	0.00	0.00	1.00	0.20
	U12	3.00	—	60	1.80	0.00	—	0.00	0.00	2.00	—	40	0.80	5.00	2.60
	U13	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00
	U14	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00
	U15	1.00	—	20	0.20	0.00	—	0.00	0.00	0.50	—	20	0.10	1.50	0.30
	U16	1.00	—	40	0.40	0.50	—	40	0.20	0.50	—	40	0.20	2.00	0.80
	U17	0.50	—	20	0.10	0.00	—	0.00	0.00	0.25	—	20	0.05	0.75	0.15
	U18	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00
	TOTAL	25.0			13.10	4.00			2.30	6.00			2.65	c 35.00	g 18.65
GRAND TOTAL		67.0			34.30	19.25			11.30	13.75			7.40	d 100.0	h 53.00

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Building* **PLANT NO.** *Contractor #1* **EST. BY** *Thompson & Lichtner Co.* **DATE** *4-30-21*

KEY
① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste, Good = 20% ", Poor = 60% Waste, a + b + c = d = 100%
④ + ⑧ + ⑫ = ⑭ Fair = 40% ", Bad = 80% ", e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT Assigned Points	MANAGEMENT Est. % Waste		MANAGEMENT Points Waste	LABOR Assigned Points	LABOR Est. % Waste		LABOR Points Waste	OUTSIDE CONTRACTS Assigned Points	OUTSIDE CONTRACTS Est. % Waste		OUTSIDE CONTRACTS Points Waste	TOTAL WASTE Assigned Points	TOTAL WASTE Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.25	—	20	0.05	0.00	—	0	0	0.00	—	0	0	0.25	0.05
	K2	0.25	—	20	0.05	0.00	—	0	0	0.00	—	0	0	0.25	0.05
	K3	0.25	—	20	0.05	0.00	—	0	0	0.00	—	0	0	0.25	0.05
	K4	1.00	—	0	0	0.00	—	0	0	0.00	—	0	0	1.00	0.00
	K5	0.50	—	0	0	0.00	—	0	0	0.00	—	0	0	0.50	0.00
	K6	1.00	—	20	0.20	0.00	—	0	0	0.00	—	0	0	1.00	0.20
	K7	0.50	—	40	0.20	0.50	—	80	0.40	0.00	—	0	0	1.00	0.60
	K8	10.00	—	40	4.00	2.00	—	60	1.20	3.50	—	80	2.80	15.50	8.00
	K9	0.25	—	0	0	0.0	—	0	0	0.00	—	0	0	0.25	0.00
	K10	3.00	—	0	0	1.50	—	20	0.30	0.50	—	20	0.10	5.00	0.40
	K11	0.25	—	20	0.05	0.0	—	0	0	0.00	—	0	0	0.25	0.05
	K12	0.75	—	40	0.30	2.00	—	80	1.60	0.00	—	0	0	2.75	1.90
	K13	1.00	—	0	0	1.00	—	20	0.20	0.25	—	20	0.05	2.25	0.25
	K14	0.50	—	20	0.10	0.50	—	20	0.10	0.25	—	40	0.10	1.25	0.30
	K15	2.00	—	0	0.00	1.00	—	20	0.20	0.25	—	20	0.05	3.25	0.25
	K16	1.00	—	40	0.40	0.50	—	40	0.20	0.00	—	0	0	1.50	0.60
	K17	3.00	—	0	0.00	3.00	—	20	0.60	0.00	—	0	0	6.00	0.60
	K18	0.00	—	0	0	0.00	—	0	0	0.00	—	0	0	0.00	0.00
	K19	0.50	—	0	0	0.00	—	0	0	0.00	—	0	0	0.50	0.00
	K20	8.00	—	20	1.60	3.00	—	20	0.60	0.25	—	20	0.50	11.25	2.70
	K21	1.00	—	20	0.20	0.00	—	0	0	0.00	—	0	0	1.00	0.20
	TOTAL	35.0			7.20	15.00			5.40	5.0			3.60	a 55.0	e 16.20
TECHNICAL Available Engineering Knowledge as to Product, Plant and Materials	T1	0.25	—	0	0	0.00	—	0	0	0.00	—	0	0	0.25	0.00
	T2	4.50	—	20	0.90	0.00	—	0	0	0.00	—	0	0	4.50	0.90
	T3	0.25	—	0	0	0.00	—	0	0	0.00	—	0	0	0.25	0.00
	T4	1.00	—	20	0.20	0.00	—	0	0	0.25	—	40	0.10	1.25	0.30
	T5	0.50	—	0	0	0.25	—	0	0	0.00	—	0	0	0.75	0.00
	T6	0.25	—	20	0.05	0.00	—	0	0	0.00	—	0	0	0.25	0.05
	T7	0.25	—	0	0.00	0.00	—	0	0	2.50	—	60	1.50	2.75	1.50
	TOTAL	7.0			1.15	0.25			0.00	2.75			1.60	b 10.00	f 2.75
UTILIZATION Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	1.00	—	0	0	0.00	—	0	0	0.50	—	40	0.20	1.50	0.20
	U2	0.50	—	0	0	0.00	—	0	0	0.25	—	40	0.10	0.75	0.10
	U3	1.00	—	60	0.60	0.00	—	0	0	0.00	—	0	0	1.00	0.60
	U4	7.00	—	20	1.40	0.50	—	40	0.20	0.00	—	0	0	7.50	1.60
	U5	0.00	—	0	0	0.00	—	0	0	0.00	—	0	0	0.00	0.00
	U6	2.50	—	20	0.50	0.00	—	0	0	0.00	—	0	0	2.50	0.50
	U7	1.50	—	20	0.30	0.00	—	0	0	0.00	—	0	0	1.50	0.30
	U8	1.00	—	60	0.60	0.00	—	0	0	0.00	—	0	0	1.00	0.60
	U9	3.00	—	20	0.60	0.00	—	0	0	0.00	—	0	0	3.00	0.60
	U10	1.00	—	40	0.40	3.00	—	60	1.80	2.00	—	60	1.20	6.00	3.40
	U11	1.00	—	20	0.20	0.00	—	0	0	0.00	—	0	0	1.00	0.20
	U12	3.00	—	40	1.20	0.00	—	0	0	2.00	—	40	0.80	5.00	2.00
	U13	0.00	—	0	0	0.00	—	0	0	0.00	—	0	0	0.00	0.00
	U14	0.00	—	0	0	0.00	—	0	0	0.00	—	0	0	0.00	0.00
	U15	1.00	—	20	0.20	0.00	—	0	0	0.50	—	20	0.10	1.50	0.30
	U16	1.00	—	20	0.20	0.50	—	40	0.20	0.50	—	40	0.20	2.00	0.60
	U17	0.50	—	20	0.10	0.00	—	0	0	0.25	—	40	0.10	0.75	0.20
	U18	0.00	—	0	0	0.00	—	0	0	0.00	—	0	0	0.00	0.00
	TOTAL	25.0			6.30	4.0			2.20	6.00			2.70	c 35.0	g 11.20
GRAND TOTAL		67.0			14.65	19.25			7.60	13.75			7.90	d 100.0	h 30.15

that no progress can be made without paying greater and greater attention to the elimination of waste.

Never in the history of our country was it so important that certain fundamental principles of economics—principles which are not mere theories, but are based positively on facts—should be accepted and established as a working program. These principles will throw overboard the fallacy that restricting production can make the work go farther, and will supplant this with the knowledge that to get one must give, that to receive the equivalent must be given in money or in time or in effort, and that increased returns can only be attained through increased production.

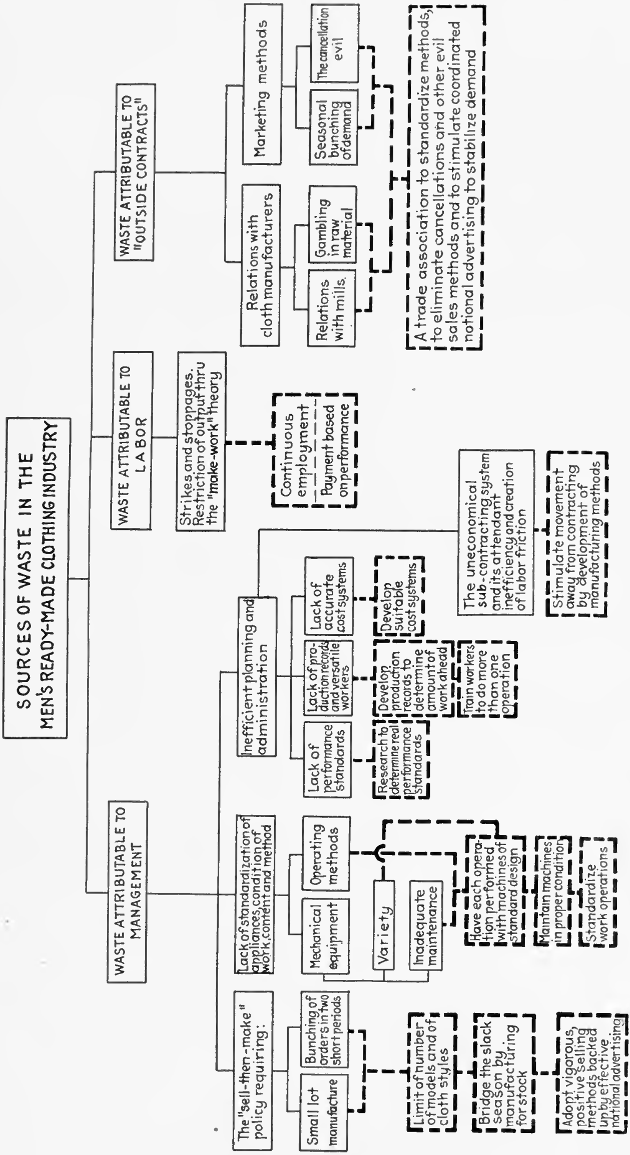
ACKNOWLEDGMENT

In the development of this report, about 106 builders and architects were consulted either personally or by correspondence. Various labor union officials and individual workmen were interviewed and furnished data from personal experience. The F. W. Dodge Company, The National Safety Council, the Massachusetts Rating and Inspection Bureau, the National Council of Workmen's Compensation Insurance of New York and various accident liability companies aided in providing statistics. Statistics from other sources were obtained, although it was found that both government and state records were sadly at fault in quantity, kind, and accuracy of data. Mr. D. Knickerbacker Boyd, Mr. W. S. Hays of Philadelphia, and the Building Trades Council of Philadelphia provided material of particular value. The Associated General Contractors of America also furnished information of interest, as did the National Federation of Construction Industries.

Some 278 questionnaires, prepared by us especially for the building trades and designed to cover all items in the formal questionnaire that applied to this industry, were given out and replies were recorded on 73 of these. The builders thus consulted were located all over the country, especial attention being paid to representative cities such as New York, Boston, Philadelphia, Baltimore, Chicago, Cleveland, Atlanta, and San Francisco.

Appreciation is extended to engineers associated with the author's firm who carried on the research for us. Mr. J. J. Keane conducted the major part of the inquiry, and is largely responsible for the wealth of material obtained. Mr. D. J. Grant and Mr. Earle B. Eldredge also aided effectively in interviews and attendance at the hearings of the Boston Chamber of Commerce on the building situation and in the preparation of the diagrams. A part of the territory was covered by Mr. William E. Curley, and his advice and experience on construction management was utilized in the selection of data and the framing of conclusions.

SANFORD E. THOMPSON.


SOURCES OF WASTE IN THE MEN'S READY-MADE CLOTHING INDUSTRY
WASTE ATTRIBUTABLE TO MANAGEMENT
WASTE ATTRIBUTABLE TO LABOR
WASTE ATTRIBUTABLE TO "OUTSIDE CONTRACTS"
The "sell-then-make" policy requiring:
Small lot manufacture
Bunching of orders in two short periods
Limit of number of models and of cloth styles
Bridge the slack season by manufacturing for stock
Adopt vigorous, positive selling methods backed up by effective national advertising
Lack of standardization of appliances, condition of work, content and method
Mechanical equipment
Operating methods
Variety
Inadequate maintenance
Have each operation performed with machines of standard design
Maintain machines in proper condition
Standardize work operations
Inefficient planning and administration
Lack of performance standards
Research to determine real performance standards
Lack of production records and versatile workers
Develop production records to determine amount of work ahead
Train workers to do more than one operation
Lack of accurate cost systems
Develop suitable cost systems
The uneconomical sub-contracting system and its attendant inefficiency and creation of labor friction
Stimulate movement away from contracting by development of manufacturing methods
Strikes and stoppages. Restriction of output thru the "make-work" theory
Continuous employment
Payment based on performance
Relations with cloth manufacturers
Relations with mills.
Gambling in raw material
Marketing methods
Seasonal bunching of demand
The cancellation evil
A trade association to standardize methods, to eliminate cancellations and other evil sales methods and to stimulate coordinated national advertising to stabilize demand

CHAPTER VI

THE MEN'S READY-MADE CLOTHING INDUSTRY

By Morris Llewellyn Cooke

Introduction

The outstanding fact of the men's ready-made clothing industry is that it is alive from top to bottom. Everything is in flux—everything is in review. We know of no other industry so open to conviction or where a movement for the elimination of waste will get such an immediate and wide-spread and sympathetic hearing from employers as well as from employees.

In reading this report, it should be borne in mind that this is a study in waste. There is much that is fine and inspiring and promising in the clothing industry. My hope is that no one will think that in doing my job—which was to analyze the weakness of the industry—I for one moment forgot all the good in an industrial structure that affords the livelihood for a million of my fellow countrymen.

The Men's Clothing Industry.—The men's clothing industry is concentrated chiefly in New York, Chicago, Rochester, Baltimore, Cleveland, Boston and Philadelphia. The total value of its output in 1919 was $1,158,006,904 and the number of establishments 5,254. An important feature of the industry is that many establishments manufacture clothing on a contract basis from materials furnished by others. About one-half of the establishments are regular factories and one-half contract shops.

In New York, however, which leads in the manufacture of men's clothing, less than 100 "inside" tailoring factories existed in 1919 and there were about 1,970 contracting shops.

The census for 1919 shows, for the country as a whole, the value of output of regular factories as $1,079,024,493 and the output of contract shops as $78,982,411.

Extent of and Responsibility for Waste.—The most waste takes the form of seasonal shut-downs, partial or complete: If the waste of the displaced labor due to these shut-downs is commensurate with that of the displaced plant capacity and were it confined to one part of the year and divided equally among all the clothing workers, they would have opportunity for one full term at school each year. This seasonal irregularity accounts, on the average, for nine wasted hours in every working week. At least ten hours more is thrown away on energy-wasting and time-wasting shop methods, while another two or three hours can easily be gained by simply cutting out unnecessary work. In this report waste attributable to management, to labor, and to outside contact will be discussed in turn.

I. WASTE ATTRIBUTABLE TO MANAGEMENT

The fundamental causes of waste attributable to management are:

1. The sell-then-make policy.
2. Lack of standardization of appliances, conditions, work content, and method.
3. Inefficient planning and administration.

1. The Sell-Then-Make Policy.—The most fundamental cause of waste is the traditional fear-inspired, order-enticing sales policy which expresses itself in wide variety, and its attendant make-to-order basis of manufacturing. The trend in recent years, due to the desire of the manufacturers to stimulate additional demand and their fear of losing ground to competitors, has been toward an increasing number of styles of young men's suits and of varieties of cloth. One concern in a recent season offered its customers 29 stock models of sack-suits and also made up suits in 14 special models designed by certain customers. Each of these was offered in 3 styles of lining construction, 3 combinations of lining material and in nearly 1,100 varieties of cloth. Thus each purchaser had a free choice among 278,000 possible combinations. While this case is extreme it is only the extreme of a widespread trend. (See Figures 1–4.) But, fortunately, a few manufacturers have seen the absurdity of thus conducting a ready-to-wear business almost on a make-to-measure basis and have successfully inaugurated the opposite policy of limiting variety.

The natural accompaniment to this excessive variety is manufacture only to fill sales orders actually in hand—the sell-then-make policy. This is a negative easy-going procedure in any event. But with this great variety of style offered, and without a tabulation and statistical study of sales data which is necessary for any dependable forecast of the probable relative popularity of the various styles, sell-then-make becomes the only safe manufacturing basis. This sales and manufacturing policy of the men's ready-made clothing industry has vast, far-reaching and ramifying effects, both economically and socially:

(*a*) It permits manufacture only in small lots.
(*b*) It necessitates seasonal production, the bunching of a large part of production into two short periods

Charts Showing Distribution of Sales Among Models

Excessive variety of product keeps production on a small lot basis. This variety coupled with a policy of manufacturing only to fill orders received also causes production to come in marked seasonal waves alternating with slack seasons of extensive unemployment.

One manufacturer offered his customers choices from 29 stock models of men's and young men's sack suits and also made up suits in 14 special models designed by certain customers. Each of these was offered in three styles of lining construction, three combinations of lining material and in over 1,000 cloth styles.

The effect of this great variety upon the size of manufacturing lots is shown in Fig. 5. The marked wave character of this firm's employment is pictured in Fig. 8.

That the public does not really demand so great variety is evidenced by the fact that 11 of these models account for 93 per cent of the total sales.

The sales of 25 of the remaining models are so small that they cannot really be represented in this chart.

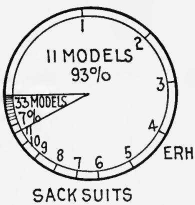


Fig. 1.

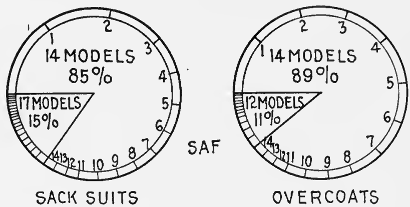


Fig. 2.

This manufacturer offers 31 models of sack suits and 26 of overcoats. But the great bulk of demand concentrates on a comparatively few models.

This manufacturer offers only two men's and six young men's suit models, each in less than 300 cloth styles. Two-thirds of his sales concentrate on three models. This enables him safely to make up suits of these models for stock between seasons and thus operate his plant continuously at full capacity; also to cut in lots averaging 128 suits each.

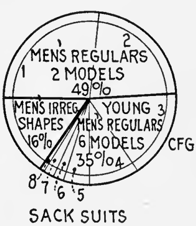


Fig. 3.

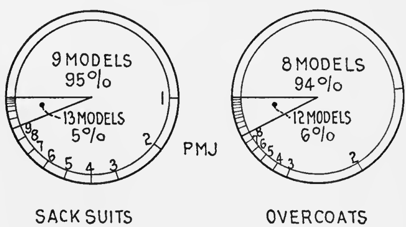


Fig. 4.

This manufacturer offered 22 models of sack suits and 20 models of overcoats, each of which was offered in over 1000 styles of cloth. One model in each accounts for nearly or quite half of all his business. He has a wonderful opportunity to eliminate slack seasons by manufacturing these models for stock.

(*a*) *Small Lots.*—The concern in the case mentioned above manufactures 400,000 suits a year in lots averaging 12 garments each (see Figure 5); rarely exceeding 20 garments, and an astonishing proportion of them are of 6, 5, 4, 3 and even 2 garments each.

Operating Wastes.—In the operations requiring matching of colors, it takes no longer to change thread for a bunch of 100 than for a bunch of 2; nor does it take longer to open and arrange bundles of garment parts, read instructions, bundle them up again, and so on. Probably the greatest loss, however, comes from the effect upon the worker's skill through frequent interruptions of the rhythm of his work. In the case cited, the work assignments were so short that one worker out of every five was interrupted at least once every six minutes, and two out of every three were interrupted from one to six or seven times every half hour. Other manufacturers try to overcome this trouble by combining garments of various cloth shades in one lot. This is effective in part.

Administrative Wastes.—Such small sized lots make effective shop planning and administration so expensive that manufacturers dispense with it. From 80 to 150 operations are involved in making a sack coat, according to the way in which the whole process is divided up. To provide individual work tickets, an order of work, adequate inspection and move orders for lots of 1, 2, 3, 4, 5 or even 12 garments means a prohibitive expense. Most of these procedures involve no more expense for a lot of 100 or 500 than for a lot of 3. Furthermore, *less* time of operators and clerks will be consumed in changing assignments of work in case of the large lots; for with the small lots there is bound to be a large amount of waiting turns. With large lots, the expense of the method just mentioned is a negligible factor, counterbalanced many times over by their benefits. With small lots the expense looms relatively so large that the manufacturer has not the courage to incur it.

The result of dispensing with effective shop planning is a considerable loss of plant capacity and of workers' time and earnings through shop idleness caused either by whole sections of operatives running out of work or by failure of certain auxiliary materials to appear—lack of co-ordination of production in the various parallel sequences. In our visits to plants manufacturing in small lots we usually observed a large part of the forces on several operations waiting for work. Picture for instance 45 collar-makers delivering their finished coats, registering their numbers in a column in a book, in order to establish the sequence in which they were to be served with work, and then twiddling their thumbs until their numbers were called, or standing in line before the hanger sewers' machines and snatching the coats one by one as they fall. All this occurred at the height of the manufacturing season when foremen were being taken to task for not getting out output.

CHARTS SHOWING NUMBER OF GARMENTS IN CUTTING LOTS.

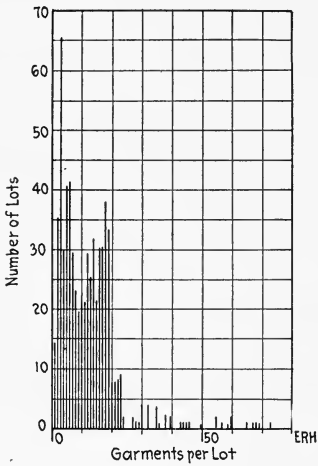


FIG. 5.

This manufacturer of men's and young men's sack suits offers a great variety in model and cloth style and ordinarily manufactures only to fill orders.

This policy causes production to take place in small lots as here shown. Rarely do manufacturing lots exceed 20 garments to the lot and an astonishing proportion of them are in lots of 7, 6, 5, 4, 3 and even 2 garments each. Observe that far more orders are of 3 garments each than of any other size.

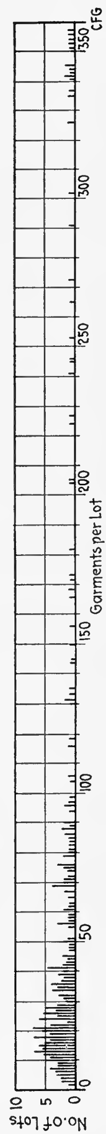


FIG. 6.

This manufacturer offers only 8 models of suits, each in less than 300 cloth styles. This enables him to cut in lots averaging 128 garments each. The large number of small-sized lots shown on this diagram probably represent the clean up toward the end of the season.

Extent of Waste Due to Small Lot Manufacture.—The amount of waste due to small lot manufacture varies, of course, with the size of the plant, but one production engineer, who has been through the process of installing effective planning and administrative mechanism in a large plant, estimates that without it about one-fifth of all the operatives' time is wasted. Excessive variety of product and the sell-then-make

CHARTS SHOWING WEEK TO WEEK FLUCTUATIONS IN PERSONNEL IN CUTTING DEPARTMENTS.

All garments must be "cut" before being "tailored." Hence these charts, which represent the week to week changes in the number of cutters in the employ of these clothing manufacturers, picture the pronounced seasonal character of this industry.

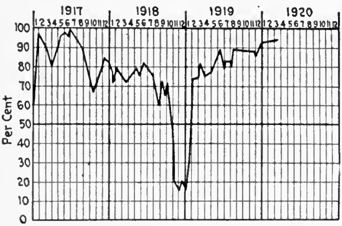


FIG. 7.

Composite chart showing fluctuations in twelve New York cutting departments.

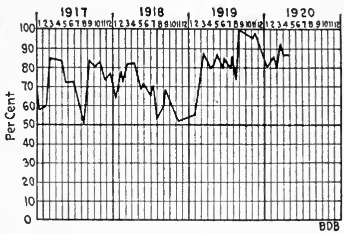


FIG. 9.

Fluctuations in another cutting department.

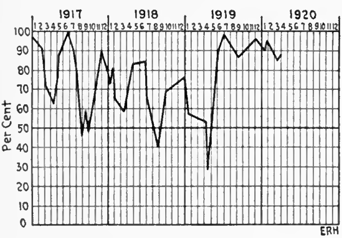


FIG. 8.

Fluctuations in one cutting department.

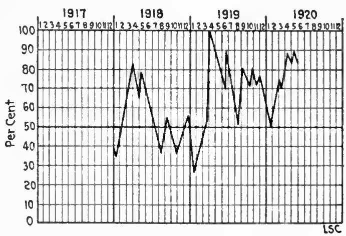


FIG. 10.

Fluctuations in a third cutting department.

manufacturing policy really block effective planning and administration of factory work, causing not merely shop idleness but other wastes as well.

(*b*) *Seasonal Demand.*—Secondly, this sell-then-make policy puts manufacturing at the mercy of the seasonal demand, bunching a large part of production into two short periods each year interspersed with many weeks of reduced operating forces and part time operation. (See Figures 7–18.) How intense this seasonal bunching is, is indicated by the fact that in eight representative plants investigated in Baltimore, Chicago, and New York the average plant utilization over a period of three years was only 69% of a possible maximum. In one plant it was only 58%.

CHARTS SHOWING MONTH TO MONTH FLUCTUATIONS IN TOTAL WORKING FORCES.

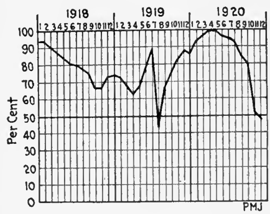


FIG. 11.

This chart, which pictures the month to month fluctuations in the total working force of another clothing manufacturer, shows a slack season in October and November, 1918, another in March, April and May, 1919, and the oncoming industrial depression commencing after May, 1920.

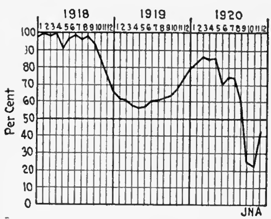


FIG. 12.

This chart shows the month to month fluctuations in the total number of persons on the payroll of another manufacturer of men's ready-to-wear clothing. It does not show the typical seasonal fluctuations in employment, but rather those longer period fluctuations due to change of status of the industry from war work in 1918 to an uncertain peace-time production after the Armistice, followed by the period of abnormal demand for clothing in the latter half of 1919 and early 1920 and culminating in the industrial depression in the latter half of 1920.

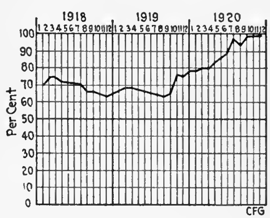


FIG. 13.

This chart shows what can be accomplished by a manufacturer who sincerely, resolutely and intelligently sets out to manufacture for stock and adopts an aggressive positive sales policy. The working force declined slightly in the latter half of 1918 and again in the latter part of 1919. But the average force is only 6% under the maximum. These declines were due to the competition of the war-working industries in 1918 and to the return of soldiers to claim their wives and sweethearts in 1919. In the latter half of 1920, when other clothing manufacturers were shutting down their factories because of industrial depression, this establishment, which is operated under scientific management, kept its force operating at nearly full capacity.

The seasonal demand is caused not so much by the ultimate purchasers' bunching their buying in the early Autumn and just before Easter as by two facts concerning the retail dealer: he does not wish to receive his merchandise before the beginning of his sales season; and secondly, partly through established tradition and habit, partly because of fear of

Charts Showing Month to Month Fluctuations in Production.

These charts picture the very spectacular ups and downs, month by month, of the average daily production of garments in the factories of certain manufacturers of men's ready-to-wear garments. Fig. 1 shows the tremendous fluctuations in overcoat production by a certain concern; Fig. 2 the sack coat (and trousers) production of the same firm. Fig. 3 represents the fluctuations in the total garments of another concern.

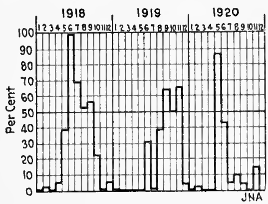


Fig. 14.

The great bulk of overcoats production is for winter use. Hence there are slack seasons of a half-year's duration. Unfortunately, the overcoat season coincides largely with the heavy weight sack suit season. The solution is either to manufacture for stock during the half year slack seasons or develop a dove-tailing business to which to transfer the overcoat facilities and force.

The same volume of output if spread uniformly over the year, could have been produced with—

70% less plant capacity in 1918
79% less plant capacity in 1919
86% less plant capacity in 1920

Here the seasonal aspect is somewhat obscured by overpowering abnormal conditions—war-time production in 1918, adjustment to an uncertain peace-time basis during the 5 months following the Armistice, the wholly abnormal demand for clothing in 1919 and the oncoming industrial depression in the latter half of 1920. However, the traditional slack seasons are represented by the lower production of the February and March and the July and August of 1918, and the period from October, 1919, to January, 1920 inclusive.

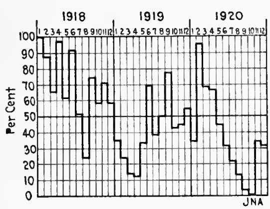


Fig. 15.

Spread uniformily through the year this same output could have been produced with—

31% less plant capacity in 1918
58% less plant capacity in 1919
66% less plant capacity in 1920

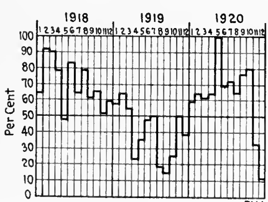
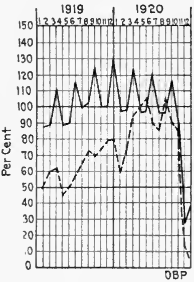


Fig. 16

This chart shows the end of a slack season in January, 1918; another slack season in April and May, 1918; again from September, 1918 to January, 1919 inclusive, accentuated by the change from war-time to peace-time production commencing with November of that year; a pronounced one in April and May, 1919, another in August, September and October; a short one in December, 1919.

being a bad guesser on the trend of fashion, he does not want to order too long in advance. For the latter reason also the manufacturer waits until the last possible moment before making a final decision concerning the models to be shown. Consequently, receipt of the sales orders precedes the opening of the new retail season by too brief a period, and the manufacturing must be bunched.

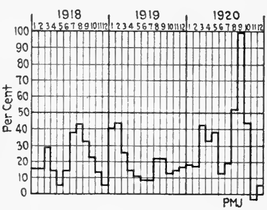
CHART SHOWING MONTH TO MONTH FLUCTUATIONS IN PRODUCTIONS AND PERSONNEL.



This chart pictures in the lower line, the seasonal ups and downs of production of another clothing manufacturer. The upper line portrays a very remarkable kind of fluctuation in the number of workers employed. Each peak represents an over-crowding of his plant.

FIG. 17.

CHART SHOWING MONTH TO MONTH FLUCTUATIONS IN SHIPMENTS.



This chart vividly portrays the marked seasonality of a certain manufacturer's shipments of men's ready-to-wear clothing to the dealers. In November, 1920 the dealers rejected and returned more clothing than was shipped to them.

FIG. 18.

Loss to Manufacturers and Workers.—From the viewpoint of manufacturing economy, this means the building of plant capacity and training personnel force great enough to take care of production at these seasonal peaks and then laying off the force and utilizing the plant far below its capacity during the remainder of the year. At the depth of recent slack seasons this waste has run as high as 80% even in large establishments, while many small ones have closed down altogether.

From the point of view of the displaced workers the effect of this seasonal production is very bad. It means extensive unemployment twice a year (see Figures 7 to 13, 17, and 18), which while it averages only 31% may affect 80 to 90% of the workers at the depth of the slack season. No doubt many workers migrate to the tailor-to-the-trade houses or to other fill-in employments; but with the best they can do, there must be great loss of earning power. Were these workers only inanimate tools, the waste might stop with that. However, they are living beings with family ties, feelings, anxieties and capacity for suffering.

How All this Affects the Workers.—One consequence of their seasonally recurring anxiety and sufferings is a vast fund of antagonism toward their employers and toward employers as a class, which we may sum up under the designation "industrial ill-will." Another is a concrete, practical though fallacious industrial philosophy, namely, the "make-work" theory; i.e., the belief that "there is only so much work to be done" and that the sensible course for workers is to stretch it out and make it last throughout the year.

These feelings and beliefs express themselves in various ways—in favoring week-work and opposition to piece-work and all systems in which pay is in any way dependent upon individual performance; in the abolition in the week-work markets of work-tickets and all mechanism for recording individual performance; in suspicion of the manufacturer's motives in connection with any mechanism he may try to adopt, thus hampering and even preventing the installation of the mechanism necessary for the most effective planning and administration of factory work.

We have dwelt at length upon this seasonal phase of the industry, its causes and effects, not merely because it constitutes one of the largest wastes, but also because it constitutes the one big problem that confronts the workers' union and for which they are demanding a satisfactory solution. And until they see promising progress being made in this direction, industrial ill-will will not only grow but will retard and in some places block the introduction of measures necessary for eliminating other wastes, big and little.

Recommendations.—The chief cause of seasonal unemployment we have seen to be the sell-then-make basis of manufacture, which in turn is largely dictated by the excessive variety in styles of product. What seems to be needed is for each manufacturer:

(*a*) To limit the number of models and cloth styles.
(*b*) To bridge the slack seasons by manufacturing for stock.
(*c*) To adopt vigorous, positive selling methods, backed up by effective national advertising.

(*a*) *Limiting Number of Models.*—Study of sales statistics indicates that neither the consuming public nor the dealers really demand such excessive variety. In one case, eleven out of thirty-one sack suit models accounted for $78\frac{1}{4}\%$ of the total sales. (See Figure 2.) In another, nine out of twenty-two models accounted for 94% of the sales and one model alone accounted for 50%. (See Figure 4.) In a third, eleven out of forty-three models accounted for 94% of the sales, while the sales of twenty-five of the remaining models ranged from $\frac{3}{10}$ of 1% down to $\frac{2}{1000}$ of 1%. (See Figure 1.) Most of the multiplicity of models seems to represent the manufacturer's effort to entice a little additional business —business that must be unprofitable on such a minute scale.

(*b*) *Bridging Slack Seasons.*—All large clothing houses have always done a considerable amount of making for stock during the slack seasons; they have simply reduced their production to 50% or 20% of normal. An intelligent study of their sales would enable them safely to make for stock up to their full normal output throughout the year. The great bulk of sales, 71% of men's sack suits and 89% of young men's, concentrate on the so-called " regular " forms and largely on five sizes. (See Figures 19 and 20.) Every manufacturer's list contains two or three models that are much better sellers than the others. Likewise, there are a number of good (not freakish and flashy) cloth styles which the manufacturer can practically be sure of selling in considerable quantities. These are the materials with which to bridge the slack seasons by manufacturing for stock.

Several houses have found that the proportions in which their sales of the first two weeks of the sales season divide themselves among the various models are substantially the same as the proportions for the entire season. On this basis they *estimate* the distribution of their total sales and continue to manufacture for stock throughout the year. This enables them to plan all cutting and manufacturing so as to secure the greatest economies both of cloth and labor.

(*c*) *Effective Selling and Advertising.*—In addition to a courageous, constructive sales policy, confining the business to from five to ten well-chosen models and 200 to 300 cloth styles which express all the variety the consuming public can appreciate, it is urgently recommended that the country be divided into sales territories, and that a definite quota not only of all garments but of each model be assigned to each. Vigorous, positive salesmanship backed up by effective national advertising should then be applied to carry out the sales policy and sell the quotas.[1]

One concern with such a three-fold sales policy as has been suggested offers but eight models of sack suits, each in less than 300 cloth styles. It is able to cut in lots averaging 128 garments and one cloth style each. Contrast this with average lots of 12 garments, cited in a foregoing illustration. Two-thirds of its sales concentrate on three of these models. The concern manufactures these three models for stock during the slack

[1] See Bulletin of the Taylor Society, Vol. V, No. 6, Abstracts of preliminary Reports of the Committee on the Organization and the Functions of the Sales Engineering Department and the Committee on the Organization and the Functions of the Sales Operating Department.

seasons, operates at nearly full capacity the year round, has the good-will and hearty co-operation of its employees, and has all the mechanism necessary for effective, economical planning and operation of its plant. (See Figures 1, 6, and 13.)

2. Lack of Standardization.—The second fundamental cause of waste attributable to management is a lack of standardization of appliances, conditions, work content and method. Production can be carried on most effectively only when:

(*a*) Each operation is performed with the best available appliances; in other words, on machines of standard design.
(*b*) Machines are maintained in proper condition.
(*c*) The work content of operations is standardized.

Men's ready-made clothing is not for the most part manufactured under these conditions.

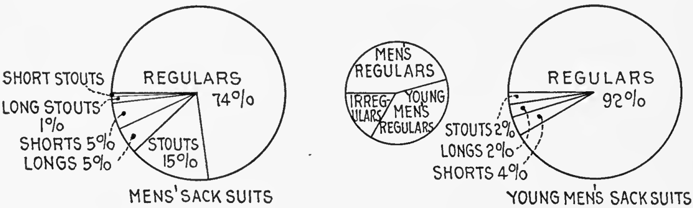
(*a*) *Variety of Design.*—Machines of a variety of design are found on the same operation in the same shop. High-speed machines are not used in those operations to which they are adapted. Machine and other work-place tables are too short, too narrow and too high or too low to afford sufficient elbow room and comfort for unhampered operation. Only one manufacturer has been found who has written standard specifications for these things, based on any real study.

(*b*) *Maintenance of Machines.*—Furthermore, machines are not maintained in proper operating condition. For instance, in one factory, 1100 operatives are served by two machinists, who are kept on the jump making emergency make-shift repairs out in the shop while the workers look on and others await their turns. They do not have time to take a machine into the repair shop and give it a thorough overhauling. Nor does the repair shop contain a single planer, speed lathe or drill press. The sewing machines are in run-down condition. Not only do the operatives, who are on piece-work, lose production and earning power through these frequent break-downs, but also through the low speeds of their machines and the interruptions by frequent thread breaks that come when the internal mechanism is out of proper adjustment. Discouragement and dissatisfaction of piece-workers under such conditions lead to excessive labor turnover.

On the contrary, certain manufacturers maintain well equipped repair shops and adequate stock of spare machines. Instead of waiting until machines break down before repairing them, all the machines are divided into comparatively small groups, each group is put on a time schedule, so that at regular stated intervals each machine is replaced from the spare stock, taken into the repair shop and the internal mechanism thoroughly inspected and restored to proper operating condition. This not only forestalls and prevents actual break-down in large part but maintains all machines in better operating condition.

(*c*) *Work Content of Operations.*—The work content of operations is not standardized. In one extreme case 45% of all the work being performed in a certain lengthy operation was found to be unnecessary. (See Figures

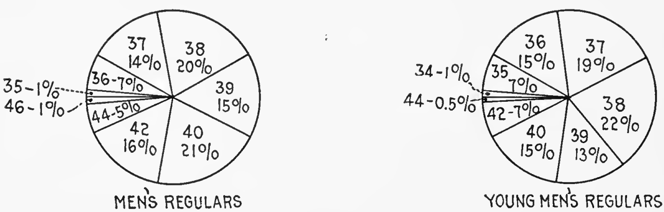
Charts Showing Distribution of Sales Among Different Shapes and Sizes.



SHAPES

Fig. 19.

The great bulk—86½%—of the demand for men's and young men's ready-to-wear sack suits is for the "regular" or standard shape or form. Men's "regulars" concentrate largely on 5 sizes, namely: 37, 38, 39, 40 and 42. Young men's regulars also concentrate on 5 sizes, namely: 36, 37, 38, 39 and 40.



SIZES

Fig. 20.

Manufacture of regulars for stock in conservative styles in these sizes and in a range of tasty (not flashy) suitings is safe up to such limits as fully to bridge the traditional slack sales season.

8 to 21.) A recognized authority in the industry, who has been through the process of standardizing coat shop operations, estimates that on the average 20% of all the work traditionally done is unnecessary.

The substitution of the most effective method for the variety o inferior methods offers probably the largest direct opportunity for production pick-up. In so simple an operation as creasing armhole seam six different methods were found in use among eleven operators working side by side. The best of them turned out work over two and a half times as rapidly as the poorest. The average productivity of all was 43% under that of the best. (See Figures 22 and 23.) The output and piecework earnings of a certain group of basting pullers were doubled by teaching them the methods of the best basting pullers in another shop. The authority referred to above states that such waste figures apply to the whole garment making process.

3. Inefficient Planning and Administration.—The third fundamental cause of waste attributable to management is inefficient planning and administration. The great majority of clothing establishments lack even the mechanism which is necessary for effective planning and administration of work. Some of the planning is done by shop executives or workers as an incident to other work. Much of the planning on cutting work is done by the cutters themselves. Manufacturers who have transferred all the planning of cutting to a planning department have as a rule found that they get higher, longer and more economical lays, consume less cloth per suit, and get a much more rapid output.

In most tailoring shops there are no dispatching stations for recording the progress of work and giving out work assignments, no work tickets, consequently no route sheets or progress records for the various manufacturing lots, no record of production either of the individual worker or operation, no record of the balance of work ahead at each operation or of the plant as a whole. Lots of garments introduced at the beginning of the process drift through without any one knowing where they are. Production is measured only in shipments of completed garments. Operatives either hunt up their own work supply or the foreman and his assistants, combining the function of shop porter with that of instructing, inspecting, disciplining and a multitude of other duties none of which are done well, watch the work supply of each worker in his jurisdiction, find and carry work to him. Congestion of work at some points, idleness at others may be said to be the normal conditions.

There are three indispensable requisites of effective planning and administration:

(*a*) Performance standards.
(*b*) An up-to-the-minute record of production in each operation, and versatile workers.
(*c*) A cost system.

(*a*) *Performance Standards.*—Without standardization of appliances, conditions, work content, and method, no valid performance standard can be determined. The great mass of clothing factories are without any performance standards. Some, indeed, do use a stop-watch in timing operations for the purpose of setting piece-rates. This so-called "time

CHARTS SHOWING TIME WASTED.

The methods and performances of 11 workers were studied in these two operations. The time that is needed by the best and easiest method in each case is represented by the length in white. The additional time needed by the method used by the worker in question is represented by the cross-hatched length. These workers were on week work and without incentive to do their best. The excess time each took over what was necessary by his method is represented in solid black. The methods used were on the average only 57% as effective as the best method. The workers' performances averaged only 59% of what they could do regularly by their methods.

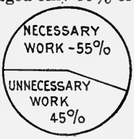
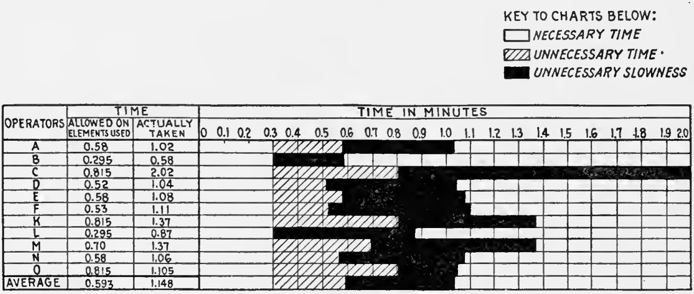


FIG. 21.

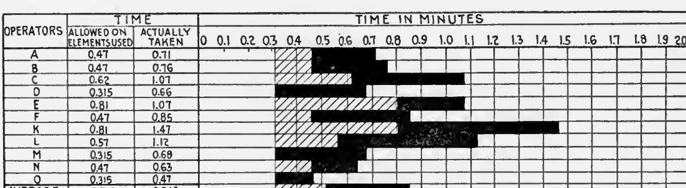
The work of 15 finish pressers were studied in a certain coat shop. Many sections of work done by some were not done by others. Yet all the coats were accepted by the manufacturer as properly pressed. Investigation showed that 45% of the work done was unnecessary.



OPERATORS	TIME: ALLOWED ON ELEMENTS USED	TIME: ACTUALLY TAKEN
A	0.58	1.02
B	0.295	0.58
C	0.815	2.02
D	0.52	1.04
E	0.58	1.08
F	0.53	1.11
K	0.815	1.37
L	0.295	0.87
M	0.70	1.37
N	0.58	1.06
O	0.815	1.105
AVERAGE	0.593	1.148

COMPARISON OF METHODS AND TIME ON CREASING ARMHOLE SEAMS

FIG. 22.—Comparison of Methods and Time on Creasing Armhole Seams.



OPERATORS	TIME: ALLOWED ON ELEMENTS USED	TIME: ACTUALLY TAKEN
A	0.47	0.71
B	0.47	0.76
C	0.62	1.07
D	0.315	0.66
E	0.81	1.07
F	0.47	0.85
K	0.81	1.47
L	0.57	1.12
M	0.315	0.68
N	0.47	0.63
O	0.315	0.47
AVERAGE	0.518	0.848

COMPARISON OF METHODS AND TIME ON PRESSING SHOULDERS

FIG. 23.—Comparison of Methods and Time on Pressing Shoulders.

study" almost without exception seeks to set tasks and rates without any attempt to standardize the variable appliances, variable machine speeds, variable lengths of stitch, and variable methods, which are invariably encountered. How can such stints and their corresponding piece-rates be just or lasting? In fact, such studies cannot result in performance standards. Indeed, the piece rates based on timing are set for the operations in name only, there being no supporting written description of the appliances, conditions, detail of work content and methods to which the piece rates refer. In consequence the piece-workers are able successfully to carry on a continuous process of reducing the work content of operations, even skimping on quality, and yet maintain the same piece-rates. The alleged performance standards of other manufacturers which are based on "average past performance" are of course equally invalid because they, too, do not refer to definite methods and standardized surroundings.

Value of Performance Standards.—Properly determined performance standards are a very valuable device, not only for planning and administering production but for conducting industrial relations on a mutually satisfactory basis. Under the piece-rate system they are the basis of just piece-rates. Under the week-work system they are the basis of a just measurement of the individual worker's performance and of adjustment of his wage rate to his capacity. One concern operates under a system of "week-work with production standards." Owing to a number of causes, including union opposition, these production standards are not based on careful detailed studies and standardization of processes, methods and the like. The interesting thing about them is that they are determined in a process of collective bargaining. Furthermore, the week-work rates refer to these standards; indeed, for many operations there is a series of progressive standards with a corresponding wage rate for each. A record is kept of each worker's performance and compared with these standards. In this way he grades himself and determines his own wage rate by his performance.

It has been reported to us that in a city not covered by this report painstaking time study with satisfactory standardization of process is now being practiced with the full co-operation of the Amalgamated Clothing Workers of America. We are satisfied that other conditions being right, the individual and collective interests of both employer and employee demand the scientific analysis of process.

By constantly checking actual performance against the standards and by promptly investigating the causes of failures to attain standards, the manufacturer can quickly detect unstandardized conditions as they creep in, and rectify them. Performance standards enable the work waiting at each operation to be expressed as *hours of work* ahead, obviously a valuable aid in planning the distribution of workers so as to prevent both congestion and failure of work supply. All sales orders can be expressed in terms of hours of work, on the basis of which a balance-of-work-ahead record can be maintained, delivery promises can be kept, the sales management can be guided in soliciting more business or refusing orders, in pushing this class of model and neglecting that. Production can be planned for an entire season. In the realm of expansion, the manufacturer can plan the size of his plant and operating force to take care of a given volume of business by a continuous operation. These methods together with a scientific make-for-stock policy, based on an intelligent use of business statistics, make it possible to eliminate the seasonal wave feature of manufacturing clothing.

(b) *Production Records and Versatile Workers.*—Without a record of production congestion of work is bound to occur at some points and running out of work is bound to occur at other points; both do occur before the shop executives can become aware of their imminence. With such records the trend of affairs at each point can be known hours, even days, ahead and adequate measures taken to maintain the even flow of work. These measures consist, for the most part, of planned transfers of workers. Transfer of workers so as to redistribute them among operations is necessary if congestion and idleness are to be avoided. Only in a factory large enough to supply the whole world and with a perfect attendance could the work forces in the various operations be so proportioned as to dispense with transfers. Hence the necessity for a versatile and mobile force of operatives—each of whom is skilled in two or more operations.

Two manufacturers in particular have done very well in these respects. One operates under scientific management, the other is making an effort to install it. Both have divided their shops into sections, each served by an order-of-work station; both have work tickets to record individual production; both have a route card for each manufacturing lot, on which the one keeps an up-to-the-minute, the other an up-to-the-hour record of the progress made upon the lot; the one has an up-to-the-minute, the other an up-to-the-hour record of the production in each operation and of the balance of work ahead of it. The one, through a policy of grading and rating the various operations according to the skill involved and of developing the all-around skill of its workers, has developed a very versatile and mobile work force and, redistributing them each day so as to "balance the shop," congestion at any point is avoided by setting a production quota for the day that will occupy the "weakest link" the full work day and by stopping production in each operation as soon as the quota is reached. The other maintains a separate "flying squadron" of versatile workers and plans the transfer each day on the basis of the balance of work ahead and production record.

All of this implies centralized planning to originate and plan for manufacturing orders, prepare the administrative stationery, collect and interpret reports, arrange for transfers and the like. Once consciousness of these needs is awakened, it will demand a survey of the work of the whole season and of future seasons. Manufacturing planning, sales planning, financial planning, both for the immediate and more remote future will become interlinked.

(*c*) *A Cost System.*—Relatively few American industries have developed a generally accepted and applied system for finding costs. The reason in the case of the men's ready-made clothing industry lies largely in the fact that a considerable part of the total cost of the product is included in two items (1) the cloth and (2) the direct labor required to fabricate the cloth; and also in the fact that a large part of this direct labor item could formerly be figured out in advance pretty accurately through the schedule of piece-rates. But in the development of large scale production, with its staff of so-called " non-productive " assistants to the operators and heavy overhead expenses, for some of which the shop is in no way responsible, cost-keeping has become more and more necessary. Any really modern cost system is operated to gage the effectiveness of manufacturing and merchandising methods and as an aid to the development of better methods. A cost system, for instance, like the one widely used in the printing industry, which simply tells the manufacturer whether his selling price is in excess of his " cost," acts as a deterrent to efficient manufacturing. " The Cost factor is the best measure of performance known." [1]

In fact, there is frequently no available measure of the efficiency of methods other than costs. An accurate cost-keeping system is especially valuable to establishments operating more than one plant, in that it makes analytical comparison of results possible. A cost-keeping system permitting the elimination of guesses and approximations will be a strong incentive in securing the interest of the workers in production. The moment cost-keeping is adopted, many present practices will be discarded. In more than one New York shop the payroll is regularly made up on wrapping paper and consigned to the waste basket after pay day. In one of the most representative plants the entire estimated cost of the suit is added to the inventory the moment it is put in process. In another large shop, the opposite practice is followed and the $200,000 tied up in work in process does not appear in the inventory.

The Sub-Contracting System.—A noteworthy feature of the industry is the progress away from the sub-contracting system in tailoring. While a considerable portion of tailoring is still contracted out in all the large

[1] " True Cost Finding, etc."—Annals of the American Academy of Political and Social Science, Philadelphia, November, 1919.

markets, New York, with nearly 2,000 contracting shops and less than 100 so-called " inside shops " remains the one market which conducts its tailoring pre-eminently on the sub-contract basis. The development elsewhere has been toward the establishment of large and stable manufacturing institutions which do their own fabrication—called tailoring—in large part. An occasional manufacturer may even be found who prides himself on doing all of his own manufacturing.

This movement must go on to its logical conclusion. Only when all the manufacturing facilities he uses are under his own control can the manufacturer secure that effective planning and administration which is necessary to the most economical production. In New York a movement has been retarded, partly because many manufacturers do not want the responsibility of maintaining employment for the workers, partly because of the attitude of the workers production in " inside shops " is more expensive than under the sub-contracting system. Not only do the workers prohibit performance standards, work tickets and all the mechanism that is necessary to effective shop planning and administration, but it is claimed that they do not work so well for the manufacturer, who to them is a fabulously wealthy non-producer whom they rarely see, as they do for the contractor who frequently works alongside of them and whose ability to pay them their high week-work wages obviously depends upon their enabling him to to deliver great quantities of finished garments to the manufacturer. The drift in every industry proves that manufacturing on a contractual basis must give way in the long run before the obvious economies and betterments of a self-contained plant executing its own plans.

II. WASTE ATTRIBUTABLE TO LABOR

Industrial discord is an important source of waste in the men's ready-made clothing industry, but even as regards this source the fact should be borne in mind that all such waste cannot rightly be charged to labor.

We have spoken of the fund of industrial ill-will of the workers toward their employers which has grown chiefly out of the large amount of recurring seasonal unemployment. The workers also have vivid memories of the mere wage pittances they received in their former years of sweatshop exploitation. The result in recent years has been a rapid unionization of the industry, which not only has brought wage rates up to proper relationship with wage rates in other industries and beyond and established the forty-four hour week, but has done much to improve sanitation in the factories.

Strikes and Stoppages.—Industrial discord is still, however, an important source of waste. A large part of the New York market was idle during the fourteen weeks' strike immediately following the Armistice. Unionization strikes kept another group from work for several weeks in the Summer of 1919, likewise a group of Chicago plants. As we write a large part of the New York market is again idle on account of what is called by one party a strike, by the other a lock-out, which commenced in December, 1920, through the failure of collective negotiations to effect a new agreement. Since the unionization of the industry, however, strikes have been relatively infrequent. The collective bargaining agreements forbid strikes, lock-outs and stoppages and provide impartial machinery and procedure for adjusting disputes. The higher union leaders act in accordance with these arrangements and do not sanction strikes and stoppages.

In most markets, however, these arrangements are still so new that neither the employers nor the employees appreciate their responsibility under them. In wage settlements the worker so concentrates his attention on the question of whether he is to get the desired wage increase that, after the decision is rendered, he overlooks his part of the bargain—the conditions subject to which the increase is granted. In New York a seasonal wage settlement was effected in April, 1919, to last until October 1st. New demands were presented and a new settlement effected in June, to last until December 1st, again in August and in October. The employers, however, were not without responsibility for this. Under the pressure of an unprecedented demand for clothing, their keen competition for labor, especially to man their new shops, advanced hiring rates higher and higher, causing rapid migration and inequality of rates in old shops in which vacancies were filled at the higher rates without like adjustments for the workers already there. Then followed discontent, individual and shop demands for further increases, many stoppages of whole sections of workers, and some unauthorized strikes, culminating in the new market demands.

In Chicago, where collective bargaining started in the factories of Hart, Schaffner & Marx in 1911, the leaders are more experienced and the workers better educated concerning their responsibilities under agreements. Nevertheless, stoppages are not infrequent. Furthermore, although general wage adjustments are not demanded except in the seasonal settlements, there is a continuous process of raising wage rates by " nibbling " at individual piece-rates in individual factories. Apparently the same process is going on in other markets. This is by no means the whole story. It is refreshing, for instance, to watch a union deputy take twenty-seven cutters to task very earnestly and in an effective manner for not keeping their production up to the standards agreed upon. And it is interesting to note that recently the Chicago clothing workers accepted a 10% reduction in wage rates by collective bargaining. In time all parties will come to a better appreciation of their obligations to one another under these agreements.

III. WASTE ATTRIBUTABLE TO OUTSIDE CONTACTS

Seasonal Bunching of Demand.—Waste in the manufacturing process cannot be entirely eliminated through steps taken within the plant. External relations both with the manufacturers of cloth and other materials and with the retailers and other agencies through which the manufactured garments are marketed have a vital bearing on the effectiveness of manufacturing procedures. It has been demonstrated that a great deal of co-operation is needed between manufacturer and retailer in order to reduce the seasonal bunching of demand.

Cancellations.—Besides, more dependable business relations must replace those now prevailing. At present a sale is not a sale. Cancellations of sales orders are commonplace every day occurrences. Indeed, it is not uncommon for a purchaser who buys on long time credit, to return his unsold goods at the end of the season, obtain credit and get it. One manufacturer reports that during the heavy-weight season of 1920 his cancellations amounted to 32% of his sales and the returned merchandise to $16\frac{2}{3}\%$. Another reports cancellations of 33% and returns of 18%. This was a very exceptional season, due to the price cutting campaign inaugurated by the U. S. Government and on-coming industrial depression. But in earlier seasons cancellations ranged from 3 to 14% and returns from 5 to 11%.

Not all the blame rests on the dealers. It is a common practice for manufacturers not only to over-sell the dealers but to over-sell their manufacturing capacity, make and deliver what they can and cancel the remainder of their orders. Sauce for the goose is sauce for the gander. The manufacturers also do the same thing to textile mills.

Certain large department stores and other stores engage in an especially reprehensible practice. One of them placed orders for about $300,000 worth of suits with a certain manufacturer, accepted deliveries of one-fourth to one-third of that amount and then, when the remainder of the order was either on the manufacturer's shelves or in process, cancelled it. Then the buyer came in and offered to buy these suits at 25% discount, which the manufacturer felt forced to accept. On this basis this buyer conducted one of the "cut-price" sales. He continued this practice for three or four seasons, until the manufacturer refused to accept any more orders subject to cancellation.

Obviously economical manufacturing cannot be conducted on any such basis. Certain manufacturers now refuse to permit cancellations. Eradication of the practice can be hastened if the manufacturers will get together on basic sales policies and have the mutual confidence and backbone to carry them out.

Relations with the Mills.—The tendency to trade and to even to gamble in cloth is everywhere apparent. The whole process of purchase and delivery is on a basis which many other industries abandoned long ago. Collective buying is successfully practiced in some sections of the ready-made clothing industry. Perhaps it is feasible for the men's ready-made group at this time. At all events, it is certain that the relations of this group with the mills which furnish their cloth leave much to be desired.

Need for a Trade Association.—All this suggests one of the outstanding weaknesses of the industry, i.e., the absence of any comprehensive trade organization through which common problems can be studied and common remedies applied. The organizations supported by the industry as a whole have to do principally with marketing the product. And the means employed are largely to afford an opportunity for the display of goods, the meeting of buyers and the more obvious types of activity grouped generally under the head of merchandising. The International Association of Garment Manufacturers has only two members in the men's ready-made trade and these do not participate to any extent in its activities. There is no joint agency studying the obvious weaknesses in merchandising and manufacturing technique. With a product so nearly uniform the economic advantage of collective action in such matters as standardization, cost-keeping and merchandising research is altogether clear. The assertion will probably not be challenged that there is not a single individual throughout the entire industry who is solely engaged in research and thus without operating duties. There are other industries which pay slight attention to research, but none, I believe, in which it is so nearly ignored.

The national Industrial Federation of Clothing Manufacturers is loosely organized, but nevertheless has proven quite effective in crises. Its leadership on the whole has been liberal. But in the light of its opportunities its policies have been far from aggressive. As a matter of fact, the failure to establish any clear national labor policy has proven a blessing, for in every one of the markets individual experiments of no mean importance are in process of being tried out.

There is a feeling in the clothing trades generally that organizations dealing with labor policies should not interest themselves in other matters. This is probably one reason why the Industrial Federation of Clothing Manufacturers takes so little interest in production methods. The practical contributions to this field have come largely on the initiative of the several impartial chairmen and a few labor managers. Without making any effort to locate the credit for it, one can say that probably no other industry in this country is so generally aware of the essential character of the group of problems included under the general heading of industrial relations. There is every reason to believe that as the good order of the industry is improved the labor managers and the representatives of the workers may find some way of arousing the interest of the workers in the technology of the industry. Peace and good order are ends to be sought, but to use a phrase current in one shop, they do not "get out the pants."

Among the efforts now being made to put the industry on a more effective basis, those directed toward the establishment of good will transcend all others in importance. But the obvious drift within the labor movement, the necessities of the times and the individual and collective interests of the employers suggest that everywhere the effort should be made to bring men and management together for the closest possible co-operative study of the technology and science of the industry. And, lastly, some means must be found for bringing the employers together in an organization—existing or to be created—the object of which should be to carry on the production and merchandising researches and activities which require collective action.

THE FIELD REPORT EVALUATION SHEETS

Through the use of the questionnaire, cause and resulting effect have been isolated in a way we would not have deemed possible at this stage of the development of the science of management. The answers on the questionnaire have been used on the rating sheet giving the nine plants analyzed the following "relative or comparative" standing in this matter of wastefulness—the best record being at the bottom:

Plant No. 1	83.6 Points	Plant No. 6	68.0 Points
2	79.8 "	7	53.9 "
3	75.7 "	8	53.2 "
4	68.6 "	9	26.5 "
5	68.3 "	Average	64.2 "

This means that the best plant has an advantage of 57 points in a hundred over the worst, and that it is 42 points ahead of the average of the other plants investigated. It will be surprising if any other industry affords an equally striking example of a single plant of high and known excellence so far ahead of its competitors in most of the things which taken together constitute good management.

One conclusion apparent from these rating sheets is the preponderant share of the responsibility for waste which is chargeable to management.

While labor naturally participates in many ways in lowering the general effectiveness, still its total contribution is but a fraction of that of management. On the other hand, the responsibility of the public appears to be negligible. In the nine plants investigated these responsibilities for waste averaged as follows: management, 75%; labor, 16%; and the public, 9%.

Owing to the scarcity of dependable data about the value of the total annual product of the industry and the complete absence of statistics of quantity production, it is difficult even to approximate preventable waste in dollars and cents. But it seems clear that a 40% pick-up in effectiveness is easily in sight. This saving can be brought about without revolutionary changes simply through the fairly general adoption of methods in current use. Fixing the present value of the output of the industry at say $600,000,000—about half of the figure given in the last census—savings easily possible would aggregate more than three-quarters of a million dollars a day.

We are fairly well satisfied that our evaluation sets forth the *comparative* wastefulness of the nine plants with substantial accuracy. However, it is evident that a considerable element of judgment enters into our relative evaluations of the forty-seven items and that until these judgments can be tested and rectified in the light of later experience, too much reliance should not be put upon the absolute accuracy of the several evaluations.

We feel that the chief value of this field report evaluation sheet is to be found not in the results of this investigation, but in that it constitutes an important *beginning* out of which will be perfected a very powerful and very valuable instrument for investigation. Later experience will of course suggest other causes of waste than those we have enumerated. It will also give us more accurate measurements of the waste-producing powers of the various causes than is possible now.

NOTE.—We consider that items K 15, K 16, and U 7, which deal on the one hand with provision whereby the organized mind of the management is evaluated and on the other with cost accounting, are relatively undervalued, but have yielded to the opinions of other authorities for the purpose of this investigation.

TYPICAL EVALUATION SHEET WITH KEY AND SUMMARY

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY | PLANT NO. | EST. BY | DATE

KEY
① + ③ + ⑤ = ⑦ Excellent = 0% Waste; Good = 20% Waste; Poor = 60% Waste; a + b + c = d = 100%
② + ④ + ⑥ = ⑧ Fair = 40% Waste; Bad = 80% Waste; e + f + g = h = % Waste

CAUSES		GUIDE QUESTIONS FOR FIELD INVESTIGATORS paraphrased and condensed from the FIELD QUESTIONNAIRE so as to afford a quick survey of the character of the investigation and constitute a key to the symbols	RESPONSIBILITIES: MANAGEMENT		LABOR		OUTSIDE CONTRACTS		TOTAL WASTE	
			Assigned Points	Points Waste	Assigned Points	Points Waste	Assigned Points	Points Waste	Assigned Points	Points Waste
			1	2	3	4	5	6	7	8
ORGANIZATION. Methods of Industry as to Type—Methods and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	Have you an ORGANIZATION CHART or its equivalent?	0.50	0.43					0.50	0.43
	K2	Is your ORGANIZATION FUNCTIONALIZED or is it built around individual personalities?	2.48	1.77	0.27	0.15	0.39	0.22	3.14	2.14
	K3	Are the duties of each executive in your ORGANIZATION WRITTEN UP?	0.90	0.70					0.90	0.70
	K4	Are there STANDARD WRITTEN INSTRUCTIONS for each executive or functionary?	1.07	0.87	0.23	0.17			1.30	1.04
	K5	Have you a RESEARCH DEPARTMENT that is not devoted wholly or in part to current production problems?	2.20	2.05					2.20	2.05
	K6	Do you keep up-to-date PERSONNEL RECORDS, particularly with reference to quality and quantity of production?	0.17	0.11	0.13	0.09			0.30	0.20
	K7	Are your WORKERS SELECTED CAREFULLY on basis of interviews, trade and other tests?	4 80	2.89	1.80	0.89			6.60	3.78
	K10	Do you make a practice of SHUTTING DOWN for inventories, unbalanced production, business fluctuations, etc.?	0.90	0.49					0.90	0.49
	K11	Do you FOLLOW UP AND INVESTIGATE QUITS?	0.18	0.14	0.12	0.10			0.30	0.24
	K12	Do you TABULATE AND ANALYZE LABOR TURNOVER by CAUSES?	0.21	0.17	0.09	0.07			0.30	0.24
	K13	HOW IS WAGE REMUNERATION DETERMINED? Union scale, competitive market, etc., day work, piece work or other forms of incentive wage?	2.91	1.73	1.49	0.92			4.40	2.65
	K14	What are the HOURS OF LABOR per day and week and how and by whom determined?	0.77	0.12	0.13	0.05			0.90	0.17
	K15	Is yours an OPEN, CLOSED UNION, PREFERENTIAL UNION OR NON-UNION SHOP?	0.67	0.36	0.23	0.11			0.90	0.47
	K16	What form of SHOP REPRESENTATION have you?								
	K17	During the last 5 years what has been your STRIKE RECORD as to frequency, duration, causes, no. affected, etc.?	0.23	0.14	0.17	0.07			0.40	0.21
	K18	During the last 5 years what has been your STOPPAGE RECORD as to frequency, duration, causes, no. affected, etc. (Stoppages are strikes by sections of workers not sanctioned by Union)	0.06	0.02	0.34	0.15			0.40	0.17
	K19	Are your INDUSTRIAL RELATIONS DIRECTED BY A COMPETENT FUNCTIONAL PERSONNEL HEAD?	1.01	0.64	0.09	0.05			1.10	0.69
	N20	What does your ACCIDENT RECORD show as to the DEGREE OF DANGER OF PERSONAL INJURY?	0.39	0.03	0.01	0.00			0.40	0.03
	K21	To what extend do you carry on PERSONNEL SERVICE WORK?	0.62	0.32	0.28	0.20			0.90	0.52
	$K7\frac{1}{3}$	Is INSTRUCTION of your workers in METHODS AND QUALITY given by SPECIALISTS?	5.11	3.22	1.99	1.27			7.10	4.49
	$K7\frac{2}{3}$	Do you apply a POLICY OF SYSTEMATICALLY DEVELOPING, ADVANCING AND PROMOTING WORKERS and others in your organization?	2.20	1.57	0.50	0.30			2.70	1.87
		TOTAL ORGANIZATION CAUSES	27.38	17.77	7.87	4.59	0.39	0.22	a 35.64	e 22.58
TECHNICAL. Available Engineering Knowledge as to Product, Plant and Materials	T1	What ORGANIZED EXTERNAL CO-OPERATION do you participate in with your own similar and inter-related industries?	1.00	0.56			0.30	0.18	1.30	0.74
	T2	Have you an UP-TO-DATE STAFF-MADE PLANT LAY-OUT showing location of depts, workplaces, path of work, etc.?	2.00	1.21	0.20	0.11			2.20	1.32
	T3	Do you maintain an UP-TO-DATE EQUIPMENT INVENTORY showing cost, repairs, depreciation by individual pieces or groups?	0.30	0.18					0.30	0.18
	T4	Are there WRITTEN STANDARD SPECIFICATIONS FOR EQUIPMENT for each of the various operations?	4.40	2.90					4.40	2.90
	T5	Is your EQUIPMENT MAINTAINED BY A PERIODIC REPAIR INSPECTION made by a SEPARATE MAINTENANCE DEPARTMENT?	3.56	1.93	0.44	0.21			4.00	2.14
	T6	Are your TOOLS STANDARDIZED for each of the various operations?	0.81	0.51	0.09	0.04			0.90	0.55
	T7	What is the extent of VARIETY IN PRODUCT DESIGN AND CONSTRUCTION?	6.00	3.93			2.20	1.37	8.20	5.30
	T8	Is each PROCESS STANDARDIZED as to work content and method?	4.10	2.20	1.90	1.27	1.10	0.71	7.10	4.68
		TOTAL TECHNICAL CAUSES	22.17	13.92	2.63	1.63	3.60	2.26	b 28.40	f 17.81
UTILIZATION. Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	Do you establish a PROGRESSIVE BUDGET based on knowledge of your manufacturing capacity and forecasts of your business volume?	0.70	0.47					0.70	0.47
	U2	Is your MANUFACTURING POLICY to MAKE-AND-SELL or SELL-THEN-MAKE?	6.00	4.67			2.20	1.81	8.20	6 48
	U3	Do you compile a RECORD OF IDLE MACHINE-TIME by amount, cost and causes?	0.30	0.27	0.10	0.08			0.40	0.35
	U4	Is your PLANNING OF WORK CENTRALIZED or distributed among a number of shop executives and workers?	3 50	2.41	0.50	0.30			4.00	2.71
	U5	Does your SHOP ADMINISTRATIVE MECHANISM enable you to anticipate idleness of machines and workers and provide against it?	1.50	0.96	0.70	0.51			2.20	1.47
	U6	Is there a WORK TICKET FOR EACH WORK ASSIGNMENT or its equivalent provided in advance and on which elapsed time is recorded by mechanical time stamp?	1.07	0.64	0.73	0.48			1.80	1.12
	U7	Have you a good CURRENT COST SYSTEM TIED IN WITH THE FINANCIAL BOOKS?	1.57	1.13	0.63	0.48			2.20	1.61
	U8	Do you compile a RECORD OF IDLE WORKER-TIME by amount, cost & causes?	0.33	0.24	0.07	0.07			0.40	0.31
	U9	Do you COMPARE PRODUCTION PERFORMANCE with PRODUCTION STANDARDS, with reference to worker, job, department and equipment?	0.11	0.07	0.19	0.13			0.30	0.20
	U11	To what extent is PURCHASING DONE TO STANDARD SPECIFICATIONS and does it CLEAR THRU A PURCHASING AGENT?	1.00	0.59			0.50	0.32	1.50	0.91
	U12	What control EXISTS OVER RECEIPT, INSURANCE AND RETURN OF MATERIALS?	3.56	1.90	0.44	0.20			4.00	2.10
	U13	Is MATERIAL STORAGE CONVENIENT of access and arrangement and does it conserve space properly?	0.90	0.36					0.90	0.36
	U14	WHAT TYPES OF INTERNAL TRANSPORTATION are used?	1.58	0.63	0.72	0.24			2.20	0.87
	U15	Is RAW MATERIAL SUBJECTED TO CAREFUL EXAMINATION AND TESTS on receipt?	0.70	0.28					0.70	0.28
	U16	Is there competent independent FUNCTIONALIZED INSPECTION OF WORK IN PROCESS with rigorous QUALITY DISCIPLINE?	1.00	0.64	0.50	0.28			1.50	0.92
	U17	Is there competent independent FUNCTIONALIZED INSPECTION of FINISHED PRODUCT?	0.20	0.09					0.20	0.09
	U18	What is the amount and character of INSPECTION EQUIPMENT?	0.40	0.19					0.40	0.19
	U19	Are there PROPER PERFORMANCE STANDARDS base on careful, detailed study and the workers' co-operation?	1.72	1.10	2.25	1.51	0.34	0.34	4.31	2.95
		TOTAL UTILIZATION CAUSES	26.14	16.64	6.73	4.28	3.04	2.47	c 35.91	g 23.39
		TOTAL ALL CAUSES	75.69	48.33	17.23	10.50	7.03	4.95	d 100	h 63.78

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Men's Readymade Clothing* PLANT NO. *N.P.S.* EST. BY *T.W.M.* DATE *4/14/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ ; Excellent = 0% Waste, Good = 20% Waste, Fair = 40% Waste, Poor = 60% Waste, Bad = 80% Waste ; a + b + c = d = 100% ; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	Est. % Waste 2	3	Points Waste 4	LABOR Assigned Points 5	Est. % Waste 6	7	Points Waste 8	OUTSIDE CONTRACTS Assigned Points 9	Est. % Waste 10	11	Points Waste 12	TOTAL WASTE Assigned Points 13	Points Waste 14
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5	100		0.5									0.5	0.5
	K2	2.4	100		2.4	0.3			0.3	0.4			0.4	3.1	3.1
	K3	0.9	100		0.9									0.9	0.9
	K4	1.0	100		1.0	0.3			03					1.3	1.3
	K5	2.2	100		2.2									2.2	2.2
	K6	0.1	50		.05	0.2		50	.10					0.3	0.15
	K7	5.0	80		4.00	1.6		80	1.28					6.6	5.28
	K8														
	K9														
	K10	0.9	100		0.90									0.9	0.9
	K11	0.2	100		0.20	0.1		100	.10					0.3	0.3
	K12	0.2	100		0.20	0.1		100	.10					0.3	0.3
	K13	3.0	80		2.40	1.4		80	1.12					4.4	3.52
	K14	0.7				0.2								0.9	
	K15	0.4	50		0.20	0.5		50	.25					0.9	.45
	K16														
	K17	0.2	100		0.20	0.2								0.4	.20
	K18					0.4		100	.40					0.4	.40
	K19	1.0	100		1.00	0.1		100	.10					1.1	1.10
	K20	0.4												0.4	
	K21	0.7	100		.70	0.2		100	.20					0.9	.90
	K7 1/3	5.0	80		4.00	2.1		80	1.68					7.1	5.68
	K7 2/3	2.3	80		1.84	0.4		60	.24					2.7	2.08
	TOTAL	27.2			22.74	8.0			6.12	0.4			0.4	a 35.6	e 29.26
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	1.0			.50					0.3		60	.18	1.3	.68
	T2	2.0	80		1.60	0.2			.16					2.2	1.76
	T3	0.3	100		.30									0.3	.30
	T4	4.4	75		3.30									4.4	3.30
	T5	3.5	50		1.75	0.5		50	0.25					4.0	2.00
	T6	0.8	80		.64	0.1		80	.08					0.9	.72
	T7	6.0	100		6.00					2.2		100	2.20	8.2	8.20
	T8	3.6	80		2.88	2.4		80	1.92	1.1		80	.88	7.1	5.68
	TOTAL	21.6			16.97	3.2			2.41	3.6			3.26	b 28.4	f 22.64
UTILIZATION: Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	0.7	40		.28									0.7	.28
	U2	6.0	100		6.00					2.2		100	2.20	8.2	8.20
	U3	0.3	100		.30	0.1		100	.10					0.4	.40
	U4	3.5	100		3.50	0.5		100	.50					4.0	4.00
	U5	1.1			1.10	1.1			1.10					2.2	2.20
	U6	0.9			.90	0.9			.90					1.8	1.80
	U7	1.1			1.10	1.1			1.10					2.2	2.20
	U8	0.2			.20	0.2			.20					0.4	.40
	U9	0.1			.10	0.2			.20					0.3	.30
	U10														
	U11	1.0	80		.80					0.5		60	.30	1.5	1.10
	U12	3.5	80		2.88	0.5		80	.40					4.0	3.28
	U13	0.9	50		.45									0.9	.45
	U14	1.5	50		.75	0.7		50	.35					2.2	1.10
	U15	0.7	40		.28									0.7	.28
	U16	1.0	80		.80	0.5		80	.40					1.5	1.20
	U17	0.2			.20									0.2	.20
	U18	0.4												0.4	
	U19	1.1	100		1.10	2.2		100	2.20	1.0		100	1.00	4.3	4.30
	TOTAL	24.2			20.74	8.0			7.45	3.7			3.5	c 35.9	g 31.69
GRAND TOTAL		73.0			60.45	19.2			15.98	7.7			7.16	d 100	h 83.59

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Men's Readymade Clothing* PLANT NO. *K. G. D.* EST. BY *T. W. M.* DATE *4/6/21*

KEY:
① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste; Good = 20% »; Fair = 40% »; Poor = 60% Waste; Bad = 80% »
④ + ⑧ + ⑫ = ⑭
a + b + c = d = 100%
e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT: Assigned Points	Est. % Waste		Points Waste	LABOR: Assigned Points	Est. % Waste		Points Waste	OUTSIDE CONTRACTS: Assigned Points	Est. % Waste		Points Waste	TOTAL WASTE: Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5		100	0.50									0.5	0.5
	K2	3.1		100	3.10									3.1	3.1
	K3	0.9		100	0.90									0.9	0.9
	K4	1.3		100	1.30									1.3	1.3
	K5	2.2		100	2.20									2.2	2.2
	K6	0.1		100	0.10	0.2		100	0.2					0.3	0.3
	K7	5.0		80	4.00	1.6		80	1.28					6.6	5.28
	K8														
	K9														
	K10	0.9												0.9	
	K11	0.1		100	0.10	0.2		100	0.20					0.3	0.30
	K12	0.2		100	0.20	0.1		100	0.10					0.3	0.30
	K13	3.0		80	2.40	1.4		80	1.12					4.4	3.52
	K14	0.9												0.9	
	K15	0.45		50	0.22	0.45		50	0.23					0.9	0.45
	K16														
	K17	0.2		100	0.20	0.20		100	0.20					0.4	0.40
	K18					0.4		33	0.13					0.4	0.13
	K19	1.10		100	1.10									1.1	1.10
	K20	0.4												0.4	
	K21	0.45		100	0.45	0.45		100	.45					0.9	.90
	K7⅓	5.00		80	4.00	2.10		80	1.68					7.1	5.68
	K7⅔	2.3		80	1.84	0.40		80	.32					2.7	2.16
	TOTAL	28.10			22.61	7.50			5.91					a 35.6	e 28.52
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	1.0			0.5					0.3		67	0.2	1.3	0.70
	T2	2.0		80	1.60	0.20		80	.16					2.2	1.76
	T3	0.3		100	.30									0.3	.30
	T4	4.4		80	3.52									4.4	3.52
	T5	4.0		100	4.00									4.0	4.00
	T6	0.9		100	.90									0.9	.90
	T7	6.0		40	2.40					2.2		40	0.88	8.2	3.28
	T8	3.6		80	2.88	2.40		80	1.92	1.1		80	0.88	7.1	5.68
	TOTAL	22.2			16.10	2.6			2.08	3.6			1.96	b 28.4	f 20.14
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	0.7		100	0.70									0.7	0.70
	U2	6.0		100	6.00					2.2		100	2.20	8.2	8.20
	U3	0.3		100	.30	.10		100	.10					0.4	.40
	U4	3.5		100	3.50	.50		100	.50					4.0	4.00
	U5	1.1		100	1.10	1.10		100	1.10					2.2	2.20
	U6	0.9		100	.90	.90		100	.90					1.8	1.80
	U7	1.1		100	1.10	1.10		100	1.10					2.2	2.20
	U8	0.2		100	.20	.20		100	.20					0.4	.40
	U9	0.1		100	.10	.20		100	.20					0.3	.30
	U10														
	U11	1.0		100	1.00					0.5		100	.50	1.5	1.50
	U12	4.0		50	2.00									4.0	2.00
	U13	0.9		50	.40									0.9	.40
	U14	2.2		20	.40									2.2	.40
	U15	0.7		50	.35									0.7	.35
	U16	1.0		100	1.00	.50		100	.50					1.5	1.50
	U17	0.2		50	.10									0.2	.10
	U18	0.4		100	.40									0.4	.40
	U19	1.1		100	1.10	2.20		100	2.20	1.0		100	1.00	4.3	4.30
	TOTAL	25.4			20.65	6.8			6.8	3.7			3.7	c 35.9	g 31.15
GRAND TOTAL		75.7			59.36	16.9			14.79	7.3			5.66	d 100	h 79.81

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Men's Readymade Clothing* **PLANT NO.** *A.L.K.* **EST. BY** *T.W.M.* **DATE** *4/5/21*

KEY ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste; Good = 20% Waste; Fair = 40% Waste; Poor = 60% Waste; Bad = 80% Waste; a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT — Assigned Points	Est. % Waste		Points Waste	LABOR — Assigned Points	Est. % Waste		Points Waste	OUTSIDE CONTRACTS — Assigned Points	Est. % Waste		Points Waste	TOTAL WASTE — Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5		50	0.25									0.5	0.25
	K2	2.4		75	1.80	0.3				0.4		40	0.16	3.1	1.96
	K3	0.9		100	.90									0.9	.90
	K4	1.0		100	1.00	0.3		100	.30					1.3	1.30
	K5	2.2		100	2.20									2.2	2.20
	K6	0.1		100	.10	0.2		100	.20					0.3	.30
	K7	5.0		80	4.00	1.6		80	1.28					6.6	5.28
	K8														
	K9														
	K10	0.9		10	.09									0.9	.09
	K11	0.2		100	.20	0.1		100	.10					0.3	.30
	K12	0.2		100	.20	0.1		100	.10					0.3	.30
	K13	3.0		80	2.40	1.4		80	1.12					4.4	1.12
	K14	0.9												0.9	
	K15	0.4		50	.20	0.5		50	.25					0.9	.45
	K16														
	K17	0.2		100	.20	0.2		100	.20					0.4	.40
	K18					0.4		50	.20					0.4	.20
	K19	1.0		100	1.00	0.1		100	.10					1.1	1.10
	K20	0.4												0.4	
	K21	0.45				0.45		100	.45					0.9	.45
	KT 1/3	5.0		80	4.00	2.10		80	1.68					7.1	5.68
	KT 2/3	2.3		80	1.84	.40		80	.32					2.7	2.16
	TOTAL	27.05			20.38	8.15			6.30	0.4			0.16	a 35.6	e 76.84
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	1.0			.50							60	0.18	1.3	.68
	T2	2.0		80	1.68	.20		80	.16					2.2	1.84
	T3	0.3		50	.15									0.3	.15
	T4	4.4		80	3.52									4.4	3.52
	T5	3.5		50	1.75	.50		50	.25					4.0	2.00
	T6	0.8		80	.64	.01		80	.08					0.9	.72
	T7	6.0		60	3.60					2.2		60	1.32	8.2	4.92
	T8	3.6		80	2.88	2.40		80	1.92	1.1		80	.88	7.1	5.68
	TOTAL	21.6			14.72	3.2			2.41	3.6			2.38	b 28.4	f 19.51
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	0.7		80	.56									0.7	.56
	U2	6.0		100	6.00					2.2		100	2.20	8.2	8.20
	U3	0.3		100	.30	.10		100	.10					0.4	.40
	U4	3.5		100	3.50	.50		100	.50					4.0	4.00
	U5	1.1		90	.99	1.10		90	.99					2.2	1.98
	U6	0.9		90	.81	.90		90	.81					1.8	1.62
	U7	1.1		100	1.10	1.10		100	1.10					2.2	2.20
	U8	0.2		100	.20	.20		100	.20					0.4	.40
	U9	0.1		100	.10	.20		100	.20					0.3	.30
	U10														
	U11	1.0		50	.50					0.5		60	.30	1.5	.80
	U12	3.5		20	.70	.50		20	.10					4.0	.80
	U13	0.9		50	.45									0.9	.45
	U14	1.5		20	.30	.70		20	.14					2.2	.44
	U15	0.7		10	.07									0.7	.07
	U16	1.0		90	.90	.05		60	.30					1.5	1.20
	U17	0.2		50	.10									0.2	.10
	U18	0.4												0.4	
	U19	1.1		100	1.10	2.20		100	2.20	1.0		100	1.00	4.3	4.30
	TOTAL	24.2			17.68	8.0			6.64	3.7			3.50	c 35.9	g 27.82
GRAND TOTAL		72.85			52.78	19.35			15.35	7.7			6.04	d 100	h 74.17

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Men's Readymade Clothing* **PLANT NO.** *P.M.J.* **EST. BY** *J. A.C.* **DATE** *4/14/21*

KEY

① + ⑤ + ⑨ = ⑬ Excellent 0% Waste Poor 60% Waste a + b + c + d = 100%
Good 20% ″
④ + ⑧ + ⑫ = ⑭ Fair 40% ″ Bad 80% ″ e + f + g + h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT				LABOR				OUTSIDE CONTRACTS				TOTAL WASTE	
		Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K 1	0.5	100		.50									0.5	.50
	K 2	2.4	80		1.92	0.3	80		.24	0.5	60		.30	3.2	2.46
	K 3	0.9	60		.54									0.9	.54
	K 4	1.0	80		.80	0.3	80		.24					1.3	1.04
	K 5	2.2	100		2.20									2.2	2.20
	K 6	0.2	60		.12	0.1	60		.06					0.3	.18
	K 7	5.0	60		3.00	1.6	40		.64					6.6	3.64
	K 8														
	K 9														
	K 10	0.9	80		.72									0.9	.72
	K 11	0.2	100		.20	0.1	80		.08					0.3	.28
	K 12	0.2	60		.12	0.1	60		.06					0.3	.18
	K 13	3.0	40		1.20	1.4	60		.84					4.4	2.04
	K 14	0.7	40		.28	0.2	40		.08					0.9	.36
	K 15	0.9	40		.36									0.9	.36
	K 16														
	K 17	0.3	60		.18	0.1	40		.04					0.4	.22
	K 18	0.1				0.3								0.4	
	K 19	1.0	80		.80	0.1	60		.06					1.1	.86
	K 20	0.4	20		.08									0.4	.08
	K 21	0.7	60		.42	0.2	60		.12					0.9	.54
	K 7 1/3	5.0	60		3.00	2.1	60		1.26					7.1	4.26
	K 7 2/3	2.3	80		1.84	0.4	60		.24					2.7	2.08
	TOTAL	27.9			18.88	7.3			3.96	0.5			.30	a 35.7	e 22.54
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T 1	1.0	60		.60					0.3	60		.18	1.3	.78
	T 2	2.0	80		1.60	0.2	40		.08					2.2	1.68
	T 3	0.3	80		.24									0.3	.24
	T 4	4.4	80		3.52									4.4	3.52
	T 5	3.5	80		2.80	0.5	60		.30					4.0	3.10
	T 6	0.8	80		.64	0.1	40		.04					0.9	.68
	T 7	6.0	80		4.80					2.2	60		1.32	8.2	6.12
	T 8	4.5	80		3.60	1.5	60		.90	1.1	60		.66	7.1	5.16
	TOTAL	22.5			17.80	2.3			1.32	3.6			2.16	b 28.4	f 21.28
UTILIZATION — Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U 1	0.7	80		.56									0.7	.56
	U 2	6.0	80		4.80					2.2	80		1.76	8.2	6.56
	U 3	0.3	80		.24	0.1	60		.06					0.4	.30
	U 4	3.5	60		2.10	0.5	40		.20					4.0	2.30
	U 5	1.7	80		1.36	0.5	60		.30					2.2	1.66
	U 6	1.2	60		.72	0.6	40		.24					1.8	.96
	U 7	1.8	80		1.44	0.4	60		.24					2.2	1.68
	U 8	0.4	80		.32									0.4	.32
	U 9	0.1	80		.08	0.2	80		.16					0.3	.24
	U 10														
	U 11	1.0	80		.80					0.5	60		.30	1.5	1.10
	U 12	3.5	80		2.80	0.5	60		.30					4.0	3.10
	U 13	0.9	60		.54									0.9	.54
	U 14	1.5	60		.90	0.7	40		.28					2.2	1.18
	U 15	0.7	40		.28									0.7	.28
	U 16	1.0	60		.60	0.5	40		.20					1.5	.80
	U 17	0.2	40		.08									0.2	.08
	U 18	0.4	40		.16									0.4	.16
	U 19	2.0	80		1.60	2.3	60		1.38					4.3	2.98
	TOTAL	26.9			19.38	6.3			3.36	2.7			2.06	c 35.9	g 24.80
GRAND TOTAL		77.3			55.46	15.9			8.64	6.8			4.52	d 100	h 68.62

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Men's Readymade Clothing* **PLANT NO.** *D.B.P.* **EST. BY** *J.A.C.* **DATE** *4/11/21*

KEY ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste, Good = 20% ", Fair = 40% ", Poor = 60% Waste, Bad = 80% " a + b + c = d = 100%, e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES												TOTAL WASTE	
		MANAGEMENT				LABOR				OUTSIDE CONTRACTS					
		Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	.5	100		.50									0.5	.50
	K2	2.4	80		1.92	0.3	80		.24	0.5	60		.30	3.2	2.46
	K3	0.9	80		.72									0.9	.72
	K4	1.0	80		.80	0.3	80		.24					1.3	1.04
	K5	2.2	100		2.20									2.2	2.20
	K6	0.2	60		.12	0.1	40		.04					0.3	.16
	K7	5.0	60		3.00	1.6	60		.96					6.6	3.96
	K8														
	K9														
	K10	0.9	80		.72									0.9	.72
	K11	0.2	80		.16	0.1	60		.06					0.3	.22
	K12	0.2	40		.08	0.1	40		.04					0.3	.12
	K13	3.0	60		1.80	1.4	60		.64					4.4	2.44
	K14	0.7	40		.28	0.2	40		.08					0.9	.36
	K15														
	K16	0.9	40		.36									0.9	.36
	K17	0.3	40		.12	0.1	40		.04					0.4	.16
	K18	0.1	40		.04	0.3	40		.12					0.4	.16
	K19	1.0	40		.40	0.1	40		.04					1.1	.44
	K20	0.4	20		.08									0.4	.08
	K21	0.7	80		.56	0.2	60		.12					0.9	.68
	K7⅓	5.0	80		4.00	2.1	60		1.26					7.1	5.26
	K7⅔	2.3	80		1.84	0.4	60		.24					2.7	2.08
	TOTAL	27.9			19.70	7.3			4.12	0.5			.30	a 35.7	e 24.12
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	1.0	60		.60					0.3	60		.18	1.3	.78
	T2	2.0	40		.80	0.2	40		.08					2.2	.88
	T3	0.3	40		.12	-								0.3	.12
	T4	4.4	80		3.52									4.4	3.52
	T5	3.5	80		2.84	0.5	60		.30					4.0	3.14
	T6	0.8	60		.48	0.1	40		.04					0.9	.52
	T7	6.0	80		4.80					2.2	60		1.32	8.2	6.12
	T8	4.5	80		3.60	1.5	60		.90	1.1	60		.66	7.1	5.16
	TOTAL	22.5			16.76	2.3			1.32	3.6			2.16	b 28.4	f 20.24
UTILIZATION — Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	0.7	60		.42									0.7	.42
	U2	6.0	80		4.80					2.2	60		1.32	8.2	6.12
	U3	0.3	80		.24	0.1	60		.06					0.4	.30
	U4	3.5	60		2.10	0.5	40		.20					4.0	2.30
	U5	1.7	60		1.02	0.5	40		.20					2.2	1.22
	U6	1.2	80		.96	0.6	60		.36					1.8	1.32
	U7	1.8	80		1.44	0.4	60		.24					2.2	1.68
	U8	0.4	80		.32									0.4	.32
	U9	0.1	80		.08	0.2	60		.12					0.3	.20
	U10														
	U11	1.0	60		.60					0.5	60		.30	1.5	.90
	U12	3.5	60		2.10	0.5	40		.20					4.0	2.30
	U13	0.9	40		.36									0.9	.36
	U14	1.5	60		.90	0.7	40		.28					2.2	1.18
	U15	0.7	60		.42									0.7	.42
	U16	1.0	80		.80	0.5	60		.30					1.5	1.10
	U17	0.2	40		.08									0.2	.08
	U18	0.4	40		.16									0.4	.16
	U19	2.0	80		1.60	2.3	60		1.38					4.3	2.98
	TOTAL	26.9			18.40	6.3			3.34	2.7			1.62	c 35.9	g 23.36
GRAND TOTAL		77.3			64.86	15.9			8.28	6.8			4.08	d 100	h 67.72

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Men's Readymade Clothing* **PLANT NO.** *S. A. F.* **EST. BY** *J. A. C.* **DATE** *4/14/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ — Excellent = 0% Waste; Good = 20% "; Fair = 40% "; Poor = 60% Waste; Bad = 80% " — a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT: Assigned Points 1	Est. % Waste 2	3	Points Waste 4	LABOR: Assigned Points 5	Est. % Waste 6	7	Points Waste 8	OUTSIDE CONTRACTS: Assigned Points 9	Est. % Waste 10	11	Points Waste 12	TOTAL WASTE: Assigned Points 13	Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	.5	100		.50									0.5	.50
	K2	2.4	80		1.92	0.3	80		.24	0.5	60		.30	3.2	2.46
	K3	0.9	80		.72									0.9	.72
	K4	1.0	80		.80	0.3	80		.24					1.3	1.04
	K5	2.2	100		2.20									2.2	2.20
	K6	0.2	100		.20	0.1	60		.06					0.3	.26
	K7	5.0	60		3.00	1.6	40		.64					6.6	3.64
	K8														
	K9														
	K10	0.9	80		.72									0.9	.72
	K11	0.2	80		.16	0.1	80		.08					0.3	.24
	K12	0.2	100		.20	0.1	60		.06					0.3	.26
	K13	3.0	60		1.80	1.4	60		.84					4.4	2.64
	K14	0.7	40		.28	0.2	40		.08					0.9	.36
	K15														
	K16	0.9	40		.36									0.9	.36
	K17	0.3	40		.12	0.1	40		.04					0.4	.16
	K18	0.1	40		.04	0.3	40		.12					0.4	.16
	K19	1.0	40		.40	0.1	40		.04					1.1	.44
	K20	04	20		.08									0.4	.08
	K21	0.7	40		.28	0.2	40		.08					0.9	.36
	K7 1/3	5.0	60		3.00	2.1	60		1.26					7.1	4.26
	K7 2/3	2.3	80		1.84	0.4	60		.24					2.7	2.08
	TOTAL	27.9			18.62	7.3			4.02	0.5			.30	a 35.7	e 22.94
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	1.0	60		.60					0.3	60		.18	1.3	.78
	T2	2.0	80		1.60	0.2	40		.08					2.2	1.68
	T3	0.3	60		.18									0.3	.18
	T4	4.4	80		3.52									4.4	3.52
	T5	3.5	40		1.40	0.5	40		.20					4.0	1.60
	T6	0.8	80		.64	0.1	40		.04					0.9	.68
	T7	6.0	80		4.80					2.2	60		1.30	8.2	6.10
	T8	4.5	60		2.70	1.5	60		.90	1.1	60		.66	7.1	4.26
	TOTAL	22.5			15.44	2.3			1.22	3.6			2.14	b 28.4	f 18.80
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	0.7	80		.56									0.7	.56
	U2	6.0	80		4.80					2.2	80		1.76	8.2	6.56
	U3	0.3	80		.24	0.1	60		.06					0.4	.30
	U4	3.5	60		2.10	0.5	40		.20					4.0	2.30
	U5	1.7	80		1.36	0.5	60		.30					2.2	1.66
	U6	1.2	60		.72	0.6	40		.24					1.8	.96
	U7	1.8	80		1.44	0.4	60		.24					2.2	1.68
	U8	0.4	60		.24									0.4	.24
	U9	0.1	60		.06	0.2	60		.12					0.3	.18
	U10														
	U11	1.0	80		.80					0.5	60		.30	1.5	1.10
	U12	3.5	80		2.80	0.5	60		.30					4.0	3.10
	U13	0.9	40		.36									0.9	.36
	U14	1.5	60		.90	0.7	40		.28					2.2	1.18
	U15	0.7	40		.28									0.7	.28
	U16	1.0	60		.60	0.5	40		.20					1.5	.80
	U17	0.2	60		.12									0.2	.12
	U18	0.4	80		.32									0.4	.32
	U19	2.0	60		1.20	2.3	60		1.38					4.3	2.58
	TOTAL	26.9			18.90	6.3			3.32	2.7			2.06	c 35.9	g 24.28
GRAND TOTAL		71.3			52.96	15.9			9.64	6.8			4.50	d 100	h 67.10

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Men's Readymade Clothing* PLANT NO. *G. L. K.* EST. BY *T. W. M.* DATE *4/14/21*

KEY ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste Good = 20% " Fair = 40% " Poor = 60% Waste Bad = 80% " a + b + c = d = 100% e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT Assigned Points		Est. % Waste	Points Waste	LABOR Assigned Points		Est. % Waste	Points Waste	OUTSIDE CONTRACTS Assigned Points		Est. % Waste	Points Waste	TOTAL WASTE Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5		60	.30									0.5	.30
	K2	2.4		40	.96	0.3		40	.12	0.4		40	.16	3.1	1.24
	K3	0.9		60	.54									0.9	.54
	K4	1.0		60	.60	0.3		60	.18					1.3	.78
	K5	2.2		80	1.76									2.2	1.76
	K6	0.2		60	.12	0.1		40	.04					0.3	.16
	K7	5.0		60	3.00	1.6		20	.32					6.6	3.32
	K8														
	K9														
	K10	0.9												0.9	
	K11	0.2		40	.08	0.1		40	.04					0.3	0.12
	K12	0.3		100	.30									0.3	.30
	K13	3.0		40	1.20	1.4		40	.56					4.4	1.76
	K14	0.7		20	.14	0.2		40	.08					0.9	.22
	K15	0.8		80	.64	0.1		20	.02					0.9	.66
	K16														
	K17	0.3		80	.24	0.1		80	.08					0.4	.32
	K18	0.1		80	.08	0.3		80	.24					0.4	.32
	K19	1.0		60	.60	0.1		60	.06					1.1	.66
	K20	0.3				0.1								0.4	
	K21	0.7		40	.28	0.2		40	.08					0.9	.36
	K7⅓	5.0		60	3.00	2.1		60	1.26					7.1	4.26
	K7⅔	2.3		60	1.38	0.4		60	.24					2.7	1.62
	TOTAL	27.8			15.22	7.4			3.32	0.4			0.16	a 35.6	e 18.70
TECHNICAL Available Engineering Knowledge as to Product, Plant and Materials	T1	1.0		60	.60					0.3		60	.18	1.3	.78
	T2	2.0		40	.80	0.2		40	.08					2.2	.88
	T3	0.3		40	.12									0.3	.12
	T4	4.4		60	2.64									4.4	2.64
	T5	3.5		20	.70	0.5		40	.20					4.0	.90
	T6	0.8		20	.16	0.1		40	.04					0.9	.20
	T7	6.0		80	4.80					2.2		80	1.76	8.2	6.56
	T8	4.5		60	2.70	1.5		60	.90	1.1		80	.88	7.1	4.48
	TOTAL	22.5			12.52	2.3			1.22	3.6			2.82	b 28.4	f 16.56
UTILIZATION Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	0.7		80	.56									0.7	.56
	U2	6.0		80	4.80					2.2		80	1.76	8.2	6.56
	U3	0.3		100	.30	0.1		100	.10					0.4	.40
	U4	3.5		60	2.10	0.5		40	.20					4.0	2.30
	U5	1.7		40	.68	0.5		40	.20					2.2	.88
	U6	1.2		20	.24	0.6		40	.24					1.8	.48
	U7	1.8		40	.72	0.4		20	.08					2.2	.80
	U8	0.4		100	.40									0.4	.40
	U9	0.2		40	.08	0.1		40	.04					0.3	.12
	U10														
	U11	1.0		20	.20					0.5		60	.30	1.5	.50
	U12	3.5		40	1.40	0.5		40	.20					4.0	1.60
	U13	0.9		40	.36									0.9	.36
	U14	1.5		40	.60	0.7		40	.28					2.2	.88
	U15	0.7		40	.28									0.7	.28
	U16	1.0		60	.60	0.5		40	.20					1.5	.80
	U17	0.2		20	.04									0.2	.04
	U18	0.3		20	.06	0.1		20	.02					0.4	.08
	U19	2.0		50	1.00	2.3		40	.92					4.3	1.92
	TOTAL	26.9			14.42	6.3			2.48	2.7			2.06	c 35.9	g 18.96
GRAND TOTAL		77.2			42.16	16.0			6.94	6.7			5.04	d 100	h 54.22

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Men's Readymade Clothing* PLANT NO. *J. N. A.* EST. BY *T. W. M.* DATE *4/5/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭
Excellent = 0% Waste; Good = 20% "; Fair = 40% "; Poor = 60% Waste; Bad = 80% "
a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT				LABOR				OUTSIDE CONTRACTS				TOTAL WASTE	
		Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5	100		0.5									0.5	.50
	K2	2.4	60		1.44	0.3	40		.12	0.4		40	.16	3.1	1.72
	K3	0.9	100		0.9									0.9	.90
	K4	1.3	100		1.3									1.3	1.30
	K5	2.2	100		2.2									2.2	2.20
	K6	0.2	0		0.2	0.1	40		.04					0.3	.24
	K7	3.3	60		1.98	3.3	40		1.32					6.6	3.30
	K8	0													
	K9	0													
	K10	0.9	100		0.9									0.9	.90
	K11	0.1	100		0.1	0.2	100		0.20					0.3	.30
	K12	0.2	100		0.2	0.1	100		0.10					0.3	.30
	K13	2.2	80		1.76	2.2	80		1.76					4.4	3.52
	K14	0.9	0		0.00									0.9	0.00
	K15														
	K16	0.45	50		0.23									0.9	0.45
	K17					0.4								0.4	
	K18					0.4								0.4	
	K19	1.0	40		0.40	0.1	40		.04					1.1	.44
	K20	0.4	0		0.00									0.4	
	K21	0.45	50		0.23	0.45	50		.23					0.9	.45
	K7 1/3	6.0	50		3.0	1.10	50		.55					7.1	3.55
	K7 1/3	1.4	60		0.8	1.30	60		.80					2.7	1.60
	TOTAL	24.8			16.13	10.4			5.38	0.4			0.16	a 35.6	e 21.67
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	1.0			0.50					0.3			0.2	1.3	.70
	T2	2.0	40		.80	0.2	40		.08					2.2	.88
	T3	0.3	40		.12									0.3	.12
	T4	4.4	40		1.76									4.4	1.76
	T5	3.5	40		1.40	0.5	40		.20					4.0	1.60
	T6	0.8	40		.32	0.1	40		.04					0.9	.36
	T7	6.0	60		3.60					2.2		60	1.32	8.2	4.92
	T8	3.6	60		2.16	2.4	60		1.44	1.1		40	.44	7.1	4.04
	TOTAL	21.6			10.66	3.2			1.76	3.6			1.96	b 28.4	f 14.38
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	0.7	40		.28									0.7	.28
	U2	6.0	60		3.60					2.2		60	1.32	8.2	4.92
	U3	0.3	100		.30	0.1	100		.10					0.4	.40
	U4	3.5	40		1.40	0.5	40		.20					4.0	1.60
	U5	1.7	40		.68	0.5	40		.20					2.2	.88
	U6	0.9	40		.36	0.9	40		.36					1.8	.72
	U7	1.8	60		1.08	0.4	40		.16					2.2	1.24
	U8	0.4	50		.20									0.4	.20
	U9	0.1	20		.02	0.2	40		.08					0.3	.10
	U10														
	U11	1.0	40		.40					0.5		60	.03	1.5	.70
	U12	3.5	50		1.75	0.5	50		.25					4.0	2.00
	U13	0.9	20		.18									0.9	.18
	U14	1.5	20		.30	0.7	40		.28					2.2	.58
	U15	0.7	40		.28									0.7	.28
	U16	1.0	40		.40	0.5	40		.20					1.5	.60
	U17	0.2	20		.04									0.2	.04
	U18	0.4	100		.40									0.4	.40
	U19	2.15	47		1.02	2.15	47		1.02					4.3	2.04
	TOTAL	26.75			12.19	6.45			2.85	2.7			1.62	c 35.9	g 17.26
GRAND TOTAL		73.15			39.58	20.05			9.99	6.7			3.74	d 100	h 53.31

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Men's Readymade Clothing* **PLANT NO.** *C.F.G* **EST. BY** *M.L.C* **DATE** *4/13/21*

KEY
① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste; Good = 20% "; Fair = 40% "; Poor = 60% Waste; Bad = 80% "
④ + ⑧ + ⑫ = ⑭
a + b + c = d = 100%
e + f + g = h % Waste

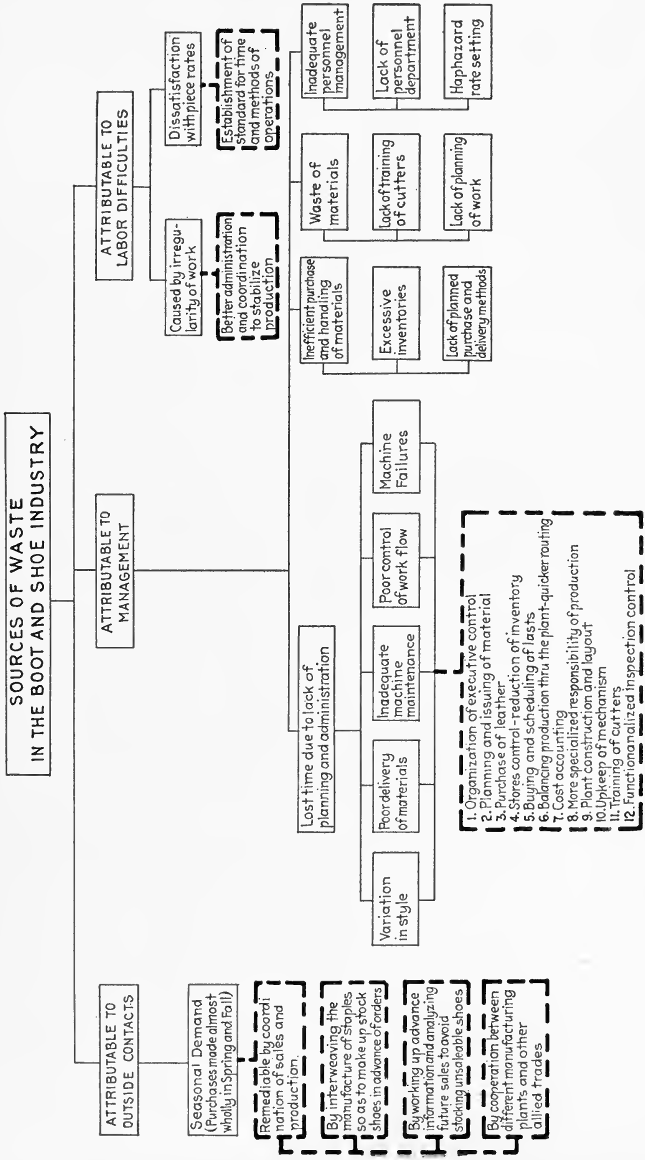
CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT: Assigned Points	Est. % Waste		Points Waste	LABOR: Assigned Points	Est. % Waste		Points Waste	OUTSIDE CONTRACTS: Assigned Points	Est. % Waste		Points Waste	TOTAL WASTE: Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5		60	.30									0.5	.30
	K2	2.4		20	.48	0.3		40	.12	0.4		40	.20	3.1	.80
	K3	0.9		20	.18									0.9	.18
	K4	1.0		20	.20	0.3		20	.06					1.3	.26
	K5	2.2		60	1.32									2.2	1.32
	K6	0.2				0.1			.04					0.3	.04
	K7	5.0				1.6		20	.32					6.6	.32
	K8														
	K9														
	K10	0.9		40	.36									0.9	.36
	K11	0.2		20	.04	0.1		60	.06					0.3	.10
	K12	0.2		20	.04	0.1		40	.04					0.3	.08
	K13	3.0		20	.60	1.4		20	.28					4.4	.88
	K14	0.7		20	.14	0.2		40	.08					0.9	.22
	K15	0.8		80	.64	0.1		20	.02					0.9	.66
	K16														
	K17	0.3		10	.03	0.1		20	.02					0.4	.05
	K18	0.1		20	.02	0.3		40	.12					0.4	.14
	K19	1.0				0.1								1.1	
	K20	0.4												0.4	
	K21	0.7				0.2		20	.04					0.9	.04
	K7 1/3	5.0		20	1.00	2.1		40	.84					7.1	1.84
	K7 2/3	2.3		40	.92	0.4		20	.08					2.7	1.00
	TOTAL	27.8			6.27	7.4			2.12	0.4			0.2	a 35.6	e 8.59
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	1.0		60	.60					0.3		60	.18	1.3	.78
	T2	2.0		20	.40	0.2		40	.08					2.2	.48
	T3	0.3		40	.12									0.3	.12
	T4	4.4		20	.88									4.4	.88
	T5	3.5		20	.70	0.5		40	.20					4.0	.90
	T6	0.8		20	.16	0.1		40	.04					0.9	.20
	T7	6.0		10	.60					2.2		40	.88	8.2	1.48
	T8	4.5		20	.90	1.5		40	.60	1.1		40	.44	7.1	1.94
	TOTAL	22.5			4.36	2.3			0.92	3.6			1.50	b 28.4	f 6.78
UTILIZATION: Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	0.7		40	.28									0.7	.28
	U2	6.0		20	1.20					2.2		80	1.76	8.2	2.96
	U3	0.3		80	.24	0.1		40	.04					0.4	.28
	U4	3.5		40	1.40	0.5		40	.20					4.0	1.60
	U5	1.7		20	.34	0.5		40	.20					2.2	.54
	U6	1.2		10	.12	0.6		40	.24					1.8	.36
	U7	1.8		40	.72	0.4		20	.08					2.2	.80
	U8	0.4		20	.08									0.4	.08
	U9	0.1		20	.02	0.2		40	.08					0.3	.10
	U10														
	U11	1.0		20	.20					0.5		60	.30	1.5	.50
	U12	3.5		20	.70	0.5		40	.20					4.0	.90
	U13	0.9		20	.18									0.9	.18
	U14	1.5		40	.60	0.7		40	.28					2.2	.88
	U15	0.7		40	.28									0.7	.28
	U16	1.0		10	.10	0.5		40	.20					1.5	.30
	U17	0.2		20	.04									0.2	.04
	U18	0.4		40	.16									0.4	.16
	U19	2.0		20	.20	2.3		40	.92					4.3	1.12
	TOTAL	26.9			6.86	6.3			2.44	2.7			2.06	c 35.9	g 11.36
GRAND TOTAL		77.2			17.49	16.0			5.48	6.7			3.76	d 100	h 26.73

Acknowledgment

In the absence in the clothing industry of any employers' organization such as facilitated similar studies in other industries, we feel under special obligations to the individual firms in several clothing markets who assisted us in various ways, and to the Clothing Manufacturers' Association of New York, through President William A. Bandler. Since united efforts of this kind have not been common practice in this industry, the cordial response to Herbert Hoover's request for co-operation is especially appreciated.

Without the services of Dr. Thomas W. Mitchell, who really acted as co-author of this report, the collection of the data and their presentation would have been impossible in the time and with the resources at our disposal. Dr. Mitchell's work as production engineer for the New York Clothing Market, and later as production advisor in individual plants fitted him specially for this task. I want also specially to mention the services of Mr. Joseph A. Carlin, both in the field and later in the office determinations.

Morris Llewellyn Cooke.


SOURCES OF WASTE IN THE BOOT AND SHOE INDUSTRY
ATTRIBUTABLE TO LABOR DIFFICULTIES
Dissatisfaction with piece rates
Establishment of standard for time and methods of operations
Caused by irregularity of work
Better administration and coordination to stabilize production
ATTRIBUTABLE TO MANAGEMENT
Inadequate personnel management
Lack of personnel department
Haphazard rate setting
Waste of materials
Lack of training of cutters
Lack of planning of work
Inefficient purchase and handling of materials
Excessive inventories
Lack of planned purchase and delivery methods
Lost time due to lack of planning and administration
Machine Failures
Poor control of work flow
Inadequate machine maintenance
Poor delivery of materials
Variation in style
1. Organization of executive control
2. Planning and issuing of material
3. Purchase of leather
4. Stores control-reduction of inventory
5. Buying and scheduling of lasts
6. Balancing production thru the plant-quicker routing
7. Cost accounting
8. More specialized responsibility of production
9. Plant construction and layout
10. Upkeep of mechanism
11. Training of cutters
12. Functionalized inspection control
ATTRIBUTABLE TO OUTSIDE CONTACTS
Seasonal Demand (Purchases made almost wholly in Spring and Fall)
Remediable by coordination of sales and production.
By interweaving the manufacture of staples so as to make up stock shoes in advance of orders
By working up advance information and analyzing future sales to avoid stocking unsaleable shoes
By cooperation between different manufacturing plants and other allied trades

CHAPTER VII

THE BOOT AND SHOE INDUSTRY

By Sanford E. Thompson

Size of the Shoe Industry.—Boot and shoe manufacture is the giant of the group of leather industries, nearly equaling in the value of its products the combined value of all the other trades in this group.

Shoe manufacture is one of the most highly competitive of the industries, having about 1300 producing companies, the largest of which manufactures about 6% of the total output. No trusts have been formed in the shoe industry and no agreements or pools exist.

	1909	1914	1921
Value of output	$442,630,726	$501,760,458	$1,300,000,000
Capital invested	197,090,344	254,590,832	500,000,000
Pairs produced	285,017,181	292,666,468	300,000,000
Numbers engaged	200,847	210,348	225,000
Value of earnings	109,646,165	128,623,475	280,000,000

Figures for 1909 and 1914 are from 1914 U. S. Census of Manufactures. Figures for 1921 are estimated, after consulting the latest published and unpublished data, since no exact figures are yet available.

New England produces about 53% of the shoes made in the country; New York, 14%; Missouri, 8%; Ohio, 6%; and Pennsylvania, 5½%. The relative value in the 12 leading states in 1914 is shown in Figure 1. The remaining production is scattered all over the country. The average output per employee is about 5.1 pairs per day, based on an average of the entire year. The range in these shops, due to styles and plant conditions, is from 3 to 12 pairs per operator per day. The far reach of shoe production is shown by the fact that, excluding hides, the materials used to make a pair of shoes come from some twenty-five countries. The exports of shoes are shown in Figure 2.

Nature of Problems to be Solved.—Shoe making as a manufacturing process did not begin its existence until the middle of the last century. Before that time shoes were made by the wearer or by the village cobbler.

The growth of the industry once under way was rapid and at the present time shoe machinery is in a high stage of development. Development of methods and management, except in a very few establishments, has not kept pace with the machinery.

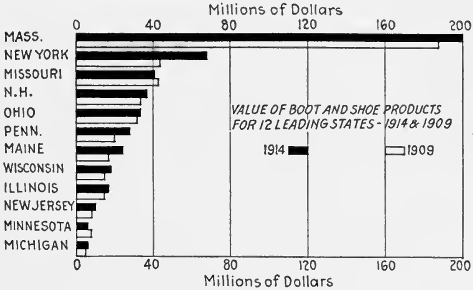


Fig. 1.

The varieties of style, the number of sizes and widths, the multiplicity of operations in making a shoe complicate the processes and tend to cause congestion between departments and irregularity of flow of work. This results in wasted time of the shoe worker with the consequent dissatisfaction and unrest and a loss in production and in overhead cost to the

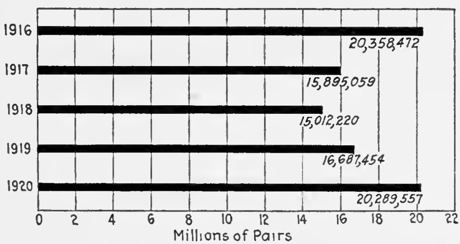


Fig. 2.—Exports of Shoes from the United States During Twelve Months Ending June 30, Each Year Since 1916—Expressed in Pairs. (Courtesy of Merchants' National Bank, Boston, Mass.)

manufacturer. In a few factories these difficulties have been overcome to an appreciable degree.

A most serious situation lies in the over-capacity of shoe plants. The capacity of shoe manufacturing plants in the United States is approximately 1,750,000 pairs of shoes per day. The average production is about 977,000 pairs for a 300-day year.

Preliminary processes of tanning and preparation of the leather greatly affect the wearing qualities of the shoe as well as the cost of the finished leather. These factors, however, have not been taken up in this report.

Causes of Waste.—In boot and shoe manufacture the causes of waste are recognized as:

I. Seasonal business complicated by variety of styles.
II. Imperfect control of production involving the organization, the handling and distribution of supplies, and the planning and routing of work and material.
III. Wastes of material and losses through defective shoes.
IV. Labor difficulties affecting the relations with the employees.

Under these four general divisions falls the discussion which follows in subsequent pages of this report.

It will take time and educational work on the part of the manufacturer to stabilize the seasonal influence in the boot and shoe industry. That this can be done to a large degree is shown by the results obtained in a few factories, to which attention is called in the pages which follow, by manufacturing shoes for stock in dull periods and by co-ordinating sales with production.

The imperfect factory organization, showing itself particularly in congestion in and between departments, causes time wastes which range between 25 and 35% of the working time, and these can be largely prevented by every manufacturer. Few shoe factories have made even an approach to the methods which have prevented such waste in other industries. Today we find one department piled with work and others slack. Dissatisfaction among employees naturally results. Those idle are antagonized because their earning ability has been impaired by causes beyond their control. Those working in congested departments are irritated by the nagging of their executives. Manufacturers must learn their own operating capacity, not from somebody's opinion, but from time study and from job analysis made in co-operation with the workers.

Losses in material, as will be discussed later, are due chiefly to imperfect grading, waste in cutting upper leather, and imperfections in shoes. Much time is involved in the repairs to shoes injured in process. "Doping" of the leather is frequently resorted to to cover up imperfections.

The nightmare of every shoe worker, except in a few shops that have standardized production methods, is the constant fear of unemployment. Add to this the loss in time when he is actually on the job waiting for shoes, and we have a picture of the situation. Manufacturers estimate that the average shoe maker spends only 65% of his possible productive hours in work; 35% of his time is spent in idleness. That this is a conservative figure is indicated by the Figure 3, showing the working and idle time of a competent shoe worker for a period of seven years, and this, it will be noted, does not allow for time lost while on the job.

Labor difficulties when traced back to their fundamentals are found to be due largely to this irregularity of work and to the lack of knowledge of the time and the methods required for the various operations. The idle time is reflected in high piece-rates, since employees must look not at weekly earnings but at annual income. It costs as much to live when one loafs as when one works.

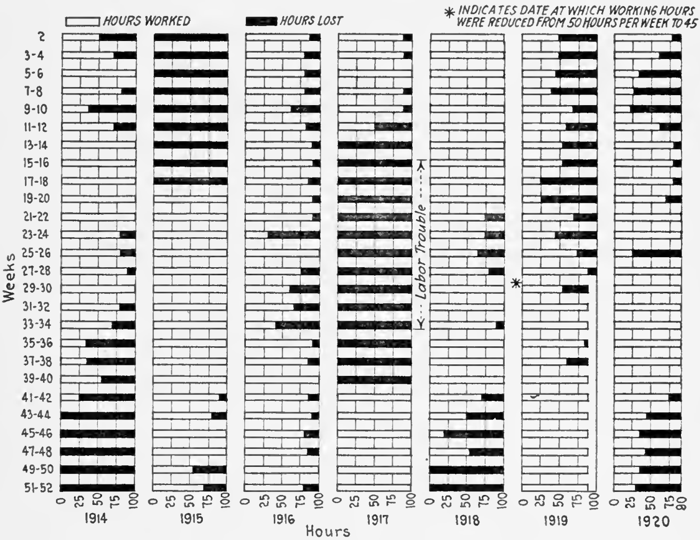


Fig. 3.—Diagram Showing Hours Lost and Hours Worked for a Shoe Cutter for Seven Consecutive Years. This cutter is an expert and in order to work the hours indicated, he was forced to jump from shop to shop every season. If he had stayed in one shop, he could not have worked as much as chart shows.

Results of Lost Production.—The loss in production from idleness results in:

1. Dissatisfaction among employers and employees, and resulting strife.
2. Higher cost of boots and shoes.
3. Excessive piece prices.
4. Exorbitant overhead cost.

The peculiar feature is the fact that nobody knows the amount of this lost time. No records are kept of the actual working time of the piece-workers. This lack of knowledge of facts interferes with intelligent dealings. Piece-rates are set by guess. Bartering takes the place of agreements based on facts. Arbitration falls flat. Decisions can be based only on opinions and the parties remain as far apart as ever.

I. SEASONAL BUSINESS

Seasonal Fluctuations.—Shoes are purchased by the retailer in the spring and fall. The seasonal fluctuations are illustrated vividly in the curves in Figures 4, 5 and 6. Although the location of the peaks in these charts is somewhat affected by war business, the trend in other years is similar. Note that sales in the maximum and minimum months range from 243% to 280% above the average, and from 87% to 89% below.

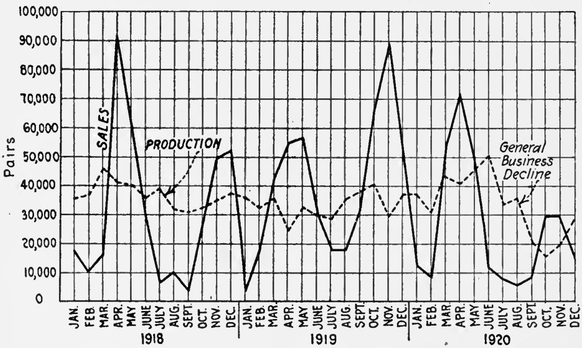


FIG. 4.—Diagram Showing Seasonal Ordering and Efforts to Overcome by Operating 51 Weeks a Year. This Company Makes Nationally Known Goodyear Welt and Turn Shoes for Men and Women.

The average women's shoes are purchased by style alone, and these cannot be made up long in advance. Even in men's shoes, the production as shown in Figure 6 discloses a fluctuation from 168% above the average to 47% below the average for a three-year period. In factories producing women's shoes the variation is still greater, as is illustrated in the production curves in Figures 7, 8, and 11. These are all typical conditions. The major variations in the curves are due to the fluctuating sales demand.

The entire business of shoe manufacture involves a decision on style, kind of leather, color of leather, and low versus high shoes. Affecting these things to a marked degree are the styles in dresses and hosiery. Expecting increased wear of woolen hose in the fall of 1921, one manufacturer estimates a demand for 80% low shoes to 20% high, against his usual demand of 40% low to 60% high. He is making up in the spring his advanced line on this basis. If long skirts should come into style creating a demand for boots, this manufacturer's guess would be in error.

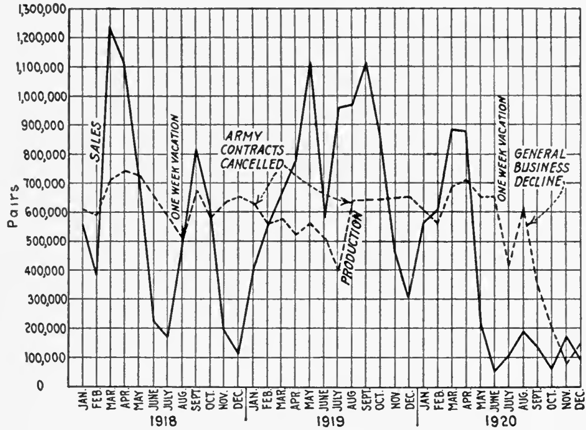


FIG 5.—Diagram Showing Seasonal Ordering and Efforts to Overcome by Operating 51 Weeks a Year. This Company Manufactures Men's and Boy's Welts, McKays and Nail Shoes.

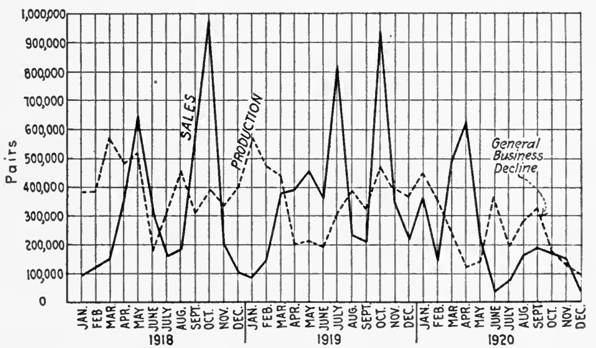


FIG 6.—Diagram Showing Seasonal Ordering and Unsuccessful Efforts to Overcome Irregular Production. This Company Manufactures Men's Welts. Actual pairs multiplied by 4 to be comparable with Figs. 5 and 6.

Losses from Fluctuations in Business.—It is fair to assume that the difference between the working time over a short period of the year and the average working time through the year is the loss due to seasonal production. Examining the curves referred to, we find the average working time through three consecutive years (omitting the period of depression in the fall of 1920) is 68% of the average maximum for three consecutives months in each year. This, it will be noted, compares

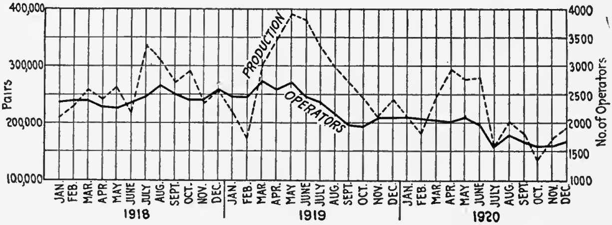


FIG. 7.—Diagram Showing Fluctuation in Production as a Cause for Decreased Production per Operator. Factory Manufactures Women's Welts and Turns. Actual figures have been multiplied by 10 to make them comparable with Figs. 8, 9 and 10.

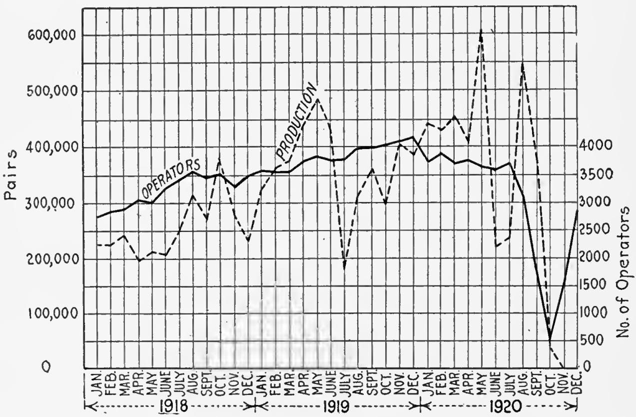


FIG. 8.—Diagram Showing Fluctuation in Production as a Cause for Decreased Production per Operator. This Factory Makes Women's, McKays, Welts and Turns. Actual figures have been multiplied by 10 to make them comparable with Figs. 7, 9 and 10.

closely with the working time of the shoe cutter shown in Figure 1. On the other hand, referring to Figures 9 and 10, it is seen that two of the plants in the group have increased their average working time through special efforts to 88% of the maximum period. The improvement shown by these charts reflects the efforts of the management applied to sales.

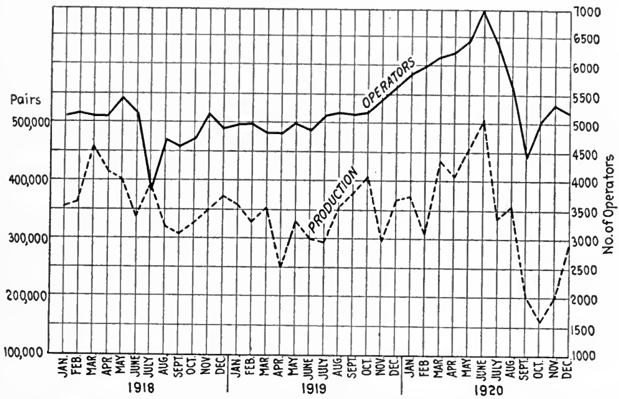


Fig. 9.—Diagram Showing Fluctuation in Production as a Cause for Decreased Production per Operator. This factory manufactures Men's Welts and Women's Welts and Turns.

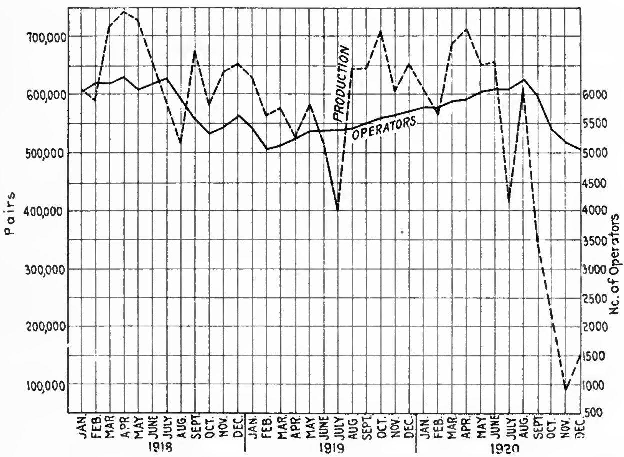


Fig. 10.—Diagram Showing Fluctuation in Production as a Cause for Decreased Production per Operator. This Factory Makes Men's and Boy's Welts, McKays and Nails.

Effects of Novelty Styles.—It is evident that the style of the shoe is becoming of greater and greater importance. It has been said, in fact, that millinery in footwear is outstripping millinery in hats.

A woman buys four pairs of shoes to one pair purchased by a man. This is shown by actual data on sales. It is due partly to style and partly

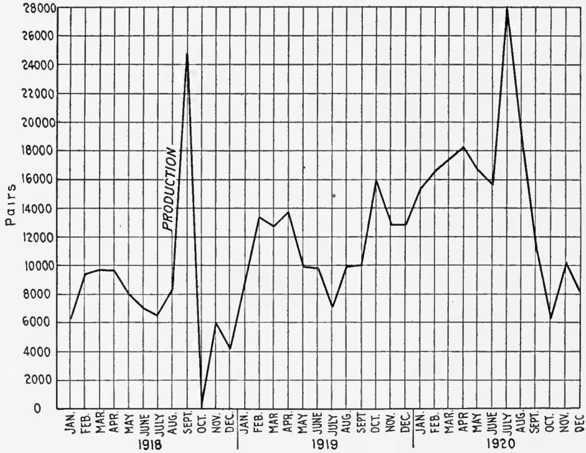


FIG. 11.—Diagram Showing Irregular Monthly Production of a Middle Western Plant Making Misses' Fine McKay and Welt Shoes.

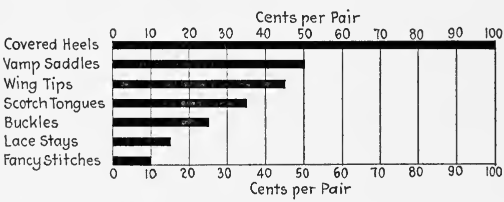


FIG. 12.—Diagram Showing Extra Manufacturing Cost of Several Novelties per Pair Over the Base Cost of a Shoe. This Factory Manufactures Women's High-grade Welts and Turns.

to the shorter wearing quality of women's shoes because of thinner soles and uppers and poorer quality of leather. During the spring season of 1921 the manufacture of novelties was greatly augmented by the efforts of the shoe manufacturer to create demand by manufacturing novelties for immediate sale. This temporarily increased the production of women's shoes, but the move was not economical; it resulted in high-priced shoes, as nearly twice the amount of work was required in the stitching room. Eventually such a practice reacts against both dealers and manufacturers because of the unsalable goods of the novelty type.

The increased cost of different types of novelty design over the cost of the ordinary shoe is shown in Figure 12. If all of these changes were made in the same shoe, it would mean an increase in labor cost of $2.80 per pair over any base shoe without novelties. Extra material is used for straps and other parts, but this cannot be figured as an item of expense because it can be worked out of scrap material. In fact the fancy treatment frequently permits the use of cheaper stock throughout. This results, however, in less desirable qualities of shoes so that there is further actual loss to the wearer. Saddle straps, so popular in 1921 with both men and women, hurt the feet in many cases but still are selected because they are stylish.

Increased Cost of Shoes Over the 1914 Base.—The tables which follow indicate the increased cost of typical men's shoes and typical women's shoes over the 1914 base price.

Detailed Costs of Women's Nine-Inch Black Kid Boot (14–8) Heel

	July, 1914	July, 1919	May, 1920	Dec., 1920	March, 1921
Uppers	$1.05	$3.75	$3.25	$2.10	$1.25
Trimmings	.08	.20	.225	.13	.12
Tongues	.04	.1138	.20	.14	.12
Linings	.04	.2050	.135	.085	.075
Laces	.025	.06	.105	.065	.059
Eyelets	.025	.0466	.0565	.0525	.07
Sole	.22	.75	.65	.35	.32
Insole	.11	.30	.24	.18	.14
Counter	.045	.08	.05	.05	.05
Box	.015	.04	.035	.035	.03
Heel	.045	.10	.09	.10	.06
Toplift	.02	.03	.025	.025	.04
Welt	.05	.10	.10	.075	.0725
Shank	.015	.02	.01	.011	.0110
Carton and Case	.04	.0736	.105	.10	.10
Findings	.12	.18			
Labor	.54	1.40	1.12	1.12	1.12
Royalty	.055	.055	.0466	.0466	.0466
Selling and Discount	.335	1.00	.95	.75	.75
Overhead	.335	1.00	.95	.75	.75
Profit	.165	.50	.475	.375	.375
	$3.370	$10.0040	$8.8181	$6.5401	$5.5591

Courtesy *Boot & Shoe Recorder.*

Detailed Costs of Man's Russia Calf Bal

(The Actual Factory Sheet)

Item	July, 1914	December, 1918	July, 1919	December, 1920	March, 1921
Upper Stock, 3 ft.	@$.31–.93	@$.73–2.19	@$1.50–4.50	@$.60–1.80	@$.50–1.50
Duck Lining No. 25	.05¼	.18¾	.21	.12	.09
Sheep leather trimmings	.05½	.09½	.16	.115	.092
Hooks and eyelets	.04½	.04½	.04½	.05	.05
Bottom stock, out-sole, welt, insole, heel, box, counter, figuring No. 1 heavy Union back	@ .40–.80¾	@ .70–1.40¼	@ .90–1.81¼	@ .60–1.30	@ .50–1.20
Cutting upper soles and heels, fitting, bottom-finishing, treeing, dressing packing	.60	.97½	1.12	1.41	1.41
		.06½	.06½	.0825	.073
Carton, box	.04	.05½	.05½	.055	.055
Royalties	.05½				
Factory and general factory labor expense	.20¼	.21¼	.24	.285	.282
Findings, laces, tongues	.12¾	.25	.26¾	.26	.20
Administrative and selling expense	.29	.45½	.62¾	.55	.492
Discount and interest	.09½	.11½	.24¾	.23	.21
	$3.30	$6.0475	$9.35	$6.2575	$5.654

Actual costs without additional charges for taxes and profits.

Courtesy *Boot and Shoe Recorder.*

Ways of Evening up Production.--The results in evening up production regardless of the fluctuation in sales have been accomplished in the few plants noted through the intensive study of markets and sales, and through the formulation of a stable sales policy radically different from the usual haphazard methods. These results have been brought about:

1. By interweaving the manufacture of staples and novelties so as to make up stock shoes in advance of orders. This involves making up stock during the dull season, which requires an increased investment.
2. By working up advance information and analyzing sales to avoid stocking unsalable shoes.
3. By co-operation between different manufacturing plants and other allied trades.

The company whose curve is shown in Figure 4 owns through subsidiary companies a large number of retail stores and this fact enables it to carry the stock required and to influence the sale of different styles. Also, through foreign representatives, advance information of probable demands is obtained. Another concern (see Figure 5) is accomplishing similar results through its jobbing houses.

Still other firms are accomplishing results and maintaining uniform production by confining themselves to fairly staple lines of women's or men's or children's shoes. These shoes also reach the consumer at a greatly reduced price because the producers are able to manufacture at a much lower cost through the simplification of processes. The reduction in the time needed for running orders through the shop also permits closer co-operation between sales and production.

This brings up the crying need for more thorough co-operation. The national associations under effective leadership may aid this by making thorough studies of market demands in this country and abroad. They may study other problems such as cooperative buying and standardization of color and finish. The field is so vast that a single firm has neither time, money, nor personnel to solve the countless problems. During the war a beginning was made along some of these lines but the agreements were discarded in the following year. The general public, particularly the women, also must realize their share in the demoralization which often occurs in the shoe business, and the increase in cost due to fickleness in choice, and must come to view such things not simply as a choice of style based on casual tastes, but at least in part from the standpoint of usefulness and utility and economy. The excess cost of the novelty shoe is a waste from the standpoint of any actual advantage in wear or durability.

Effect of Rapid Turnover in Retail Stores.—The placing of orders by the retailer has a tremendous effect on manufacture. He alone can aid greatly in leveling production peaks. One retailer in Bridgeport, Conn., turns his stock ten times a year. This rapid turnover is a gain to both manufacturer and retailer, for loss of the latter in dead stock and capital lying idle is reduced to a minimum.

The diagram, Figure 13, shows the turnover for twenty-one representative retail stores (Bridgeport dealer noted above not included). The difference between the store of this group having the largest and the one having the smallest turnover, as shown in the upper and lower curves, is very marked, and indicates the savings that are possible along these lines.

II. CONTROL OF PRODUCTION

The shoe industry has progressed more slowly than most others in the last twenty years, except in the development of machinery. The glaring loss due to time lost through internal irregularities is striking, and it is allowed to continue as a tradition of the business.

The dread of overhead costs, timidity in setting precedents, fear of the labor unions, are the reasons for so little progress. Research work is practically unknown, thorough analysis is lacking, yet both must be employed to co-ordinate the units of an organization manufacturing a product involving as many complexities as the shoe industry.

Scarcely one manufacturer in a hundred appreciates the actual money losses due to irregular flow of shoes through the different departments and operations. Go through almost any shoe shop after 3 o'clock in the

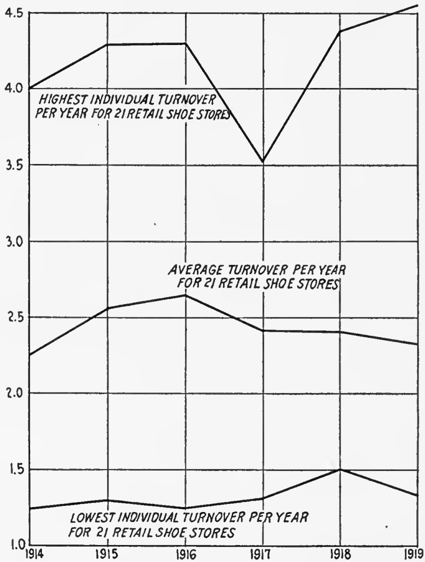


Fig. 13.—Stock Turnover in a Group of 21 Retail Stores Show Average Turnover, and Turnover in the Two Stores Having the Highest and Lowest respectively.

afternoon, and you usually find at any time of the year one or more departments entirely shut down for lack of shoes. Go through almost any shop at any time of the day and you will find some operators in every department waiting for shoes. Notice the diagrams Figures 14 and 15 which show the variation in weekly pay of the worker from month to month, showing a fluctuation of over 200% between the highest and lowest months, and the proof of the above statements is evident. In Figures 16 and 17 this variation is still more convincing.

Variations in production from month to month, most of which are actually due to irregular flow of work through the plant, are illustrated in

Figures 18, 19, and 20. The variation that is apt to occur in the work ahead of different operations in the same department is illustrated in Figure 21.

Effect of Complexity of Operations.—If this waste from departmental congestion is so evident and startling, why do not the manufacturers do

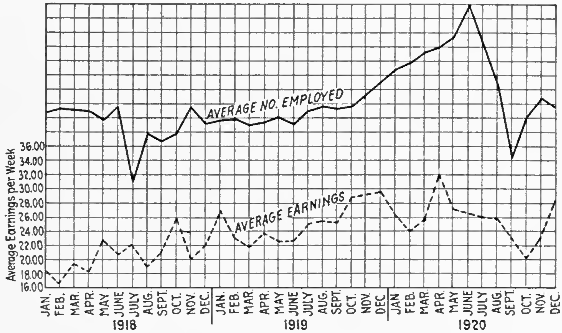


Fig. 14.—Diagram Showing Weekly Earnings in Relation to Number Employed. Irregular Production Reflected in Irregular Earnings. This Company Makes Men's Welts and Women's Turns and Welts.

Fig. 15.—Diagram Showing Weekly Earnings in Relation to Number Employed, Irregular Production Reflected in Irregular Earnings. This Company Makes Men's Welts.

something to prevent it? Why do they not get busy and provide shoes for each worker at all times? The difficulty of this may be appreciated if we consider for a moment the complications of shoe making—complications, because of the small sized lots put through, are greater than in almost any other industry. One lady's shoe may have up to 14 sizes and each size may have four widths. Assuming only six sizes, this gives 24 different pairs of lasts. Consider also that there are often as many as 180 operations on each shoe, and that different styles running consecu-

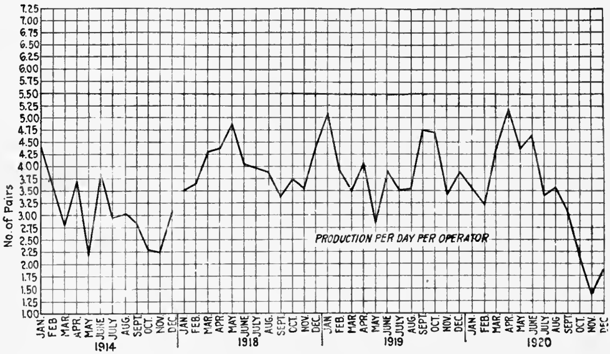


FIG. 16.—Diagram Showing Loss in Production Due to Operators not Receiving Enough Shoes to Produce their Maximum. This Company Manufactures Men's and Women's Welts and Turns

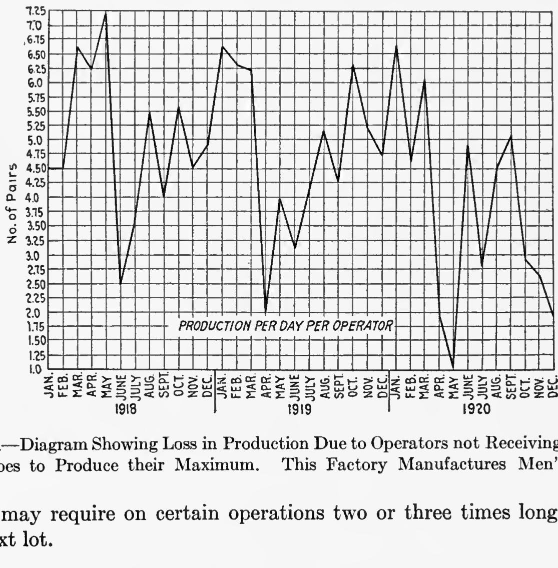


FIG. 17.—Diagram Showing Loss in Production Due to Operators not Receiving Enough Shoes to Produce their Maximum. This Factory Manufactures Men's Welts.

tively may require on certain operations two or three times longer than the next lot.

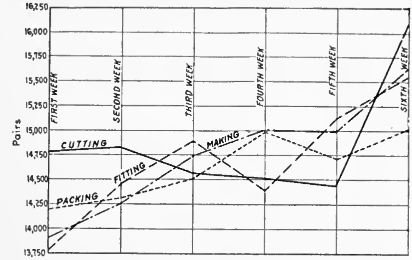


FIG. 18. — Diagram Showing Regular Departmental Output in a Factory with Means of Providing Operators with a Uniform Quantity of Work Each Week. Factory Manufactures Women's Welts and Turns.

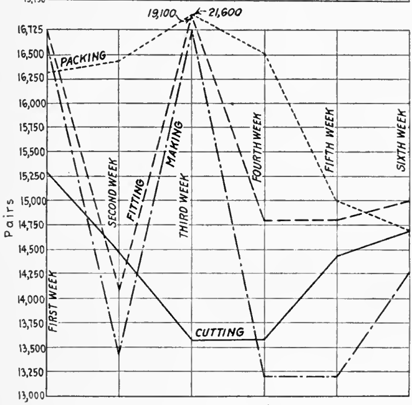


FIG. 19 — Diagram Showing Irregular Departmental Output in a Factory without Means of Providing Operators with a Uniform Quantity of Work Each Week. Factory Manutactures Women's Turn Shoes.

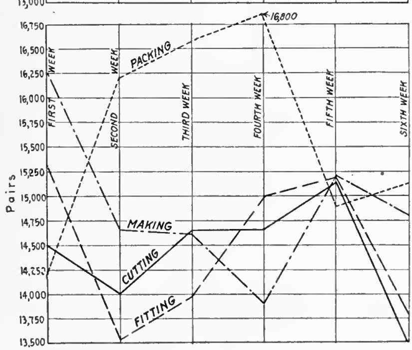


FIG. 20.—Diagram Showing Irregular Departmental Output in a Factory which Has not Developed a Means of Providing Operators with a Uniform Quantity of Work Each Week. Factory Manufactures Men's Welt Shoes.

At the beginning of the season new styles require new specifications, proper stocks of upper leather, manufacture of lasts, ordering of wood heels, developing stock of findings for the particular styles, while, in the shop, questions of new rates, of balancing the departments, of training the operatives, complicate the production. Even during the regular season the planning of orders, the treatment of lasts, the balancing of different lots and styles in material and time, necessitates the complete mastery of production and processing.

These complications are so great that few shoe manufacturers have attained even a small degree of proficiency. Only two or three plants in the country have made even an approach to an intensive study of proper manufacturing technique.

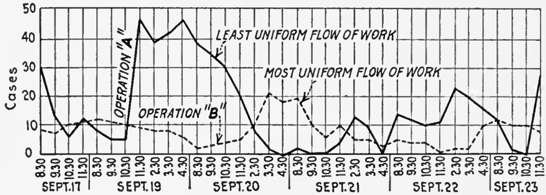


FIG. 21.—Diagram Showing the Number of Cases Ahead of Two Operations in One Department. The solid line indicates the least uniform flow of work and the broken line the most uniform.

Gains through Rapid Manufacture.—Certain manufacturers are finding it possible to make unheard-of reductions in time of putting shoes through the factory and the old idea that "good shoes must remain in the factory several weeks" is being exploded every day. The relative time in four factories making similar men's welt shoes is shown in Figure 22. The time in each department of these four factories is:

Department	Factory A days	B days	C days	D days
Order and Tag	4	3	1	2
Cutting	5½	5	2½	2
Stitching	4	4	3	1½
Lasting	3½	1	3	½
Making	1½	3	3	1
Finishing	1½	1	1½	½
Treeing and Shipping	3	1	2	½
Total	23	18	16	8

On nailed shoes the record has been brought down to five days. On McKay shoes, reductions have been made from twenty-one to fourteen days in some plants. Women's welts and turns are more difficult to make up, but a drop from thirty days to twenty-two has been made in certain plants.

Such reduction in time in process as this of course must not be expected at the price of quality, but speed by no means implies reduction in quality. As a matter of fact manufacturers rarely have given this subject intensive study to see whether improvement is not possible in their particular plants.

The really large saving which is effected by reduction in stock wherever it may be is but little appreciated by the manufacturer. For example, a plant turning out 10,000 pairs of shoes per day, assuming the value of these shoes to be \$3.50 per pair, releases the equivalent of \$525,000 a year, or \$31,500 interest charges at 6%. This is full cost price instead of allowing for the fact that operations are incomplete, but the reckoning is fair because no account is taken of saving in floor space and ease of operation. With running inventories of all stores and worked materials, it is possible to do away with the cost of making annual physical inventories.

In Factory A there are twenty-three days' work on 10,000 pairs, or 230,000 pairs in process, against Factory D where there are eight days' work or 80,000 pairs in process. Figuring \$3.50 as the average cost, the value of goods in process in these two factories is \$805,000 and \$280,000 respectively. Factory A is carrying an inventory of \$525,000 more than Factory D.

Reasons for Lost Production.—In the following table is a compilation of detail records in a department of one of the best run plants in the country showing the amount of, and causes for lost time under normal working conditions:

Record of Non-productive Time by Causes Based on Study of a Lasting Room Making Men's Cheap Nailed Shoes of Simple Pattern and One Last

Lost time due to		
Variation in style	7.2%	
Poor deliveries	4.5	
Lack of machine parts	3.5	
Poor control flow work	2.8	
Machine breakdowns	2.6	
Findings	2.4	
Equipment failure	1.0	24%
Actual Productive Time		76%
Total Working Time		100%

From records of other shops, it is found that the average loss due to the causes enumerated—and this, remember, is during running time and does not include shut-downs—is between 30 and 35%. Even if we call 80% running time the maximum readily attainable, this means a possible increase of nearly 20% in productive capacity, and a similar increase in plant capacity.

How Management can Reduce Waste.—In boot and shoe manufacture, because of the many styles, sizes, and widths, the control of materials and of production plays a most vital part. Such control involves:

1. Organization of executive control.
2. Planning and issuing of material.
3. Purchase of leather.
4. Stores control.
5. Buying and scheduling of lasts.
6. Balancing production through the plant.
7. Cost accounting.
8. Responsibilities of foreman.
9. Plant construction and layout.
10. Machinery control.

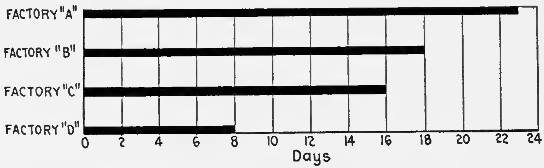


Fig. 22.—Diagram Showing Variation in Length of Time Required to Produce a Men's Goodyear Welt Shoe in Four Different Plants, Each Factory Produces the Same Grade of Shoe. Note small capital turnover for *A*, *B* and *C* compared with *D*.

These factors are of such importance from the standpoint of economical shop management and elimination of waste, amounting well into the millions every year, that a brief treatment of each topic must be given.

1. Organization of Executive Control.—Of the various plants examined, but a few have developed a chart of organization or specifically indicated the duties of the various executives. This results in confusion, lack of responsibility in ordering and divided responsibility in the control of production.

2. Planning and Issuing of Material.—The day sheet system of control is most popular in the larger factories, and has been developed in some of them to a high degree. The plan originated with the W. H. McElwain Company and is particularly adapted to the production of shoes of comparatively uniform style. It involves the making up of a coupon sheet for each lot put through the factory, usually 24 or 36 pairs, the coupons containing the major requirements involved. A certain number of sheets are put in each day and theoretically the lots for every sheet should come out in completed shoes at the end of a definite number of days, regardless of the complications in style, or the character of material worked on.

The issuing of materials based on the day sheets and specifications requires thorough knowledge of materials on hand and effective clerical work in order to avoid delays in the shop waiting for material.

3. Purchase of Leather.—Many a shoe manufacturer makes or loses a fortune through manipulations in leather. Disregarding in our present analysis the loss and gains due to the fluctuating leather market, it is more pertinent to call attention to the greater need for scientific research for the predicting of kinds and qualities of leather required. Even in many of our largest plants the leather buyer purchases from judgment with almost no advance estimates as to the kind, color and quantity of leather expected to be in greatest demand. A necessity for economical manufacture is a careful planning out in advance of the expectations for sales so that the buyer of leather may have all possible information to serve as a guide. The sum involved is so great, and the loss through over-supply, low grade stock culled out from the better grades remaining on hand, and from other conditions, are so large that thorough study is necessary.

4. Stores Control.—In but very few plants are accurate balances of stock kept of the leather by grades to insure quantities which will match up with the orders. The few shops which are keeping track of this are saving many thousands of dollars per year. When it is considered that an inventory of a million dollars worth of leather entails an interest charge, with money at 6%, of $60,000 per year, it is apparent that the savings which have been found possible by properly storing, grading, and recording the stock are a tremendous item.

Another frequent but unnoticed interest loss is due to the purchase of leather, on a stable or falling market, in advance of requirements. Some of the most advanced companies order their leather when orders for shoes are received even if it is not to be used for two or three months. This means the carrying of unnecessary inventory. The necessity for records of stock of other materials is as imperative as for records of leather. The reduction in inventory values for eight different shoes factories of the same company, due to elimination of dead stock and surplus stock, is shown in Figure 23.

One of the constant complaints of the foreman and the individual worker is shortage of material. Special lacings have not come in, eyelets of a particular color are lacking, or, most often, the leather available is not of the right shade or grade. These deficiencies cause large losses in production and delays to the piece-worker. They can only be avoided by modern methods of stores control, which as yet have been introduced into only a few plants.

Need for thorough stores control is particularly noticeable in large concerns having several factories. With proper stores records, materials in individual factories are known and the danger of over-stocking, with consequent interest losses, are largely avoided. Stores records prevent buying something for one factory when it is already on hand in another. With running inventories of all stores and worked materials, it is possible to do away with annual physical inventories.

It is possible, also, to reduce inventories; in one plant where $3,000,000 worth of kid leather is carried in stores it would be possible to operate the business properly with only $1,000,000 worth. Savings on interest on investment through this reduction would amount to $120,000 per

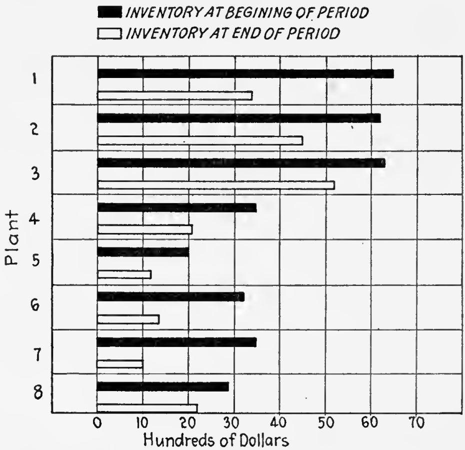


FIG. 23.—Diagram Showing Reduction in Inventory Values in Storerooms of Eight Different Shoe Factories Over a Six-months' Period. Production remained practically the same in each plant during this period. Elimination of dead and surplus stock accounts for the decrease in value.

year in this one plant. Control insures having materials on hand when needed although maintaining a minimum quantity.

It is easy to illustrate the actual losses in production and therefore in money through poor control. In one case noted the foreman knew six barrels of shanks were on hand. When ordered from the store room, however, it was found that the shanks were too small and production on shoes requiring them was delayed an entire month until the proper shanks arrived. Due to shortage of lasts, a factory had 20,000 pairs of shoes in the assembly room when 2,000 was the normal number. This, in turn, was occasioned by lasts held up with the shoes on them waiting for certain findings.

One factory having a capacity of 2,400 pairs a day could turn out for a considerable period only 1,900 pairs, because of shortage of racks due to congestion on account of the cobbling necessary on damaged shoes of a pointed last. Another factory had 50,000 pairs of shoes tied up in the fitting room, instead of the normal 15,000, because of congestion of operations. In another case a factory producing 700 pairs of shoes a day had 36,000 pairs in its fitting room, or ten times the normal supply, and was piling in more. Again, we find 1,000 pairs held up in a fitting room several weeks waiting for a certain style of button. In one case, 24,000 pairs of shoes were held up because no rubber top lifts of proper size were on hand. An entire factory was held up for several days waiting for leather heels required for 12,000 pairs of men's shoes. Most frequent delays in the packing room occur in waiting for proper cartons, embossing dies, brands, and shipping containers.

These cases are not exceptional. Similar delays are occurring daily in the large majority of factories.

The ordinary methods of issuing materials are no less an evil than the lack of production control. In the large majority of shoe factories supplies are dealt out to employees without definite knowledge of requirements and, therefore, with no real check on the disposition of quantities delivered.

The development of stores control provides a mechanism which shows whether the proper use has been made of materials.

5. Buying and Scheduling Lasts.—The buying of lasts is usually a hit-and-miss affair, based on estimated popularity of style. One shoe company has made large savings by getting together with the last manufacturer and arranging for delivery of lasts on orders placed the day the tags go into the cutting room.

This plan is seldom practicable, and in general it is wise to over-buy rather than under-buy lasts because of the large losses in time and production occasioned by last turnover. Manufacturers have sometimes lost sales because of cancellation of large orders of shoes of novelty design through delay in last turnover.

It is insufficiently realized that turnover of lasts is not simply an office function of planning, but involves as well the issue and delivery of leather and findings on schedule and the time of flow through each department.

In the diagram of Figure 24 is shown the specified versus the actual last cycle in a well-managed plant. The delay from the specified time of nine days to the actual time running up to thirteen days results not simply in longer time, but affects the total production and the work of the piece-worker.

6. Balancing Production through the Plant.—With the exception perhaps of seasonal demand and production, ineffective methods of control account for the greatest losses in shoe production.

This fluctuation has a bad effect upon the morale of the entire organization. The management brings pressure on the superintendents to correct the drop in production or remove congestion. The superintendents hammer the foremen, who in turn stir up the employees. Each realizes the cause is beyond his control and that it is a result of improper management.

Labor leaders have seized upon this issue and point to it as a waste chargeable to management. These claims are justified by analysis of the underlying causes.

Matters are left to the foreman which should be taken care of by planning. He is expected to chase up materials when they should come to him automatically.

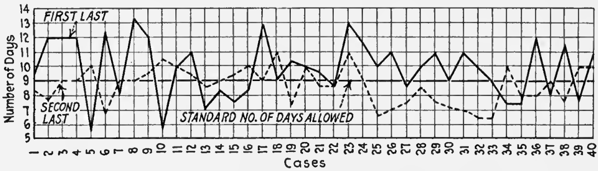


FIG. 24.—Diagram Showing Variation in Turning Lasts in Turn Shoe Factory (Wood Heels) Covering a 4-week Period for Two Different Lasts.

It is evident that a proper system of control is essential to maintain an even flow of work and insure deliveries of the right materials. The sheet system ordinarily used is lacking in flexibility for complicated processes, and in many cases can well be superseded by methods which have being successfully applied to other industries. In a few factories, for example, a modification of the sheet system has been effected by breaking up the process into units and treating the units independently.

The more exact records kept in a few shoe factories, showing the exact location of work in process and also recording the time of piece-workers spent on productive work, as well as the day workers, furnish a means for visualizing the production and eliminating many of the delays and lost time.

7. Cost Accounting.—Scarcely two factories have the same method of keeping costs and few of them maintain sufficient records to give the proper information for assisting in production. There is a need for unification of methods.

8. Responsibilities of Foreman.—All shortcomings, delays, shortages, and low production are laid on the shoulders of the foreman. He is accused of lack in diplomacy and tact in dealing with the employees, as well as of showing partiality and discrimination in distributing work to them. He also receives constant criticisms on handling production. Consider for a moment the duties of the average foreman in a shoe shop:

To route and plan work.
To maintain quantity production.
To maintain quality production.
To employ workmen.
To discipline workmen.
To set rates.
To instruct workers.

It is physically impossible for any one man to execute all these duties properly. Often he is paid a salary inadequate to stimulate him to do his best. He has not the training for all his varied duties, nor the time to carry them out. In one instance the number of applicants for jobs in one day would have taken more than the entire time of the foreman if he had spent fifteen minutes with each applicant.

Along with the proper development of control, before the waste in the shoe factory can be eliminated, must come the further functionalizing of duties, the development of planning departments, of rate setting departments, and of inspection methods which have been tried and proved in other industries.

9. Plant Construction and Layout.—Tests of losses in production through poor light and arrangement of plant have shown surprising deficiencies. The ordinary old-fashioned shoe shop is provided with small windows, while dirt keeps out the light which should pass through. Individual electric lights are provided at certain machines, but these may be insufficient to insure first-class quality in work.

The layout of the machinery and work-benches, although usually of less importance than the methods of control, frequently plays an important part in economy. In one factory production per hundred square feet of manufacturing space was increased from 6.8 pairs of men's welts to 12.6 pairs per day as a result of radical changes in layout. In another factory 12.5 pairs of nailed shoes per hundred square feet were increased to 16.6 pairs. Lack of storage space for racks, congested machinery and the necessity for long carry of shoes in process, reduced productive capacity.

10. Machinery.—The high development of shoe machinery impels the manufacturer to pay too little attention to upkeep. An example of the neglect common to most shops is aptly illustrated in a factory where shoes were jamming at the Goodyear stitchers. The union refused to permit more operatives on the line, because the business agent found out from the men that the machines were delivering but 70% of their capacity, because of needed repairs. As soon as new parts were placed in all machines, production went back to normal.

III. WASTE OF MATERIAL

Wastes involving material occur in the grading of leather which in many plants is done without definite standards, in the purchase of supplies in excess of requirements, in the cutting of leather, and in defective shoes.

Waste in Cutting Upper Leather.—One of the enormous sources of loss is the waste in cutting upper leather. Some factories work out standard quantities for each style with the aid of measuring machines, while a few others adopt what are called the Krippendorf standards. Other firms leave it entirely to the cutters to economize in leather. Even where standards are in use, enormous waste occurs through the carelessness or lack of training of the cutters. A difference of at least $100 worth of leather per week used by two different men for the same styles and same grades of stock is not unusual. Until methods are adopted for controlling this, as well as for interesting and training the cutter to use minimum quantities, the waste will continue.

Cutters are usually employed on a day-work basis with the object of keeping the waste of leather as small as possible. With the full development of standards obtained by careful analysis it is possible to pay the cutters an incentive for quantity and quality output, with a resulting saving of at least 10%.

Losses from Damaged Shoes.—The losses from damaged shoes average 1½ to 2% and run into several millions of dollars yearly, even without considering customers' rejects, the net loss from which has never been satisfactorily estimated. The cost of these must be put into the price of shoes. In a small factory making women's welts and turns, a $20,000 net loss in one year was discovered after the books were closed. In another large company damaged factory product and customers' rejects, excluding cancellations, cost the company over $90,000 in one month.

In addition to the defective shoes are those damaged in process. An ordinary allowance for that cause is 25%. This does not mean that this quantity of shoes is thrown away, but that there is some defect which has to be repaired. Systems of proper inspection, or of proper incentive to the worker for doing good work, are almost entirely lacking. Although these damages are of small money value in themselves, the delays in production both in quantity of output and to the individual operative are serious. In many cases also the blemishes are covered up by polish and reappear when the shoe is worn. To show the need of better inspection, we may refer to a case of shoes made up of two shades of tan leather which had passed through one hundred and sixty-five operations and three central inspectors before being noticed. Under proper inspection control, this could not have happened.

IV. LABOR DIFFICULTIES

Labor in Shoe Making.—Extravagant claims are made by certain shoe manufacturers as to restriction in output due to union rules. Many of these assertions are warranted but, on the other hand, we find case after case of the manufacturer restricting output through failure to provide a full day's work or by unfair methods of dealing with the worker.

What stands out before all else in the negotiations and controversies between the employer and the operator is the lack of knowledge of facts that can be used as a basis for the setting of rates.

Effect of Union Rules.—Certain rules of the union result in the stopping of work in individual departments and the blocking of production in subsequent departments due to the holdup of the shoes. For example, in some localities all the workmen in any operation quit for the remainder of the day provided they are held up fifteen minutes for work. This rule applies whether the delay occurs at 9 o'clock in the morning or at 4 o'clock in the afternoon.

Analyzing these rules, however, we find that they tend in the long run to stabilize production. For example, if a manufacturer by 9 o'clock in the morning cannot provide sufficient orders for his cutters to prevent their waiting for work, and consequently, as is the rule in many places, all the cutters quit work for the day, his routing methods are so poor that he should be compelled to take steps to improve matters.

Numerous cases indicate the necessity for union backing in smaller shops where no employee representation exists. For example, cases were found where workmen in open shops called attention of the employers to certain unjust practices or low rates, and, although their point was carried, the man acting as spokesman was discharged within the next two weeks.

Apprentices.—The unions do not intend to create a surplus of workers in any part of the craft. In shops closely affiliated with the unions, a union man before apprenticing himself to a job outside of his own local, must obtain permission through regular union channels before he can be taken on by the manufacturer.

Strikes and Lockouts.—In the East frequent newspaper accounts appear of strikes in Lynn, Mass. Whereas one strike in 1917 was of a serious nature, most of the strikes of which the papers make so much account have been in individual shops over comparatively small matters. The 1917 strike and lockout lasted six months, affected 18 factories, and threw 4,200 people out of work. The case was a dispute over a new wage agreement. Figure 25 illustrates the unemployment caused by the dispute. One of the manufacturers involved stated that the manufacturers were as much to blame as the unions. The relations of the manufacturers to the unions varies greatly in different localities. In some cities, even where the shops are highly organized, strikes are rare. Cases for adjustment are constantly coming up, but are usually settled without strike on a basis of compromise. The leaders in other sections, on the other hand, take more hasty action, with resulting increase in friction.

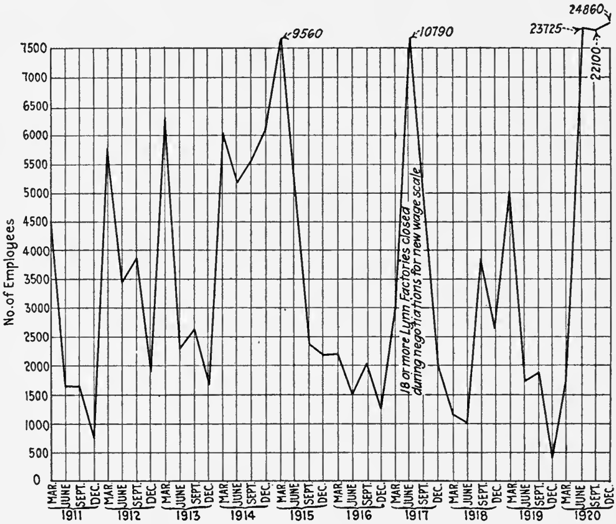


Fig. 25.—Diagram Showing Number of Union Workers Unemployed at End of Each Quarter—Boot and Shoe Workers in Massachusetts. Figures represent approximately 50 per cent of all shoe workers in Massachusetts. Based on union returns to Bureau of Statistics.

Few Personnel Departments.—With perhaps two or three exceptions, shoe shops have no departments exercising modern personnel relations with the employees. This gives the worker no unbiased means of approach to his employer, and the employer is at a loss in treating with his own employees.

This important function is commonly exercised by either the foremen or superintendents. Men occupying either of these positions have not as a rule the proper training to discharge the duty properly.

To this fault of the management may be attributed in part the cause fo lack of knowledge as to labor turnover, its causes and effects. Under present conditions there is little appreciation of the value of these facts, and general impressions of executives close to the employees serve as a basis for the promulgation of policies affecting labor.

Shoe manufacturers must develop employment or personnel departments headed by trained specialists capable of dealing impartially and tactfully with the employees. The department must have accessible at all times accurate and complete information giving the status of the labor situation for any period and create a routine for reaching new employees, following them up after once employed and handle all conditions which influences the period of their association with the company.

Fig. 26.—Comparative Costs of Training Apprentices in the Boot and Shoe Industry. (Complied by Robert R. Haskell.)

Waste in Labor Turnover.—The cost of training an inexperienced man for cutting upper leather in a well-managed shop is $576; for a semi-experienced man is $450; and to install an experienced man in a different shop costs $50.

These are facts brought out in a very thorough analysis made in one of the large shoe plants. As this company is exceptionally well-managed, the figures given are unquestionably low for the average shop.

Few manufacturers either in the shoe or other trades appreciate the losses due to labor turnover and the actual money that can be saved annually by preventing changes in the force. The diagram, Figure 26, gives the comparative cost of training apprentices in the shop referred to. Figure 27 gives the progress and time for the apprentices to attain 100% ability. The cost also of hiring and training is presented in detail in Figure 28.

The reasons why men left the employ of another company during a representative month are shown in Figure 29.

Working Hours.—The hours of work throughout the country vary greatly. In the spring of 1921, Lynn and Haverhill, Mass., were running 45 hours per week with Saturday as a full holiday; Brockton, Mass., was working 48 hours; Auburn, Maine, 54 hours; Manchester, New Hampshire, 48 hours; Brooklyn, 44 hours with Saturday half holiday; Milwaukee, 50 hours; Chicago, 48 hours; Rochester, 48 hours; Cincinnati, 50 hours; and St. Louis, 48 hours.

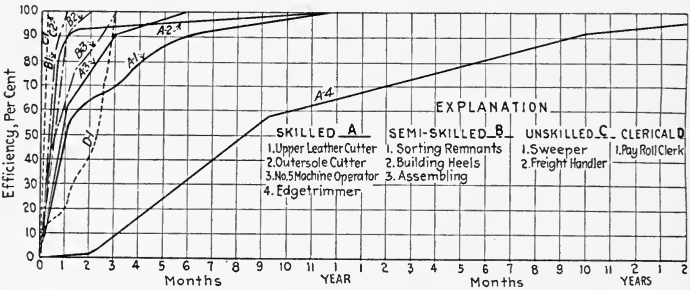


FIG. 27.—Progress Records of Apprentices of Average Ability on Ten Operations in the Shoe Factories of the Boot and Shoe Industry. (Compiled by Robert S. Haskell.)

Haphazard Rate Setting.—Bartering between employers and workers, either directly or through association and union business agent, is the basis of all wage agreements, and piece-rates. If a new rate is required—and new rates must be set with every change in style in the stitching room—the operatives, where unions are dealt with, make a guess through their agent of the time required and therefore the proper price. The manufacturer or the association secretary makes a similar guess which is always lower, in fact perhaps half the guess of the operatives. The compromise is based not on facts but on the selling ability of the two parties. If the rate is set too high, it means unequal payments to the workers or else cutting of rates later on. It is this makeshift policy that is responsible for much of the friction. The friction will continue until methods are adopted by which standards are determined so that rates may be set on a basis of facts instead of guess.

In cutting upper leather, piece-rates, if used as generally operated, are but little more than a farce unless very exact standards of areas for each

Cost of Hiring and Training Operators in the Boot and Shoe Industry

Operations	Cost of Hiring and Training: Hiring	Instruction	Wear and Tear	Reduced Production	Spoiled Work	Cost According to Classes: Class A Total	Class B Total	Class C Total	Loss in Production Hours: Average Wage an Hour	Class A	Class B	Class C
Skilled Operations:												
Upper Leather Cutting	$2.50	$100.00	.....	$23.50	$450.00	$576.00	$450.00	$50.00	$.90	640.0	500.0	55.6
Outersole Cutting	2.50	70.00	.....	54.50	175.00	302.00	250.00	25.00	.80	377.5	312.5	31.3
Operating No. 5 Machine	2.50	61.00	.....	8.00	70.00	141.50	125.00	10.00	.67	211.2	186.6	14.9
Edgetrimming	2.50	35.00	.....	47.00	50.00	134.50	125.00	35.00	.71	189.4	176.1	49.3
Average	2.50	67.00	10.00*	33.00	186.00	298.50	237.50	30.00	.77	354.5	293.8	37.8
Semi-skilled Operations:												
Sorting Leather Remnants	2.50	5.00	.....	1.50	.....	9.00	9.00	3.50	.40	22.5	22.5	8.8
Building Heels	2.50	5.00	.....	12.00	.....	19.50	17.50	5.00	.52	37.5	34.8	9.6
Assembling	2.50	34.00	.....	1.00	3.00	40.50	35.00	7.00	.50	81.0	70.0	14.0
Average	2.50	14.50	10.00*	5.00	1.00	33.00	20.50	5.25	.47	47.0	42.4	10.8
Unskilled Operations:												
Sweeper	2.50	.50	.....	2.00	.....	5.00	4.00	3.00	.43	11.6	9.3	7.0
Freight Handler	2.50	2.00	.....	5.50	.....	10.00	9.00	5.00	.45	22.2	20.0	11.1
Average	2.50	1.25	.....	3.75	.....	7.50	6.50	4.00	.44	16.9	14.7	9.1
Clerical Force:												
Pay Roll Clerk (Enterer)	2.50	96.00	.....	112.00	3.00	213.50	150.00	25.00	.35	610.0	428.6	71.4

Summary of Results Based upon a Normal Labor Turnover (75.8%).

Group	Relative Number and Percentage of Distribution: %	No. a Month	Class A		Class B		Class C		Monthly Loss in Production Hours: Class A	Class B	Class C	Monthly Total	Yearly Loss: Yearly Total	Monthly Cost According to Classes: Class A	Class B	Class C	Monthly Total	Yearly Loss: Yearly Total
Skilled	27.6	87	2%	2	8%	7	90%	78	709.0	2056.6	2948.4	5,714.0	68,568.0	$597.00	$1662.50	$2340.00	$4599.50	$55,194.00
Semi-skilled	65.5	207	5%	10	20%	42	75%	155	470.0	1780.8	1674.0	3,924.8	47,097.6	330.00	861.00	813.75	2004.75	24,057.00
Unskilled	3.2	10	15%	2	60%	6	25%	2	33.8	88.2	18.2	140.2	1,682.4	15.00	39.00	8.00	62.00	744.00
Clerical	3.7	12	45%	5	50%	6	5%	1	3050.0	2571.6	71.4	5,693.0	68,316.0	1067.50	900.00	25.00	1992.50	23,910.00
Averages and Totals	100%	316	16.7%	19	34.5%	61	48.8%	236			Grand Total	15,472.0	185,664.0			Grand Total	8658.75	103,905.00

* Estimated average amount.

Fig. 28.

style are provided. Even the difference in hides is so great that a good cutter is often unjustly penalized. In practice the more expert or more fortunate cutters slow up or turn over their credits to a neighbor. On the other hand, by adopting accurate standards, training the workmen, and providing definite and adequate rewards for saving in leather, large savings may be effected.

The feeling exists among manufacturers that the unions are opposed to the use of the stop watch. The union men state, however, that they are not opposed to its use but only to its abuse in speeding up production instead of determining facts as to the time and best method.

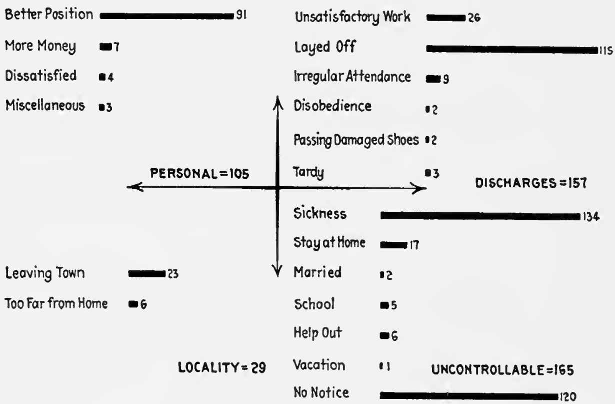


FIG. 29.—Diagram Showing Causes for Exits for Representative Month from One Shoe Factory. Average Number of Employees = 5100. Total Exits = 411.

The lack of knowledge of what a man should do results in payments not in proportion to skill and effort but in accordance with precedent. Skilled jobs requiring months of training earn $40 per week. Other jobs requiring maybe three days' training for the operator, earn $35 per week.

Disadvantage of Uniform Piece Rates.—One of the worst features of these rate-setting agreements is the fact that factories in a certain locality providing good conditions and plenty of work, both through the day and through the year pay the same piece-rates as are paid in the most poorly run factory in the district. The manufacturer, therefore, has comparatively little incentive to provide constant work for his employees, unless he appreciates fully the saving through decreased overhead and increased production. The unions often demand the entire benefits of improvements.

The practice of setting a rate for each operation to apply to all factories in a given locality is entirely wrong. A thorough study of the same operation as performed in the different factories in the same locality will prove they are unlike. It may be the same in principle, but not in detail. There is a difference in product, in materials, equipment, methods, or personnel. Each has a bearing on the output and should be considered when determining the output which can reasonably be expected of a workman. Frequently the wage scale is governed by the strength of the union rather than by the skill required in the various classes of work.

Progressive manufacturers who appreciate this defer taking the steps toward standardization, feeling that the unions will disapprove such a movement. Much time must be spent educating the union leaders and the workmen to a point of view that will appreciate these principles.

In one case, for example, a new method for cutting sock linings increased production threefold. The work of the employees was lightened at the same time, yet the piece-rates remained the same as before.

Accurate Rates from Job Analysis.—One or two factories in the country have proved the practicability of fixing accurate rates by the determination of rates based on time study. Even in these plants, however, the plan has not been carried far enough to get the results that have been attained in certain other industries and that are possible here so as to permit the setting of new rates on a basis of unit operations.

BASIS FOR SETTLING LABOR DISPUTES

Labor Disputes Must be Settled by Fact Arguments.—Success depends upon faith, goodwill, and co-operation. These things can never be attained, however, until, along with the best of intentions, shop conditions and shop methods are adjusted by keen analyses of causes and remedies, until the present haphazard rate setting is replaced by methods based on fact knowledge.

The big factor behind labor disputes is the attempt of the worker to secure a wage that will make up for the irregularity of work through the day and through the year. Management shares the blame with labor for the disagreements and the strikes and lockouts that occur. When the employer and the worker realize, as they are doing in a number of the most successful plants, that the success of each depends upon faith in the other, and when along with this and of vital importance comes the realization of both that most differences can be settled by determination of fact and the establishing of standard methods in production so as to prevent the causes of friction, most of our labor difficulties in the shoe shop will disappear. And with these same developments will come about the elimination of a large portion of the waste now existing in the boot and shoe industry.

Accident Prevention.—The cost of accidents from the return of the National Council of Workmen's Compensation Insurance shows a comparatively small loss for the boot and shoe industry, the accident cost being 36c. per $100 of the pay roll. Even this, however, is appreciable and through "safety first" work reductions in lost time in two different factories have amounted to about 18%.

EFFECT OF WASTE ELIMINATION ON THE COST OF SHOES

The waste of time through the year due to seasonal demand and the daily losses of time through unbalanced production of departments and processes, make the cost of labor on a pair of shoes almost double the possible minimum. With an output valued at some $1,300,000,000, this loss of labor alone, even assuming that only 25% is wasted time, amounts (since the labor cost is about 20% of the shoe cost) to $65,000,000 a year.

Manufacturers as yet are making but little effort to remedy the unsatisfactory conditions of employment because they do not realize the bearing on their costs and profits. The manufacturer says: "This lost time does not cost anything. The operators are on piece-work and simply lose their own time." But the fact is that not only must irregular work be paid for by higher piece-rates to maintain a fair annual income for the operator, but the effect of this idle time on the actual cost is surprising.

In the following paragraphs are pointed out the reduction in price that is shown to be possible by the actual results in a few of the best shops. The effect of standardization is not considered because, although of great benefit, actual data are lacking from which to give definite figures. The reductions in cost are based on:

1. Overcoming seasonal fluctuations.
2. Overcoming internal congestion.
3. Saving material.

From the combined result is shown the comparative prices of the finished shoe.

Analysis of Cost.—Statistics of earnings of industrial workers in this country, as well as cost values, are inadequate and inexact. However, it has been possible by balancing various sources of information and checking these with the records of the shops subjected to special study to arrive at definite figures. The average annual income of boot and shoe workers we find to be $1250. This income is earned in approximately thirty-four full weeks of productive effort. The manufacturing cost of the average shoe in the early part of 1921 was approximately $3.50 per pair. This figure includes cost for shoes ranging from the smallest baby shoe to the fanciest shoe for women, as well as from the cheapest man's nailed to the finest woman's turned. Analyzing the cost of a shoe we find the division of material, labor, and expense to be as follows:

Material	$2.10	60%
Labor	.70	20%
Overhead	.70	20%
Total Cost	$3.50	100%

Result from Overcoming Seasonal Fluctuation.—Presuming for the present an annual income of $1250 to be earned by the average shoe worker in forty-five weeks of productive effort instead of the present average of thirty-four weeks, since shoe workers think in terms of annual income the labor cost would be reduced in inverse proportion.[1] Since the annual overhead remains the same, the overhead per pair would be reduced in like measure. Assuming the same cost of material, the result in cost with this 32% increased production would be:

Material	$2.10	66%
Labor	.53	17%
Overhead	.53	17%
Total Cost	$3.16	100%

This is equivalent, by reducing the idle time through the year, to a reduction of about 25% in the cost of labor and in overhead with a reduction in the total cost of the shoe of 10%.

Results from Overcoming Internal Congestion.—But we have still another loss from idleness, the loss of the operative, occasioned chiefly by waiting for work and material—a loss shown by our factory studies to amount to another 35% of the time. This can be eliminated to a great extent by accurate methods of planning and controlling the work. The manufacturer can at least reduce this cost by 20%, in addition to the increase in annual working time, since this actually has been done in certain factories.

Results of the increased output over and above the saving already figured would then be reflected by a 20% reduction in the cost of labor and of overhead as follows:

[1] In practice, through additional gains, the earnings per year would be increased also.

Material..........	$2.10	71%
Labor............	.44	14.5%
Overhead.........	.44	14.5%
Total Cost........	$2.98	100%

Results from Saving Material.—But it is unfair to assume no reduction in the cost of material. Examination made in the tanning industry in connection with this report shows large possibilities for reduction in cost of upper leather, but even disregarding these and considering only the possible saving within the shop due to improved methods of grading, more expert cutting and fewer defective shoes which have been discussed in the report, we would have a reduction in material cost of at least 10%. Taking this into consideration, we have:

Material.........	$1.89	68%
Labor............	.44	16%
Overhead.........	.44	16%
Total Cost........	$2.77	100%

Total Reduction in Manufacturing Costs.—The net savings which may be obtained is $0.73 per pair of shoes or a reduction of 21%. Accordingly, since selling prices in general vary with manufacturing costs, shoes which are now purchased from the retailer for $15 could be had for $11.85, or a saving of $3.15 per pair. Shoes now sold for $10 would sell at $7.90, or a reduction of $2.10 per pair.

Conclusion.—Summarizing these facts, the greatest needs in the shoe industry are:

1. More uniform distribution of work throughout the year, which can be effected by co-ordination of sales and production.
2. Adjustment of methods of planning and production to the multiple processes involved in shoe manufacture.
3. Co-operation of the manufacturers and the workers in development of the best-working methods and piece rates through the determination of facts and analyses of operations.
4. Development of more intimate relations between the worker and the management through the employment or personnel function.
5. Strengthening the other weak places which have been noted in this report.

The Field Report Evaluation Sheets.—In the studies for this report 17 boot and shoe factories have been personally visited and detail facts as outlined in the questionnaire have been obtained from 8 of these.

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Boot and Shoe* **PLANT NO.** *5* **EST. BY** *Thompson & Lichtner Co.* **DATE** *4/15/21*

KEY
① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste, Good = 20% "
④ + ⑧ + ⑫ = ⑭ Fair = 40% "
Poor = 60% Waste, Bad = 80% "
a + b + c = d = 100%
e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT: Assigned Points	MANAGEMENT: Est. % Waste		MANAGEMENT: Points Waste	LABOR: Assigned Points	LABOR: Est. % Waste		LABOR: Points Waste	OUTSIDE CONTACTS: Assigned Points	OUTSIDE CONTACTS: Est. % Waste		OUTSIDE CONTACTS: Points Waste	TOTAL WASTE: Assigned Points	TOTAL WASTE: Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5		100	0.5									0.5	0.5
	K2	1.0		100	1.0									1.0	1.0
	K3	0.5		100	0.5									0.5	0.5
	K4	0.5		100	0.5									0.5	0.5
	K5	0.5		50	0.25									0.5	0.25
	K6	0.5		75	0.37									0.5	0.37
	K7	0.5		100	0.5									0.5	0.5
	K8	8.0		75	6.0					4.0		100	4.0	12.0	10.0
	K9	0.5		100	0.5									0.5	0.5
	K10	3.0		50	1.5									3.0	1.0
	K11	1.0		100	1.0									1.0	1.0
	K12	1.0		100	1.0	1.0		100	1.0	1.0		100	1.0	3.0	3.0
	K13	2.0		100	2.0	2.0		100	2.0	2.0		100	2.0	6.0	6.0
	K14	0.12				0.25				0.13				0.5	
	K15	0.25				0.25								0.5	
	K16	1.0		100	1.0	1.0								2.0	1.0
	K17	2.0				2.0								4.0	
	K18	2.0				2.0								4.0	
	K19	1.0		100	1.0									1.0	1.0
	K20	0.25				0.25								0.5	
	K21	0.5		100	0.5									0.5	0.5
	TOTAL	26.62			18.12	8.75			3.0	7.13			7.0	a 42.50	e 28.12
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	0.25								0.25				0.5	
	T2	1.0												1.0	
	T3	2.5		100	2.50									2.5	2.5
	T4	0.5												0.5	
	T5	1.5												1.5	
	T6	0.5												0.5	
	T7	2.0								2.0		100	2.0	4.0	2.0
	TOTAL	8.25			2.50	0.0			0.0	2.25			2.0	b 10.50	f 4.50
UTILIZATION: Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	1.0												1.0	
	U2	7.0		50	3.5									7.0	3.5
	U3	2.0		100	2.0									2.0	2.0
	U4	10.0		100	10.0									10.0	10.0
	U5	5.0		100	5.0									5.0	5.0
	U6	0.5		100	0.5									0.5	0.5
	U7	2.0												2.0	
	U8	3.0												3.0	
	U9	2.0		100	2.0									2.0	2.0
	U10	1.0		100	1.0	1.0								2.0	1.0
	U11	1.0		100	1.0									1.0	1.0
	U12	6.5		100	6.5									6.5	6.5
	U13	0.5		50	0.25									0.5	0.25
	U14	0.5												0.5	
	U15	0.25		50	0.13					0.25		50	0.12	0.5	0.25
	U16	2.5		50	1.25									2.5	1.25
	U17	1.0												1.0	
	U18	0.0												0.0	
	TOTAL	45.75			33.13	1.0			0.0	0.25			0.12	c 47.00	g 33.25
GRAND TOTAL		80.62			53.75	9.75			3.0	9.63			9.12	d 100	h 65.87

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Boot and Shoe* **PLANT NO.** *4* **EST. BY** *Thompson & Lichtner Co.* **DATE** *4/15/21*

KEY

① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste; Good = 20% Waste; Fair = 40% Waste; Poor = 60% Waste; Bad = 80% Waste

④ + ⑧ + ⑫ = ⑭

a + b + c = d = 100%

e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT Assigned Points	Est. % Waste		Points Waste	LABOR Assigned Points	Est. % Waste		Points Waste	OUTSIDE CONTACTS Assigned Points	Est. % Waste		Points Waste	TOTAL WASTE Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5		100	0.5									0.5	0.5
	K2	1.0		50	0.5									1.0	0.5
	K3	0.5		100	0.5									0.5	0.5
	K4	0.5		50	0.25									0.5	0.25
	K5	0.5		50	0.25									0.5	0.25
	K6	0.5		50	0.25									0.5	0.25
	K7	0.5		10	0.05									0.5	0.05
	K8	8.0		50	4.0					4.0		100	4.0	12.0	8.0
	K9	0.5		100	0.5									0.5	0.5
	K10	3.0		50	1.5									3.0	1.5
	K11	1.0		100.	1.0									1.0	1.0
	K12	1.0		100	1.0	1.0		100	1.0	1.0		100	1.0	3.0	3.0
	K13	2.0		50	1.0	2.0		50	1.0	2.0		50	1.0	6.0	3.0
	K14	0.13		100	0.13	0.25		100	0.25	0.12		100	0.12	0.5	0.5
	K15	0.25				0.25								0.5	
	K16	1.0				1.0								2.0	
	K17	2.0				2.0								4.0	
	K18					4.0		100	4.0					4.0	4.0
	K19	1.0		50	0.50									1.0	0.5
	K20	0.5		50	0.25									0.5	0.25
	K21	0.5		100	0.5									0.5	0.5
	TOTAL	24.88			12.68	10.50			6.25	7.12			6.12	a 42.50	e 25.05
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	0.25								0.25				0.5	
	T2	1.0		50	0.5									1.0	0.5
	T3	2.5		50	1.25									2.5	1.25
	T4	0.5												0.5	
	T5	1.5		50	0.75									1.5	0.75
	T6	0.5												0.5	
	T7	4.0		25	1.0									4.0	1.0
	TOTAL	10.25			3.50	0.0			0.0	0.25			0.0	b 10.50	f 3.50
UTILIZATION — Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	1.0												1.0	
	U2	7.0		50	3.5									7.0	3.5
	U3	2.0		100	2.5									2.0	2.5
	U4	10.0		90	9.0									10.0	9.0
	U5	5.0		50	2.5									5.0	2.5
	U6	0.5		100	0.5									0.5	0.5
	U7	2.0		50	1.0									2.0	1.0
	U8	1.5		100	1.5	1.5		100	1.5					3.0	3.0
	U9	2.0		50	1.0									2.0	1.0
	U10	2.0		50	1.0									2.0	1.0
	U11	1.0												1.0	
	U12	6.5		10	0.65									6.5	0.65
	U13	0.5		50	0.25									0.5	0.25
	U14	0.5		10	0.05									0.5	0.05
	U15	0.35								0.15				0.5	
	U16	2.5		50	1.25									2.5	1.25
	U17	1.0		50	0.5									1.0	0.5
	U18	0.0												0.0	
	TOTAL	45.35			25.20	1.5			1.5	0.15			0.0	c 47.00	g 26.10
GRAND TOTAL		80.48			41.38	12.0			7.75	7.52			6.12	d 100	h 55.25

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Boot and Shoe* **PLANT NO.** *3* **EST. BY** *Thompson & Lichtner Co.* **DATE** *4/15/21*

KEY

① + ⑤ + ⑨ = ⑬	Excellent = 0% Waste Good = 20% " Fair = 40% "	Poor = 60% Waste Bad = 80% "	a + b + c = d = 100%
④ + ⑧ + ⑫ = ⑭			e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT: Assigned Points	Est. % Waste		Points Waste	LABOR: Assigned Points	Est. % Waste		Points Waste	OUTSIDE CONTACTS: Assigned Points	Est. % Waste		Points Waste	TOTAL WASTE: Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5		100	0.5									0.5	0.5
	K2	1.0		50	0.5									1.0	0.5
	K3	0.5		100	0.5.									0.5	0.5
	K4	0.5		50	0.25									0.5	0.25
	K5	0.5		50	0.25									0.5	0.25
	K6	0.5		50	0.25									0.5	0.25
	K7	0.5		50	0.25									0.5	0.25
	K8	8.0		25	2.0					4.0		100	4.0	12.0	6.0
	K9	0.5		50	0.25									0.5	0.25
	K10	3.0												3.0	
	K11	1.0		100	1.0									1.0	1.0
	K12	1.0		25	0.25	1.0		25	0.25	1.0		25	0.25	3.0	0.75
	K13	2.5		75	1.88	2.5		75	1.87	1.0		50	.50	6.0	4.25
	K14	0.12		100	0.12	0.25		100	0.25	0.13		100	0.13	0.5	0.5
	K15	0.25				0.25								0.5	
	K16	1.0				1.0								2.0	
	K17	2.0		50	1.0	2.0		50	1.0					4.0	2.0
	K18	2.0		50	1.0	2.0		50	1.0					4.0	2.0
	K19	1.0		25	0.25									1.0	0.25
	K20	0.5												0.5	
	K21	0.5												0.5	
	TOTAL	27.37			10.25	9.00			4.37	6.13			4.88	a 42.5	e 19.50
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	0.25								0.25				0.5	
	T2	1.0		10	0.10									1.0	0.10
	T3	2.5		10	0.25									2.5	0.25
	T4	0.5												0.5	
	T5	1.5												1.5	
	T6	0.5												0.5	
	T7	2.0		25	0.25					2.0		100	2.0	4.0	2.25
	TOTAL	8.25			0.60	0.0			0.0	2.25			2.0	b 10.5	f 2.60
UTILIZATION — Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	1.0												1.0	
	U2	7.0		25	1.75									7.0	1.75
	U3	1.0		100	1.0	1.0		100	1.0					2.0	2.0
	U4	7.0		50	3.5	3.0		100	3.0					10.0	6.5
	U5	4.0		10	0.4	1.0		10	0.1					5.0	0.5
	U6	0.5												0.5	
	U7	2.0												2.0	
	U8	2.0		100	2.0	1.0		100	1.0					3.0	3.0
	U9	1.0		50	0.5	1.0		100	1.0					2.0	1.5
	U10	1.0		50	0.5	1.0		100	1.0					2.0	1.5
	U11	1.0												1.0	
	U12	6.5												6.5	
	U13	0.5												0.5	
	U14	0.5												0.5	
	U15	0.35								0.15				0.5	
	U16	2.5		10	0.25									2.5	0.25
	U17	1.0		10	0.10									1.0	0.10
	U18	0.0												0.0	
	TOTAL	38.85			10.00	8.00			7.10	0.15			0.00	c 47.0	g 17.10
GRAND TOTAL		74.47			20.85	17.00			11.47	8.53			6.88	d 100	h 39.20

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Boot and Shoe* **PLANT NO.** 2 **EST. BY** *Thompson & Lichtner Co.* **DATE** *4/15/21*

KEY

① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste; Good = 20% Waste; Fair = 40% Waste; Poor = 60% Waste; Bad = 80% Waste

④ + ⑧ + ⑫ = ⑭

a + b + c = d = 100%

e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points	Est. % Waste		MANAGEMENT Points Waste	LABOR Assigned Points	Est. % Waste		LABOR Points Waste	OUTSIDE CONT' ACTS Assigned Points	Est. % Waste		OUTSIDE CONT' ACTS Points Waste	TOTAL WASTE Assigned Points	TOTAL WASTE Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5												0.5	
	K2	1.0												1.0	
	K3	0.5		10	.05									0.5	0.05
	K4	0.5		100	0.5									0.5	0.5
	K5	0.5												0.5	
	K6	0.5												0.5	
	K7	0.5												0.5	
	K8	8.0		25	2.0					4.0		50	2.0	12.0	4.0
	K9	0.4				0.1		10	0.01					0.5	0.01
	K10	3.0												3.0	
	K11	1.0		10	0.1									1.0	0.1
	K12	1.0		10	0.1	1.0		25	0.25	1.0		10	0.1	3.0	0.45
	K13	3.0		20	0.6	2.0		20	0.4	1.0		10	0.1	6.0	1.1
	K14	0.12				0.25				0.13				0.5	
	K15	0.25				0.25								0.5	
	K16	1.0		10	0.1	1.0		10	0.1					2.0	0.2
	K17	2.0				2.0								4.0	
	K18	2.0				2.0								4.0	
	K19	1.0												1.0	
	K20	0.25				0.25		50.	0.12					0.5	0.12
	K21	0.25				0.25								0.5	
	TOTAL	27.27			3.45	9.10			0.88	6.13			2.20	a 42.5	e 6.53
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	0.25								0.25				0.5	
	T2	1.0		20	0.2									1.0	0.2
	T3	2.5												2.5	
	T4	0.5												0.5	
	T5	1.5												1.5	
	T6	0.5												0.5	
	T7	2.0		20	0.4					2.0		20	0.4	4.0	0.8
	TOTAL	8.25			0.6	0.0			0.0	2.25			0.4	b 10.5	f 1.0
UTILIZATION — Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	1.0												1.0	
	U2	7.0		10	0.7									7.0	0.7
	U3	2.0		100	2.0									2.0	2.0
	U4	10.0		10	1.0									10.0	1.0
	U5	5.0		10	0.5									5.0	0.5
	U6	0.5												0.5	
	U7	2.0		10	0.2									2.0	0.2
	U8	3.0		100	3.0									3.0	3.0
	U9	1.0		20	0.2	1.0		20	0.2					2.0	0.4
	U10	2.0		10	0.2									2.0	0.2
	U11	1.0												1.0	
	U12	6.5												6.5	
	U13	0.5												0.5	
	U14	0.5		10	0.05									0.5	0.05
	U15	0.35								0.15				0.5	
	U16	2.5		10	0.25									2.5	0.25
	U17	1.0		10	0.1									1.0	0.10
	U18	0.0												0.0	
	TOTAL	45.85			8.20	1.0			0.20	0.15			0.00	c 47.0	g 8.40
GRAND TOTAL		81.37			12.25	10.10			1.08	8.53			2.60	d 100	h 15.93

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Boot and Shoe* **PLANT NO.** *1* **EST. BY** *Thompson & Lichtner Co.* **DATE** *4/15/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ ; Excellent = 0% Waste, Good = 20% „, Fair = 40% „, Poor = 60% Waste, Bad = 80% „ ; a + b + c = d = 100% ; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES												TOTAL WASTE	
		MANAGEMENT				LABOR				OUTSIDE CONTACTS					
		Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Rensobility and Relationship	K1	0.5												0.5	
	K2	1.0												1.0	
	K3	0.5												0.5	
	K4	0.5												0.5	
	K5	0.5												0.5	
	K6	0.5												0.5	
	K7	0.5												0.5	
	K8	8.0		10	1.2					4.0		50	2.0	12.0	3.2
	K9	0.5												0.5	
	K10	3.0												3.0	
	K11	1.0												1.0	
	K12	1.0		10	0.2	1.0		10	0.1	1.0		10	0.1	3.0	0.4
	K13	3.0				2.0		20	0.4	1.0		10	0.1	6.0	0.5
	K14	0.12				0.25				0.13				0.5	
	K15	0.25				0.25		100	0.25					0.5	0.25
	K16	1.0				1.0		100	1.0					2.0	1.0
	K17	2.0		25	0.25	2.0		50	1.0					4.0	1.25
	K18	2.0				2.0		50	1.0					4.0	1.0
	K19	1.0												1.0	
	K20	0.25				0.25		100	0.25					0.5	0.25
	K21	0.5												0.5	
	TOTAL	27.62			1.65	8.75			4.00	6.13			2.20	a 42.50	e 7.85
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	0.25								0.25				0.5	
	T2	1.0												1.0	
	T3	2.5												2.5	
	T4	0.25				0.25								0.5	
	T5	1.5												1.5	
	T6	0.5												0.5	
	T7	3.0		10	0.3					1.0		10	0.1	4.0	0.4
	TOTAL	9.0			0.3	0.25			0.00	1.25			0.10	b 10.50	f 0.40
UTILIZATION: Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	1.0												1.0	
	U2	7.0		10	0.7									7.0	0.7
	U3	2.0		50	1.0									2.0	1.0
	U4	10.0		10	1.0									10.0	1.0
	U5	5.0		10	0.5									5.0	0.5
	U6	0.5												0.5	
	U7	2.0		50	1.0									2.0	1.0
	U8	3.0												3.0	
	U9	2.0												2.0	
	U10	2.0												2.0	
	U11	1.0												1.0	
	U12	6.5												6.5	
	U13	0.5												0.5	
	U14	0.5												0.5	
	U15	0.35		10	0.05					0.15				0.5	0.05
	U16	2.5												2.5	
	U17	1.0												1.0	
	U18	0.0												0.0	
	TOTAL	46.85			4.25	0.00			0.00	0.15			0.00	c 47.0	g 4.25
GRAND TOTAL		83.47			6.20	9.00			4.00	7.53			2.30	d 100	h 12.50

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Boot and Shoe* PLANT NO. *6* EST. BY *Thompson & Lichtner Co.* DATE *4/15/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ ; Excellent = 0% Waste, Good = 20% Waste, Fair = 40% Waste, Poor = 60% Waste, Bad = 80% Waste ; a + b + c = d = 100% ; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES												TOTAL WASTE	
		MANAGEMENT				LABOR				OUTSIDE CONTACTS					
		Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5												0.5	
	K2	1.0												1.0	
	K3	0.5		25	0.12									0.5	0.12
	K4	0.5		25	0.13									0.5	0.13
	K5	0.5												0.5	
	K6	0.5												0.5	
	K7	0.5		25	0.12									0.5	0.12
	K8	8.0		25	3.0					4.0		100	4.0	12.0	7.00
	K9	0.5												0.5	
	K10	3.0												3.0	
	K11	1.0												1.0	
	K12	1.0		10	0.1	1.0		0.2	0.2	1.0		50	0.5	3.0	0.8
	K13	3.0				2.0				1.0		50	0.5	6.0	0.5
	K14	0.13				0.25				0.12				0.5	
	K15	0.25				0.25								0.5	
	K16	2.0		100	2.0									2.0	2.0
	K17	2.0				2.0								4.0	
	K18	2.0				2.0								4.0	
	K19	1.0		100	1.0									1.0	1.0
	K20	0.5												0.5	
	K21	0.5		50	0.25									0.5	0.25
	TOTAL	28.88			6.72	7.50			0.20	6.12			5.00	a 42.50	e 11.92
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	0.25								0.25				0.5	
	T2	1.0												1.0	
	T3	2.5												2.5	
	T4	0.5												0.5	
	T5	1.5												1.5	
	T6	0.5												0.5	
	T7	2.0								2.0		50	1.0	4.0	1.0
	TOTAL	8.25			0.00	0.00			0.00	2.25			1.00	b 10.50	f 1.00
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	1.0		25	0.25									1.0	0.25
	U2	7.0		50	3.5									7.0	3.5
	U3	2.0		100	2.0									2.0	2.0
	U4	10.0		25	2.5									10.0	2.5
	U5	5.0		25	1.25									5.0	1.25
	U6	0.5		25	0.13									0.5	0.13
	U7	2.0												2.0	
	U8	3.0		100	3.0									3.0	3.0
	U9	2.0		25	0.5									2.0	0.50
	U10	1.0				1.0								2.0	
	U11	1.0		25	0.25									1.0	0.25
	U12	6.5		25	1.62									6.5	1.62
	U13	0.5		100	0.5									0.5	0.50
	U14	025								0.25				0.5	
	U15	0.5		25	0.13									0.5	0.13
	U16	2.5		50	1.25									2.5	1.25
	U17	1.0												1.0	
	U18	0.0												0.0	
	TOTAL	45.75			16.88	1.00			0.00	0.25			0.00	c 47.0	g 16.88
GRAND TOTAL		82.88			23.60	8.50			0.20	8.62			6.00	d 100	h 29.80

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Boot and Shoe* PLANT NO. 7 EST. BY *Thompson & Lichtner Co.* DATE *4/14/21*

KEY: ① + ⑤ + ⑨ = ⑬; ④ + ⑧ + ⑫ = ⑭ — Excellent = 0% Waste, Good = 20% ", Fair = 40% ", Poor = 60% Waste, Bad = 80% " — a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	Est. % Waste 2	3	Points Waste 4	LABOR Assigned Points 5	Est. % Waste 6	7	Points Waste 8	OUTSIDE CONTACTS Assigned Points 9	Est. % Waste 10	11	Points Waste 12	TOTAL WASTE Assigned Points 13	Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5		100	0.5									0.5	0.5
	K2	1.0		100	1.0									1.0	1.0
	K3	0.5		100	0.5									0.5	0.5
	K4	0.5		100	0.5									0.5	0.5
	K5	0.5		100	0.5									0.5	0.5
	K6	0.5		100	0.5									0.5	0.5
	K7	0.5		50	0.25									0.5	0.25
	K8	8.0		100	8.0					4.0		100	4.0	12.0	12.0
	K9	0.5		50	0.25									0.5	0.25
	K10	3.0		50	1.5									3.0	1.5
	K11	1.0		50	0.5									1.0	0.5
	K12	1.0		100	1.0	1.0		50	0.5	1.0		50	0.5	3.0	2.0
	K13	3.0		100	3.0	2.0		100	2.0	1.0		100	1.0	6.0	6.0
	K14	0.13				0.25				0.12				0.5	
	K15	0.25				0.25								0.5	
	K16	1.0		100	1.0	1.0								2.0	1.0
	K17	2.0				2.0								4.0	
	K18	2.0				2.0								4.0	
	K19	1.0		100	1.0									1.0	1.0
	K20	0.5		100	0.5									0.5	0.5
	K21	0.5		100	0.5									0.5	0.5
	TOTAL	27.88			21.00	8.50			2.50	6.12			5.50	a 42.50	e 29.00
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	0.25								0.25				0.5	
	T2	1.0												1.0	
	T3	2.5		100	2.5									2.5	2.5
	T4	0.5												0.5	
	T5	1.5												1.5	
	T6	0.5												0.5	
	T7	2.0								2.0		50	1.0	4.0	1.0
	TOTAL	8.25			2.50	0.00			0.00	2.25			1.00	b 10.50	f 3.50
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	1.0		100	1.0									1.0	1.0
	U2	7.0		100	7.0									7.0	7.0
	U3	2.0		100	2.0									2.0	2.0
	U4	10.0		100	10.0									10.0	10.0
	U5	5.0		50	2.5									5.0	2.5
	U6	0.5		50	0.25									0.5	0.25
	U7	2.0		100	2.0									2.0	2.0
	U8	3.0		100	3.0									3.0	3.0
	U9	2.0		100	2.0									2.0	2.0
	U10	1.0				1.0								2.0	
	U11	1.0		100	1.0									1.0	1.0
	U12	6.5		100	6.5									6.5	6.5
	U13	0.5		100	0.5									0.5	0.5
	U14	0.5		25	0.12									0.5	0.12
	U15	0.25		50	0.13					0.25		50	0.12	0.5	0.25
	U16	2.5		25	0.63									2.5	0.63
	U17	1.0												1.0	
	U18	0.0												0.0	
	TOTAL	45.75			38.63	1.00			0.00	0.25			0.12	c 47.00	g 38.75
GRAND TOTAL		81.88			62.13	9.50			2.50	8.62			6.62	d 100.0	h 71.25

FIELD RERORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Boot and Shoe* PLANT NO. *8* EST. BY *Thompson & Lichtner Co.* DATE *4/15/21*

KEY: ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste, Good = 20% ”, Fair = 40% ”, Poor = 60% Waste, Bad = 80% ”; a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES — MANAGEMENT: Assigned Points 1	Est. % Waste 2	3	Points Waste 4	LABOR: Assigned Points 5	Est. % Waste 6	7	Points Waste 8	OUTSIDE CONT ACTS: Assigned Points 9	Est. % Waste 10	11	Points Waste 12	TOTAL WASTE: Assigned Points 13	Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	0.5												0.5	
	K2	1.0		50	0.5									1.0	0.5
	K3	0.5		100	0.5									0.5	0.5
	K4	0.5		75	0.37									0.5	0.37
	K5	0.5		90	0.45									0.5	0.45
	K6	0.5		50	0.25									0.5	0.25
	K7	0.5		25	0.13									0.5	0.13
	K8	8.0								4.0		100	4.0	12.0	4.0
	K9	0.5		50	0.25									0.5	0.25
	K10	3.0												3.0	
	K11	1.0												1.0	
	K12	1.0		100	1.0	1.0		100	1.0	1.0		100	1.0	3.0	3.0
	K13	3.0		100	3.0	2.0		100	2.0	1.0		100	1.0	6.0	6.0
	K14	0.13				0.25				0.12				0.5	
	K15	0.25				0.25								0.5	
	K16	2.0		20	0.4									2.0	0.4
	K17	2.0				2.0								4.0	
	K18	2.0				2.0								4.0	
	K19	1.0		100	1.0									1.0	1.0
	K20	0.5												0.5	
	K21	0.5												0.5	
	TOTAL	28.88			7.85	7.50			3.00	6.12			6.0	a 42.5	e 16.85
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	0.25								0.25				0.5	
	T2	1.0		50	0.5									1.0	0.5
	T3	2.5												2.5	
	T4	0.5												0.5	
	T5	1.5												1.5	
	T6	0.5												0.5	
	T7	2.0								2.0		50	1.0	4.0	1.0
	TOTAL	8.25			0.50	0.00			0.00	2.25			1.00	b 10.50	f 1.50
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	1.0												1.0	
	U2	7.0												7.0	
	U3	2.0		100	2.0									2.0	2.0
	U4	10.0		25	2.5									10.0	2.5
	U5	5.0		25	1.25									5.0	1.25
	U6	0.5		100	0.5									0.5	0.5
	U7	2.0												2.0	
	U8	3.0		100	3.0									3.0	3.0
	U9	1.0		100	1.0	1.0		100	1.0					2.0	2.0
	U10	1.0				1.0								2.0	
	U11	1.0												1.0	
	U12	6.5		25	1.62									6.5	1.62
	U13	0.5												0.5	
	U14	0.5												0.5	
	U15	0.25								0.25				0.5	
	U16	2.5		25	0.63									2.5	0.63
	U17	1.0												1.0	
	U18	0.0												0.0	
	TOTAL	44.75			12.50	2.00			1.00	0.25			0.00	c 47.0	g 13.50
GRAND TOTAL		81.88			20.85	9.50			4.00	8.62			7.00	d 100	h 31.85

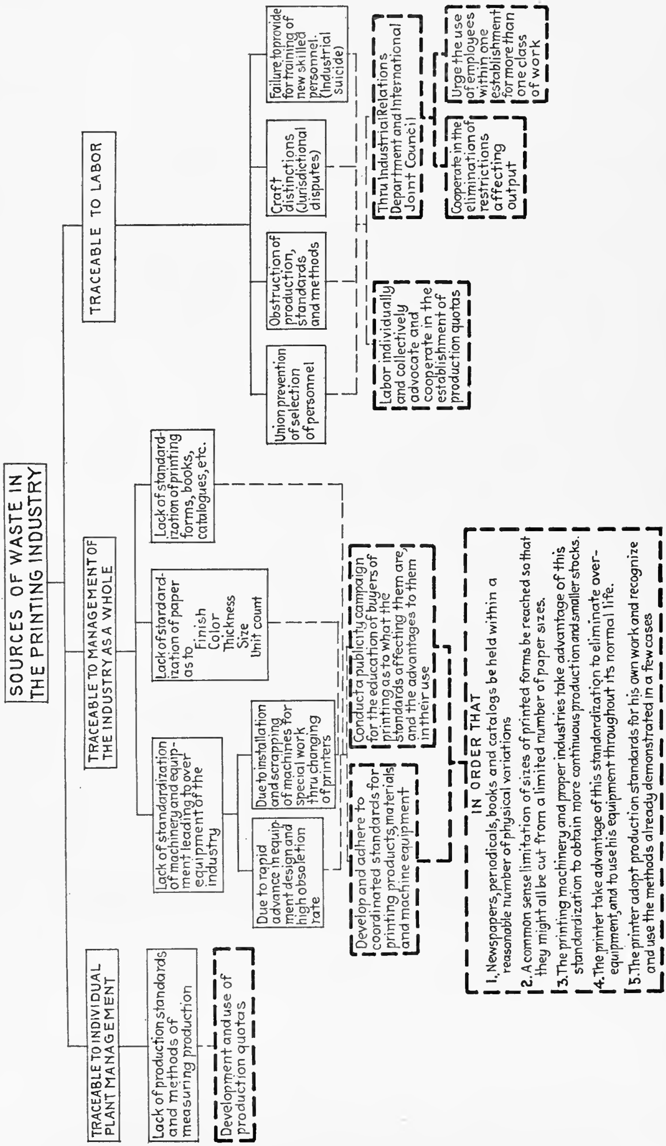
To cover certain specific points 25 other factories have been interviewed by correspondence. These factories were located in the following states: Massachusetts, Maine, New Hampshire, New York, Pennsylvania, Missouri, Ohio, Michigan, Illinois, Wisconsin, Kentucky, and Virginia.

ACKNOWLEDGMENT

Appreciation is extended to the various shoe manufacturers who have so cordially opened their records and tabulated the data requested. Also officials of various labor unions, manufacturers' associations, and many individual workmen have rendered important aid in our assay. The wholesalers' associations and retailers' associations, both local and national, have furnished information of value. The trade papers, The *Boot and Shoe Recorder*, the *Weekly Bulletin of Leather and Shoe News*, *The Cutler Publications*, and *American Shoe Making* all contributed reliable and helpful data.

For the detail work of the investigation, appreciation is expressed to our engineers, Mr. H. E. K. Thompson in conducting the major part of the inquiry and to Mr. Edward H. Hansen for his examination of certain shops. Mr. Richard B. Lewis, Jr., has assisted us greatly in the analyses and preparation of the diagrams. The studies on labor turnover made by Mr. Robert R. Haskell form one of the most valuable studies ever made on this subject in any industry, and have provided material for three charts given in this survey.

Sanford E. Thompson.


SOURCES OF WASTE IN THE PRINTING INDUSTRY
TRACEABLE TO INDIVIDUAL PLANT MANAGEMENT
Lack of production standards and methods of measuring production
Development and use of production quotas
TRACEABLE TO MANAGEMENT OF THE INDUSTRY AS A WHOLE
Lack of standardization of machinery and equipment leading to over equipment of the industry
Due to rapid advance in equipment design and high obsoletion rate
Due to installation and scrapping of machines for special work thru changing of printers
Lack of standardization of paper as to Finish Color Thickness Size Unit count
Lack of standardization of printing forms, books, catalogues, etc.
Develop and adhere to coordinated standards for printing products, materials and machine equipment
Conduct a publicity campaign for the education of buyers of printing as to what the standards affecting them are, and the advantages to them in their use
IN ORDER THAT
1. Newspapers, periodicals, books and catalogs be held within a reasonable number of physical variations
2. A common sense limitation of sizes of printed forms be reached so that they might all be cut from a limited number of paper sizes.
3. The printing machinery and proper industries take advantage of this standardization to obtain more continuous production and smaller stocks.
4. The printer take advantage of this standardization to eliminate over-equipment, and to use his equipment throughout its normal life.
5. The printer adopt production standards for his own work and recognize and use the methods already demonstrated in a few cases
TRACEABLE TO LABOR
Union prevention of selection of personnel
Obstruction of production, standards and methods
Craft distinctions (Jurisdictional disputes)
Failure to provide for training of new skilled personnel. (Industrial suicide)
Labor individually and collectively advocate and cooperate in the establishment of production quotas
Thru Industrial Relations Department and International Joint Council
Cooperate in the elimination of restrictions affecting output
Urge the use of employees within one establishment for more than one class of work

CHAPTER VIII

THE PRINTING INDUSTRY

By John H. Williams

INTRODUCTION

The Industry.—Printing represents a total investment of approximately a billion and a half dollars, and according to the 1919 census has an annual production of over three billions. These figures are based upon the inclusion of such dependent industries as printing machinery, printing ink, type founding, and the two-thirds of the paper industry making paper for printing.

The printing industry in the narrower sense may be divided into newspaper, periodical and book, and job printing concerns, representing about 90% of the whole; and music printing, book binding, lithographing, engraving and plate printing concerns which make up the other 10%. About one-quarter of these printing concerns are located in New York City; Illinois and Pennsylvania together represent another quarter, so that practically half of the printing work of the country centers about its three largest cities.

Unavoidable Waste.—Broadly speaking, all production industry may be divided into three major classes:

1. *Continuous Process*, such as flour, textile and paper milling, where production is largely dependent on a machine, its supply and tending.
2. *Repetitive*, where the same operation with minor variations is done over and over again, as in the shoe and men's clothing industries, and the making of articles like boxes, bolts, nuts and buttons.
3. *Job*, where the work is custom made, so to speak, as in the building trades and printing industry.

These three classes are not hard and fast, but as a rule it is not difficult to determine the preponderating element in any given industry. The printing business apart from the printing of large magazines and newspapers is essentially " job " business, and in this fact lies, to a large extent, the cause of certain elements of waste which may be regarded as impractical of elimination.

The limitless, yet essential variation in product usually makes it desirable and often necessary that the customer shall be in close contact with the printer throughout the entire period of production. The average page of text contains from one to two thousand separate characters, differing on each page. In display work, the number of characters decreases, but the variations in face of type, style and spacing so increase as to complicate, rather than simplify the process. In addition to a limitless variety in sizes, shapes, color, tone of paper and ink, and their possible combinations, there are the varieties in paper stock and finish and styles of binding. Almost every one of these variables is apparent to, and usually prescribed by the customer, and more often than not, is changed during the progress of the work. The advantage to the customer of being in personal contact with the printer has had a marked tendency to keep down the size and increase the number of printing plants. (See Figure 1.) The 1914 census shows that 57% of the industry is individually owned, and produces one-third of the total product.

This in turn has tended toward one of two evils: either intense competition among small concerns not informed as to their own costs, or the cost-plus basis of business. It is hard to say which is the greater evil.

The necessity for prompt conversion of news and information into printed form to make it commercially valuable, and the resultant competition in service and price occasions over-equipment. This is accompanied either by unavoidable waste in maintaining an otherwise unnecessarily large force of labor, or else irregular employment. (See Figure 2.) The United Typothetae of America, the national trade organization, by actual survey throughout the country estimates the over-equipment at from 50 to 150%, representing hundreds of millions of dollars in idle equipment, to say nothing of annual rent, and other overhead charges. A fluctuation of 50% in the number of employees at different seasons of the year is not unusual in the larger plants doing mail order catalogues and railroad work. The fact that the job printer always works to order, and has no opportunity to fill in his dull periods by producing for stock, materially complicates matters, and virtually lifts him out of the class of manufacturers in the ordinary acceptation of the word.

Scope and Limitations.—The investigation has been limited to book, job and periodical printing, eliminating the large metropolitan daily, on account of the influence of their policy and distribution on the problem of waste.

Intensive studies have been made of seven concerns doing a general class of work, and a volume of business of $100,000 per annum, or over. Less intensive studies have been made of a large number of concerns of all kinds and sizes. Information and advice have been received from the leading trades associations and from innumerable individuals. The findings will be limited to the larger plants because the smaller are so dependent upon the capacity of the individual owner that they are not adapted to assay and comparison. While an effort has been made to cover the field geographically, the principal investigations have been

PREPONDERANCE OF SMALL PLANTS IN PRINTING INDUSTRY AS COMPARED WITH STEEL INDUSTRY EMPLOYING EVEN A LESS NUMBER OF PERSONS

Printing and Publishing (Including Newspapers and Periodicals)

Size, Number of Employees	Establishments		Employees	
	Number	Per Cent	Number	Per Cent
No wage earners...........	8,524	25.46		
1–5	17,456	52.15	40,665	14.94
6–20	5,081	15.18	53,694	19.73
21–50	1,500	4.49	47,285	17.37
51–100	499	1.50	35,067	12.89
101–250	311	0.93	47,650	17.52
251–500	71	0.21	23,909	8.79
501–1,000	25	0.07	16,939	6.23
Over 1,000	4	0.01	6,883	2.53
Total.................	33,471	100.	272,092	100.

U. S. Census of Manufactures, 1914, vol. 2, page 636, Table 22.

Steel and Rolling Mills

Size, Number of Employees	Establishments		Employees	
	Number	Per Cent	Number	Per Cent
1–5	3	0.70	8	0.03
6–20	16	3.74	196	0.08
21–50	30	7.02	1,119	0.45
51–100	46	10.78	3,629	1.45
101–250	92	21.54	15,414	6.19
251–500	94	22.02	33,921	13.63
501–1,000	87	20.38	61,185	24.60
Over 1,000	59	13.82	133,244	53.57
Total.................	427	100.	248,716	100.

U. S. Census of Manufactures, 1914, vol. 2, page 224, Table 43.

FIG. 1

in New York and Chicago, which together do almost half of the total printing of the United States.

There has been no effort to make the report all inclusive of the industry, or of the possible elimination of waste, but rather to determine and deal with the evils that lie at the root of waste. Waste through strikes, lock-outs and lay-offs is not dealt with as such, because available records are inadequate. Moreover, the industry is at the moment in the throes of adjustment after war conditions, and until this situation is cleared up, no opinion on the subject would be valid.

Conscious Technique of Management.—As bearing upon the causes of waste, the Committee as a whole compiled a questionnaire for the purpose

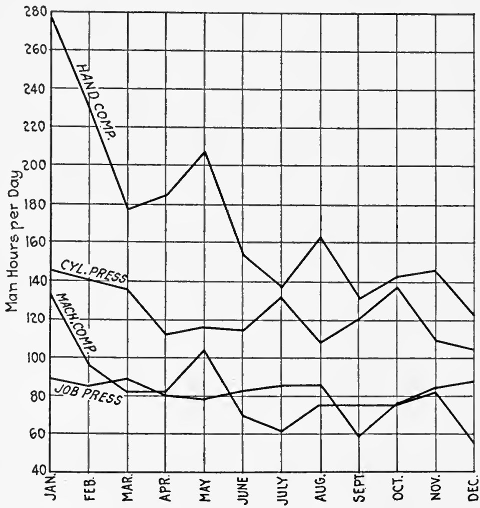


FIG. 2.—Fluctuation in Employment in Different Departments of the Same Establishment.

of developing the degree of conscious technique on the part of the management. The findings on the basis of this questionnaire are given, as indicating a more or less academic assay from an engineering viewpoint of potentiality for waste within the six plants in which intensive studies were made. They should not be confused with the actual waste and causes of waste as given for the investigation as a whole from a practical operating standpoint.

The causes and responsibilities for waste in an ideal or 100% efficient plant are shown, as compared with those found by means of the questionnaire in the six plants in which intensive investigations were made.

The responsibilities are given under the same three headings as will be used for the findings from a practical operating standpoint, for the industry as a whole. They are as follows:

I. Management of Individual Plants.
II. Management of Industry as a Whole.
III. Labor.

As compared with an ideal plant, the six plants investigated were guilty of an average waste of 57.8 points. Of this total, the management of the individual plant was responsible for 18.1 points or over $\frac{3}{10}$ of all, the management of industry as a whole for 23.4 points or over $\frac{4}{10}$ of all, and labor for 16.3 points, or nearly $\frac{3}{10}$ of all. As to the causes of waste, the burden is about equally divided between the three: organization with 19.3 points, technique with 19.8 points, and utilization with 18.7 points.

The responsibility for waste on the part of the industry as a whole was conspicuously less in such highly specialized plants as book printing than in general jobbing plants.

Labor's responsibility for waste is notably less in non-union plants because of lack of restrictions enforced by the unions, and the resulting flexibility in maintaining a balance between labor and production.

I. MANAGEMENT OF INDIVIDUAL PLANTS

With a very few conspicuous exceptions, the management within the individual plants is still typically individualistic. This is primarily because the individual units are as a whole so small that they do not require, or indeed justify much organization. Organization is not to curtail individuality, but to supplement it, and make possible co-operation of a number of individuals within a given plant. In a plant so small that one mind is able to compass and to direct all phases of its activity, organization beyond ordinary records would only complicate matters by injecting devices for achieving the co-ordination which should unconsciously take place. However, about 50% of the industry, in terms of production, although only 5%, in terms of establishments, operates in sufficiently large units to justify a great deal more organization than now exists.

Production Standards.—The crux of waste within the individual printing establishment is the lack of accurate production standards constituting a fair basis of appraisal for the individual worker. Only through such standards can the printing industry avoid the wastes due to its jobbing nature, and secure the advantages of repetitive operation.

Only two of the plants investigated had analyzed their work into elementary operations for which they could predict in advance the time required for each operation. These are apparently the only two plants

THEORETICAL RESPONSIBILITY FOR WASTE

Record of Six Plants as Compared with an Ideal Plant

Causes	Management										Labor					Total				
	Individual Plants					Industry as a Whole														
	Assigned Points	Average 6 Plants	Best Plant	Worst Plant	Range	Assigned Points	Average 6 Plants	Best Plant	Worst Plant	Range	Assigned Points	Average 6 Plants	Best Plant	Worst Plant	Range	Assigned Points	Average 6 Plants	Best Plant	Worst Plant	Range
Organization	10.0	4.5	1.4	5.4	4.0	9.0	5.8	4.7	6.8	2.1	16.0	9.0	0.5	11.1	10.6	35.0	19.3	7.7	23.3	15.6
Technique...	12.0	4.6	2.1	6.2	4.1	20.0	13.9	12.2	14.8	2.6	3.0	1.3	0.0	1.8	1.8	35.0	19.8	14.3	22.6	8.3
Utilization...	15.6	9.0	4.5	11.5	7.0	5.0	3.7	2.3	4.0	1.7	9.4	6.0	0.0	7.4	7.4	30.0	18.7	8.5	21.5	13.0
Total...	37.6	18.1	8.0	22.4	14.4	34.0	23.4	19.2	25.6	6.4	28.4	16.3	0.5	20.0	19.5	100.0	57.8	30.5	67.3	36.8

where this work has even been started. They are in somewhat different fields, almost a thousand miles apart, and both have carried the work to a point comparing favorably with similar work in other industries. They have been conspicuously successful. One specializes in book work, the other in catalogue and job work, and between them, they cover virtually every phase of the industry.

Method of Determining Quota Time for Display Advertisement of Inter-State Car Company

In reading the following instructions one must assume the use of various tables for different factors and conditions.

Preparation. Covering time of compositor getting copy and preparing for work at prescribed rates, according to schedule covering various operations and conditions.

Display. Covering setting and justification excepting special items otherwise provided for. In this case figured to be twenty lines. The rate per line varies according to conditions.

Straight Matter. Based on the number of words in body type not requiring display spacing. In this case figured at 55 words.

Diagonals. Based upon an estimate of the number of spacing units necessary to maintain diagonals. In this case figured to be six for each corner.

Rules. A flat unit for each rule used as an enclosure. Rules otherwise used would, of course, be at different rates according to circumstances of use.

Borders. A flat rate for enclosing type.

Sections. A flat rate for sections in which special spacing is necessary.

To illustrate what I mean by production standards and their use, I have secured an example from one of those plants of the method of determining a production quota for display composition. (Figure 3.) Contrary to the general opinion throughout the trade, this illustration, taken from a plant which has used production standards in every department over a long period of time, conclusively proves that printing is susceptible to this form of standardization.

Piece-work rates are contained in compositor's rules, but are seldom used. Bindery piece-rates are partly in use. None of these is sound. They are advantageous only in avoiding responsibility for continuous employment of labor. They are based upon casual observation and experience, modified by bargaining and carry no obligation on the part of the employer beyond payment for work performed in accordance with the rate set. Scientifically determined quotas are based upon careful time and motion study under prescribed conditions, and in practice, are used either as a basis of paying a bonus in addition to a regular salary, which is paid regardless of production, or as a medium for readjustment of weekly work rates.

Without the ability to determine what a worker can or should do, the employer is largely in the hands of his employees, for he is unable

A636-3-21-100M

OPERATION	No.	UNIT	TIME	
Preparation				200
Display	20	1600	3	200
St. Matter	55	0216	1	188
Galleys				
Corrections				
Runover				
Respaced Lines				
Tabular				
Diagonal	24	0680	1	632
Lifts				
Box Heads				
Rules	4	1000		400
Borders	1	2000		200
Cuts				
Mortises				
Sections	1	2000		200
Spacing and Folio	—			
Tie and Untie				
Prove and Stack				
Est. .... Total			7	020

WORK ORDER TICKET—ORIGINAL

Job Name .... Job No. ....

Employe .... Clock No. ....

Description				G. T. No.
Page	Galley	Form	Ads	Alt. No.

Date	Non Bonus	Bonus	Standard	Operation
Off				
On				
Off				
On				Pro rate with
Off				
On				

Actual Time .... Wage .... Unit .... Total Unit ....

Total Time .... Total Wage .... Bonus ....

225-135-23 N Y C Neely

Copy of actual Work Order Ticket under which the accompanying display advertisement was set by hand from hand written copy. Name of customer and other data is omitted, and "Unit" and "Time" figures changed at request of concern furnishing this example. The relation of "Unit" and "Time" figures is, however the same as in the original.

ISCAR ISCAR

E. H. DARRACH, Pres.
GEO. J. DIVER, Mgr.

Inter-State Car Company

OF INDIANAPOLIS, INDIANA

Solicits inquiries of Railroads and private car owners

Cars:	Freight type, steel or wood construction.
Rebuilt:	Second-hand or reconstructed cars.
Repairing:	Freight cars repaired on contract.
Castings:	Grey iron, especially locomotive, car and machinery.
ISCAR Iron: (For Strength and Wear)	Especially adapted for piston rings, shoes, wedges, bull rings, cylinder heads, steam pipes, etc.
Forgings:	Iron and steel machine forgings for cars.
Pressed Steel:	Manifold work on specification.
Underframes:	Steel, for cars, on specifications.

ISCAR ISCAR

Fig. 3.

fairly to reward his workers according to their effectiveness. Moreover, a worker unable to assure either himself or his employer of the value of his work will vitally lack incentive.

Labor unions and the socially minded public have been critical of all efforts to establish production standards. They hark back to the old piece-work system, and point out that it can result only in driving the workers unduly. An understanding of the essential difference between the old piece-work system and the proper method of determining quotas disposes of this objection.

Labor's Approval.—It is interesting in this connection to note the changing attitude of the more radical labor unions on the question of production standards. Some unions now recommend the scientific determination of standards for production. The Amalgamated Clothing Workers of America at their biennial convention in Boston, May, 1920, passed a resolution endorsing production standards. They met the issue squarely with the statement, "we oppose overspeeding as well as restraint of output; we advocate normal production," and concluded that "the remedy for the situation is a week-work system, based upon reasonable standards of production; the former will conserve the health of the workers, which is our first consideration; and the latter will regulate output."

Employers' Objections.—Many printers insist that there is some peculiar condition of their particular business which does not permit the use of production standards, and that the cost of establishing them is prohibitive for all but a few of the larger plants.

That they are mistaken so far as the larger plants are concerned, is amply demonstrated by the success of the two concerns referred to. As for the prohibitive cost to smaller concerns, this objection is substantial, though on the other hand, the work would undoubtedly be developed jointly or through the United Typothetae, much as the standard cost methods have been worked out. One of the Typothetae executives, in explaining the work of his organization, volunteered the remark that very little had been done from an engineering standpoint, and that the work had so far been confined to educating the body of printers in keeping cost records, their use in making prices, and an elementary understanding of the industry. The work of the two plants in question, put together and unified, would in itself constitute a technique sufficient for the entire printing industry.

The example given refers only to composition, but similar standards have been set for press work and binding, and in fact, all the major operations in the printing industry. The example for composition was selected because it is with special reference to display composition that printers have most persistently maintained that it is impossible to set standards.

II. MANAGEMENT OF INDUSTRY AS A WHOLE

United Typothetae of America.—Before taking up what should be done, credit is first due for the most excellent work already accomplished by the United Typothetae of America and its local branches. Its educational work has been extensive, well conceived and directed. It covers not only basic information concerning the industry, but extensive work in cost finding and labor relations.

A survey made by the United Typothetae of New York City showed:

56 plants using standard cost system.
187 plants with no cost system, but with a knowledge of all general costs.
741 plants with no cost system and incomplete knowledge of all general costs.
554 plants with no cost system and incomplete knowledge of general costs.

The first two groups made money, the last two lost money in 1919.

The work of the Industrial Relations Department of the United Typothetae, and that of the International Joint Conference Council, organized early in 1919, is notable especially in its potentiality for the gradual elimination of strikes, lockouts, and union regulations and traditions adversely affecting and hindering production.

In connection with the work of the United Typothetae, I recommend that a section be added for the development and utilization of standards, as already outlined for the individual printer, so that the smaller printers who cannot afford to do this work individually, may none the less participate in its advantages.

Standardization of Equipment.—Probably in no other industry has the development of the machine process been carried further than in printing. Every substantial establishment can tell the story of an almost uninterrupted series of replacements, due to the constant improvement in mechanical devices. If we contrast the iron hand press of the *London Times* in use until 1814, which had a maximum capacity of not over 200 impressions an hour, with the capacity of a modern press, which is able to print and fold 24,000 copies of a 16-page metropolitan newspaper in the same time; if we contrast the modern Linotype and Monotype machines with the tedious processes of hand composition, or examine the modern magazine presses which print, fold and bind in one continuous operation, and consider that all this change has taken place within a period of some eighty years, we realize the extent of replacement which must have occurred, and the reason for the lack of standardization that exists. With the increasing complexity of equipment, this lack of standardization becomes daily more costly.

As illustrative of what may be accomplished in standardization of equipment, one has but to point to the already accomplished standardization of type bodies. Prior to the year 1885 each type foundry cast its type on a more or less different body, and although the exchange from the old system to the point system involved an expenditure of some $3,000,000 by the type founders, it is universally conceded that this expenditure has been saved many times over.

Impressive results have also been achieved in the standardization of colors for printing, ink and combinations of colors and shades of paper and ink. The "Grammar of Colors" recently issued by the Strathmore Paper Company represents a notable contribution in this connection. The Standardization Committee of the American Institute of Graphic Arts is working on the standardization of process colors, and it is hoped that these standards will be in operation in most of the larger engraving and printing plants within a year or so. Determination of color combinations by trial and error, and elaborate color proofs are wastes which can be eliminated through standardization.

Proportionately greater results may be anticipated from a co-ordinated standardization of machinery, paper and products.

Among all the manufacturers of flat bed cylinder presses, there is an almost unlimited number of variations in size, yet all agree that a limited number of standard sizes would be advantageous. The President of one of the large companies manufacturing printing presses says: "For forty years or more, I personally have been of the opinion, and have stated it everywhere, whenever occasion arose, that if we could consolidate on three sizes of presses, the printer and we ourselves would be much better off—these sizes being, a press to print a sheet 25×25 or smaller, another to print a sheet 38×50 or smaller, and another to print a larger sheet as may finally be determined."

The President of the Dexter Folding Company states:

> "We understand that the United Typothetae of America recently made a survey of the different types and sizes of folding machines, and found that there were about 600. Prior to three years ago, we were building more or less, frequently more than sixty types and sizes of folding machines. Through exhaustive research, with the help of the paper manufacturer, printer, and binder, we have succeeded in meeting the practical needs of the purchaser of printing with approximately six types of folding machines, made in a minimum number of sizes. This plan not only simplifies and economizes our factory production, but even more so it economizes the production of printing and binding.
>
> "Because of the threatened intense competition, it is necessary for the manufacturers of machinery, the printer, the binder and the purchaser of printing to follow Mr. Hoover's suggestion, and obtain the largest measure of standardization, so as to eliminate waste in material and human effort."

Standardization of machine sizes would make possible the use of one machine for a greater variety of different jobs. In every printing establishment of any size, one sees expensive machines covered up and out of use, or inefficiently used for purposes other than that for which they were built. A printer secures a contract, and buys a machine to do the work economically. When the work comes up for contract next time, if some other printer secures it, it invariably means another special machine. One concern paid $17,000 for a special press for printing a trading stamp. On losing this job, the press was scrapped and later sold for $2,000. Since then the contract has been awarded to three other printers in succession, and each in turn purchased a new press which he had to scrap or use disadvantageously at the expiration of his contract.

In recommending the standardization of machine equipment, I recognize that the machine manufacturers have no association to take the initiative in this work, and I recommend that such an association be formed. As one machine plant may make equipment for a variety of trades, it would be necessary for such an association to have separate branches for the different leading trades.

Standardization of Paper.—There are as many variations in the possible combinations of content, finish, color, thickness and size of paper as there are combinations of the three prime colors, red, yellow and blue. This is a natural outgrowth of the evolution of an industry, but the time has come when it should be faced and corrected. There are two main factors: what the standards should be, and how to make them effective.

Content.—The most practical immediate step seems to be the limiting of brands and water-marks by the mills themselves. This will result in economy of production, and will furnish the same protection to the consumer that exists in all trade-marked goods. I recommend to buyers of printing that they insist upon one of a limited number of well-established brands or water-marks. This will stimulate legitimate competition in both price and quality, while protecting the buyer from his own ignorance, since a mill cannot afford to vary substantially the content of its established brands.

As illustrating what can be done, the American Writing Paper Company recently announced the following standardization of their different grades of paper:

	1917	1921
Bonds	35 grades	9 grades
Ledger	32	5
Writing	63	3
Linen	36	4
Cover	22	5
Drawing	5	3
Mimeograph	5	3
Wedding and Papeterie	19	9
	237	41

Multiplying this difference by the unavoidable variations in color, thickness and size, the total variables eliminated reach staggering proportions. It is estimated that this change will reduce the stock necessary to be carried by the mill and its representatives to about one-half of its former proportions.

There are approximately 6,000 brands of paper 50% of which are more or less active. Every considerable paper merchant, a few printers, and even some large consumers have their own brands or water-marks. One mill company admits having over 4,000 dandy rolls. There is also an enormous amount of paper made to sample, without any real ability on the part of the buyer to judge of the value or fitness of the paper until it is too late. Several government departments have each their own specifications, without relation to each other, or to any standard brand.

There is not as yet sufficient standardization of the main components from which paper is made to permit of exact standards. Wood and rag fibre, the principal components of paper, vary so much that a merely quantitative standardization would not be effective. The same thing is true to a lesser degree of clay, alum, and other chemicals definitely affecting the printing and wearing quality of paper. Some broad classification of grades should, however, be determined upon for each kind of paper, as A, B, C, for each of the principal kinds—Bond, Ledger, Writing, Super, Machine Finish, etc.—and mills should grade their brands within such classifications.

There should also be a standard testing device and standard tests for each grade. The device should be developed and the standards set by joint action of the interested parties. I believe that standards for tearing, folding and bursting, with per cent of wood and rag fibre would be sufficient. This would in itself weed out the enormous duplication of brands, even within the line of one mill or jobber. This duplication serves no useful purpose. It ties up vast sums of money in unnecessary stock, and is at the root, intentionally or otherwise, of much misunderstanding as to values in paper.

The various departments of the government might well take the first step by standardizing the paper they use on the basis of a selected list of well-known brands, as has been done by the German Government for ten years or more. The standardizing and grading of gold, cotton, wool, lumber, rubber, oil, etc., has proved to be of such great practical advantage, that there can hardly be any doubt as to the desirability of similar grading of paper.

Finish.—If one is able to judge of the value of paper, there is no objection to the mill or dealer asking an additional price for any given finish that the buyer may desire. The point is that the buyer should know comparatively how much he is paying for a particular finish, and not be misled by appearances.

Color.—It is doubtful how far standardization of color is practicable in paper.

Thickness.—There is no advantage in minor gradations of thickness, except for paper made for other purposes than printing, which will necessarily have to meet special requirements. The ordinary consumer of paper cannot distinguish between differences of less than 10 pounds to 500 sheets of 25×38.

For mechanical reasons, it is seemingly impracticable to grade paper by caliper thickness, though this would be the desirable thing to do. There are, however, 14 different bases of weight for different papers, as, Book, Writing, Wrapping, etc.. I recommend that 1,000 sheets, 25×38, graded in steps of not less than 20 pounds be adopted as the standard for all paper.

Size.—Standardization in this connection has already received a great deal of consideration, and much progress has been made, so far as the standards themselves are concerned. There is not the same opportunity here for misunderstanding between buyer and seller, but there is an even greater opportunity for waste through lack of information about advantageous sizes.

As a glaring example of the utter disregard of standard sizes, the Federal Reserve bank check will not cut without waste from any of the now numerous regular paper sizes. A draft questionnaire issued during the war was of such non-standard size as to require special filing cabinets. The Technical Publishers' Association on measuring 927 catalogues found 147 different sizes.

In a plant printing 2,000,000 each of three different mail order catalogues, the same paper was required in 66, 70 and 73 inch widths, the economical width for that particular paper being 72 inches. A customer ordering a catalogue of a certain size may make necessary a very considerable wastage by specifying some fraction of an inch which is really negligible to him. Or he may and very often does make it necessary for the paper to be made to order, thus involving waste in the entire process of manufacture. Wastage of only one-quarter inch on a 6×9 page is equal to 7% of the total cost of the paper.

The establishment of standard sizes of paper should extend to a corresponding standardization of printed pages and columns, through which a further economy, apart from that in paper, would be achieved. John Sullivan, Secretary of the Association of National Advertisers, states that standardization of newspapers to one size would make possible an annual saving of three to five millions on composition and plates alone.

Stalker's Universal Rate Service (see the following table) shows that among the current magazines there are 18 variations in width, and 76 variations in length of page or column. Among trade paper publications, there are 33 variations in width, and 64 in length. Even among newspapers, there are 16 in width and 55 in length. Taking into consideration the variations of width within each length and vice versa, there is an appalling total of variations which accomplishes absolutely nothing and, directly and indirectly, costs the public certainly not less than a hundred million dollars each year.

Standards for cover paper sizes have not only been established, but are accepted and used more than any other paper standards. The principal variants in cover paper consist, however, of things other than size, so that the resultant saving has been limited.

Unit of Count.—While much progress has been made in this direction, there is room for improvement. The old ream and quire are still used. All printing is ordered in thousands, and there is no conceivable reason why the basis of material should not be on the same unit.

Advantages of Standardization.—Standardization of paper and equipment, with a corresponding standardization of printed pages and columns would:

1. Permit many machines now made very largely by hand to be produced in quantity to jigs and tools, would make possible interchangeability of parts.

2. Reduce the amount of machinery necessary to each printer to meet trade requirements.

3. Eliminate the waste of discarding or sacrificing machines, when a contract for printing changes hands.

3. Facilitate planning. Work could be laid out and planned for a group of machines, instead of for a given machine.

5. Make possible interchangeability of advertising and catalogue plates.

6. Facilitate the filing of data for reference purposes, especially catalogues for purchasing agents. A beginning has already been made in the standardization of catalogues within industries. The electrical jobbers have accepted $7\frac{1}{2} \times 10\frac{5}{8}$ inch as a standard size, and 90 per cent of their catalogues now correspond to this standard. The National Association of Purchasing Agents have adopted a $7\frac{1}{2} \times 10\frac{5}{8}$ inch basis for forms, or a 32×44 standard sheet.

7. Make possible more continuous operation in the process of manufacturing paper. It would not be necessary to stop so often for changes in grade, size and thickness. In one mill 243 size changes were made in one month on one machine, running on 7 grades of bond paper, without consideration of weight.

8. Reduce paper stocks now carried on hand to meet trade requirements. In considering this economy, mills and the entire paper jobbing industry, as well as the printer, may be considered as one. There are no reliable figures as to the paper carried on hand, but it is safe to say that it is considerably more than a hundred million dollars' worth. This investment could be halved and the turnover doubled through standardization.

Obstacles to Standardization of Paper.—In considering the responsibility of the individual manager for waste, certain supposed objections of labor and of the managers themselves were stated. Likewise in the

Variations in Page and Column Widths and Lengths as shown by Stalker's Universal Rate Service

Magazines

WIDTH INCHES

2 $\frac{1}{16}-\frac{1}{12}-\frac{1}{8}-\frac{1}{6}-\frac{3}{16}-\frac{1}{4}-\frac{1}{3}-\frac{3}{8}-\frac{5}{16}-\frac{1}{2}-\frac{5}{8}-\frac{2}{3}-\frac{3}{4}$
3 $\frac{5}{8}$
4 $\frac{1}{2}-\frac{5}{8}$

LENGTH

7 $\frac{1}{2}-\frac{3}{4}$
8 $\frac{1}{4}-\frac{1}{2}-\frac{3}{4}$
9 $\frac{1}{2}-\frac{3}{4}$
10 $\frac{1}{8}-\frac{1}{6}-\frac{3}{16}-\frac{1}{4}-\frac{1}{2}-\frac{5}{8}-\frac{2}{3}-\frac{3}{4}-\frac{13}{16}$
11 $\frac{1}{8}-\frac{3}{14}-\frac{1}{4}-\frac{3}{8}-\frac{3}{7}-\frac{1}{2}-\frac{3}{4}-\frac{13}{14}$
12 $\frac{1}{8}-\frac{1}{7}-\frac{1}{4}-\frac{1}{2}-\frac{5}{8}-\frac{3}{4}-\frac{7}{8}$
13 $\frac{1}{8}-\frac{1}{7}-\frac{3}{16}-\frac{1}{4}-\frac{3}{8}-\frac{1}{2}-\frac{9}{16}-\frac{5}{7}-\frac{3}{4}-\frac{11}{14}$
14 $\frac{1}{6}-\frac{3}{16}-\frac{1}{4}-\frac{5}{16}-\frac{3}{8}-\frac{1}{3}-\frac{1}{2}-\frac{5}{8}-\frac{3}{4}$

LENGTH

15 $\frac{1}{4}-\frac{1}{2}-\frac{3}{4}$
16 $\frac{3}{16}$
17
18 $\frac{1}{4}-\frac{1}{2}-\frac{3}{4}$
19
20 $\frac{1}{2}-\frac{3}{4}$
21 $\frac{1}{8}-\frac{1}{4}-\frac{1}{2}-\frac{5}{7}$
22

Newspapers

WIDTH

1 $\frac{1}{6}-\frac{7}{8}$
2 $\frac{1}{16}-\frac{1}{12}-\frac{1}{8}-\frac{1}{6}-\frac{1}{4}-\frac{1}{3}-\frac{1}{2}-\frac{5}{8}-\frac{3}{4}-\frac{7}{8}$
3 $\frac{7}{8}$
6 $\frac{1}{6}$
22 $\frac{1}{6}$

LENGTH

13 $\frac{1}{2}-\frac{3}{4}$
15 $\frac{1}{4}-\frac{1}{2}$
16 $\frac{1}{4}-\frac{1}{2}-\frac{3}{4}$
17 $\frac{1}{4}-\frac{1}{2}-\frac{3}{4}$
18 $\frac{1}{2}$
19 $\frac{1}{2}-\frac{5}{8}-\frac{3}{4}-\frac{7}{8}$
20 $\frac{1}{8}-\frac{1}{6}-\frac{1}{4}-\frac{1}{3}-\frac{1}{2}-\frac{5}{8}-\frac{2}{3}-\frac{3}{4}-\frac{7}{8}$
21 $\frac{1}{14}-\frac{1}{8}-\frac{1}{6}-\frac{1}{4}-\frac{1}{3}-\frac{2}{7}-\frac{3}{7}-\frac{3}{8}-\frac{1}{2}-\frac{5}{8}-\frac{9}{14}-\frac{5}{7}-\frac{3}{4}-\frac{7}{8}-\frac{6}{7}$
22 $\frac{1}{4}-\frac{1}{3}-\frac{3}{7}-\frac{1}{2}-\frac{3}{4}$
23 $\frac{1}{2}-\frac{4}{7}-\frac{3}{4}$
24 $\frac{1}{3}$

Trade Papers

WIDTH

1 $\frac{1}{8}-\frac{3}{4}-\frac{7}{8}$
2 $\frac{1}{16}-\frac{1}{8}-\frac{1}{6}-\frac{1}{4}-\frac{1}{3}-\frac{3}{8}-\frac{1}{2}-\frac{2}{3}-\frac{5}{8}-\frac{3}{4}-\frac{7}{8}$
3 $\frac{1}{8}-\frac{1}{6}-\frac{1}{4}-\frac{1}{3}-\frac{3}{8}-\frac{1}{2}-\frac{2}{3}-\frac{5}{8}-\frac{3}{4}-\frac{7}{8}$
4 $\frac{1}{8}-\frac{1}{4}-\frac{1}{2}-\frac{3}{4}$
6 $\frac{1}{4}$
12 $\frac{1}{6}$

LENGTH

5 $\frac{1}{4}-\frac{1}{2}$
6 $\frac{1}{8}-\frac{3}{8}-\frac{1}{2}$
7 $\frac{1}{4}-\frac{1}{2}-\frac{5}{8}$
8 $\frac{1}{8}-\frac{1}{4}-\frac{1}{2}-\frac{3}{4}$
9 $\frac{1}{16}-\frac{1}{8}-\frac{1}{6}-\frac{1}{4}-\frac{1}{2}-\frac{5}{8}-\frac{2}{3}-\frac{3}{4}$
10 $\frac{1}{8}-\frac{1}{6}-\frac{1}{4}-\frac{1}{3}-\frac{3}{8}-\frac{1}{2}-\frac{5}{8}-\frac{2}{3}-\frac{3}{4}-\frac{7}{8}$
11 $\frac{1}{8}-\frac{1}{6}-\frac{1}{4}-\frac{1}{2}-\frac{3}{4}-\frac{7}{8}$
12 $\frac{1}{8}-\frac{1}{2}-\frac{3}{4}$
13 $\frac{1}{2}$ $\frac{3}{4}$

LENGTH

14 $\frac{1}{2}$
15 $\frac{1}{2}$
16 $\frac{1}{2}-\frac{3}{4}$
17 $\frac{1}{4}$
18
19 $\frac{3}{4}$
20
21 $\frac{1}{4}$

matter of standardization of paper, obstacles conscious and otherwise will be met. So far as these obstacles are unconscious, they are largely a result of custom which has crystallized into habit and prejudice. Such obstacles can usually be removed by education appealing to self-interest. There is, however, another more subtle type. It arises from the fact that in isolated instances lack of standardization gives rise to the following money advantages:

1. *To Printer.* (*a*) Profit secured through abnormal cuttings, resulting from using non-standardized materials.
   (*b*) Ability to break specifications in competitive bidding.
   (*c*) Inability of purchaser to make comparison of prices on non-standardized products.
   (*d*) Encouragement to salesmen to recommend unusual features in avoiding competition.
2. *To Paper Manufacturer.* Opportunity to avoid cumulative responsibility for unstandardized materials.
3. *To Paper Jobber.*—Often the manufacturer does not have sufficient capital to maintain the large local sales organizations needed to sell a non-standardized product. The provision of such an organization by the jobber gives him control over the manufacturer.
4. *To Labor.*—The additional work required furnishes greater employment.
5. *To Machinery Manufacturers.*—Additional business through necessity for greater quantity of machinery required through lack of interchangeability and special requirements for special features.

Constructive Action for Standardization.—Seven national trade organizations, representing 95% of the consumers of paper, and over 11,000 of the leading firms in their lines, including printers, stationers, lithographers, engravers, advertisers and purchasing agents, have passed resolutions calling attention to the waste in the industry, and urging co-operation in eliminating unnecessary grades, weights and sizes, and reducing the number of colors, finishes, water-marks, etc.

The resolution passed by the United Typothetae, which was specifically indorsed by several other associations, characterizes the paper situation as "a serious menace to the printing industry," and calls attention to the fact that printing equipment is increasing more rapidly than paper manufacturing equipment, both in quantity and in production percentage, causing such increase of prices both in paper and printing as to threaten serious curtailment of the volume of printing. In conclusion, the resolution calls on every one concerned to appoint committees to co-operate with the Typothetae's committees to work on standardization.

Answers to a questionnaire sent out by the Typothetae indicate that the printers believe they already do or can control the buying of paper for commercial and job printing. If this is true, they themselves have the power to make the resolution effective for this class of paper.

A meeting held in Chicago, on May 22, 1918, under the auspices of the National Association of Purchasing Agents, is probably the most representative meeting to consider this subject ever held, but its deliberations were limited to the standardization of catalogue and paper sizes.

A resolution passed by the Catalogue Conference was as follows:

> *Resolved,* That catalogues be standardized to $6\times9''$ or $7\frac{1}{2}\times10\frac{5}{8}''$, or $8\times11''$.
>
> *Resolved,* That we recommend for catalogues the manufacture of paper sheets ranging as follows: $25\times38''$, $32\times44''$, $33\times46''$, with their double sizes. That we also indorse the weights of 40, 45, 50, 60, 70 and 80 pounds on the basis of $25\times38''$, and that colors be limited to white and natural.

A recommendation of the Standardization Committee of the National Association of Purchasing Agents reads: "In order that the investment in catalogues bought by purchasing agents may reach the highest degree of productiveness, we urge that all catalogues meant for the use of purchasing agents be made $7\frac{1}{2}\times10\frac{5}{8}''$, or in half sizes, saddle stitched so that they will open flat to that size, for filing in such manner as will insure their coming to hand when wanted.

"This recommendation was unanimously indorsed by the National Association of Purchasing Agents in convention. This Association has appointed a Committee on Promotion of Standards to encourage the use of this and other standards throughout the business world."

How to Make Standards Effective.—Individuals, or even groups and trade associations, unless all inclusive, have neither the knowledge to make the most desirable standards, nor the ability to make them effective. Collective action by all the trade organizations affecting, or affected by the printing industry is needed, in order that the standards of equipment, materials and product may be co-ordinated, and in order that financial and moral support necessary to put over a publicity campaign may be secured, the object of the campaign being to give the buyer of printing a knowledge of the standards agreed upon, and a knowledge of the selfish advantage to be gained through conforming to them.

Apparently the interest of all concerned, excepting the consumer, has already been aroused, and the research done. Unified action and education of the public are needed next. While I do not recommend government determination in matters of this kind, I very definitely believe that it is part of the work of the Department of Commerce to lend its support and assistance in bringing about meetings to this end.

III. LABOR

Organization.—The printing industry is over 50% unionized. There were by the 1914 census of printing and publishing (including newspapers and periodicals) 272,092 workers in the industry, and the Allied Printing Trades Council claims 150,000 members. In New York City approximately 60,000 persons are employed, the Union membership being about 40,000. The 1914 census shows that 52% of all workers are in plants employing 50 persons and less; that 25% of establishments are one-man shops and further that 75% of all establishments employ five people or less. These small plants are the most difficult for the unions to organize. Sixty-eight per cent of the workers are native born. This is high as compared with the percentage in the metal trades, which is 30%, and with that in the building trades, which is 25%.

An average book and job plant must deal with the following individual unions:

Compositors (typographical)	Mailers
Cylinder Pressmen	Stampers and Gold Layers
Cylinder Feeders	Paper Cutters
Job Pressmen	Blank Book Workers
Job Press Feeders	Bookbinders
Sheet Straighteners	Bindery Women
Paper Handlers	

The selection of personnel is a responsibility of both management and labor, though it rests almost wholly with labor in union plants. No status of competence is required. Union membership makes a man eligible. Each department foreman employs the workers in his department. Workers are supplied from the local union headquarters. Precedence is given to the first name on the list, without reference to specialization, convenience of home to plant, or other factors having a bearing on labor turnover.

Production Standards.—As recommended to the employing printer that he develop standards for measuring production of his employees, I recommend to labor, both individually and collectively, that it change its present attitude of opposition or indifference to a frank and aggressive insistence upon proper standards for production. This would enable each employee to secure direct evidence of the service which he renders, and properly to evaluate himself as to wages.

Production standards, or what we call quotas, have been characterized by labor and other critics as making the work monotonous, killing initiative, unduly speeding up the work, and tending to displace inefficient people who have to make a living somehow.

Monotony.—As to the monotony entailed, the facts show quite the contrary. The basic principle of all diversion is doing something against an opponent, or against a standard, and it also applies to work. Measuring oneself against a standard for a reward of merit is more stimulating than a monotonous routine without this stimulus.

Killing Initiative.—As regards killing initiative, it is hard to see that there is any advantage in doing a thing in a traditional manner. The methods used, excepting where scientifically determined, are almost invariably traditional, and have grown up without any conscious analysis of comparison. Mrs. Carleton Parker, who has been investigating factory conditions by taking positions as an unskilled worker in several different types of plant, says that she made it a point to ask every girl to whom she talked whether she liked to do the same thing over and over again, or to do different kinds of things and thus break the monotony. Without one exception, they all replied that they preferred to keep on doing the same thing.

After she had been working a kick press in a brass factory on one job for three days, and was exhausted by the interminable repetition, she asked the woman next to her how long she had been operating on the job she was doing.

"Six weeks."

"Wouldn't you like to do something else—don't you get terribly tired of it?"

"Oh no, you get used to it, and then you don't want to change."

"How long did you work at the job you had before you came here?"

"Six months."

"Didn't you get tired of that?"

"No—when you get the swing of it once, you'd rather keep on doing the same thing than learn to do something else."

In a candy factory she found that the girls preferred packing small uniform boxes of one or two kinds of candy, to filling the larger boxes holding a variety, and giving opportunity for choice and individuality in the work. Mrs. Parker frankly admits that this experience has quite shattered a very fond illusion about the worker's instinct to create.

Speeding Up Work.—Fear of speeding up the worker implies a fundamental lack of understanding of the theory of production standards. Their basic principle involves consideration for the worker's physical and mental welfare, if only to keep him at his maximum of efficiency over a long period of time. A stated living wage and fixed hours of employment without regard to production are essentials of such consideration. I also believe, though this is not as yet universally recognized, that, apart from the abstract justice involved, and if only for the psychological effect on the worker, he should be represented in determining the quota. This would wholly meet the objection.

Displacing Inefficient People.—In practice it is found that where work is properly studied and analyzed, and quotas are scientifically set, differences not previously recognized develop which permit of adjusting people to their tasks in such a manner that inequalities of ability and temperament can be allowed for or overcome. So far as I know, the only conspicuously incompetent people who hold their jobs over a considerable period are those who previously rendered a life of competent service to the same concern, and there is every reason why they should continue to be cared for in the same way, regardless of whether they meet their production quotas or not.

Restrictions.—At present the printing unions almost without exception oppose aggressively or otherwise, not only the setting of standards for production, but also the measuring of work performed.

Many employing printers claim that there has been a marked falling off in production. Since there are no production standards by which to measure this, it is not possible to reach conclusions. The following examples are, however, interesting in this connection.

One plant reports the following:

1916 Average	5,400 ems per hour
1920 Average	4,200 ems per hour
Decrease in 4 years	1,200 ems per hour

Another plant doing at different periods identically the same jobs in magazine and pamphlet work showed the following comparison in average time per page:

TABLE SHOWING DECREASE IN PRODUCTION EXPRESSED IN AVERAGE TIME PER PAGE

1919		1920	
Hand Composition	Linotype Composition	Hand Composition	Linotype Composition
.525	.303	1.214	.375
.872	.532	1.091	.761
.506	.595	.514	.477
.516	.741	.717	.300
.520	.509	.939	1.060
1.201	.362	1.336	.550
1.111	.751	1.337	.700
5.251	3.793 Total	7.148	4.223 Total

This shows an increase of time or loss of production of:

Hand Work..................36%
Linotype machine work.....$11\frac{1}{3}$%

The following statement is taken from an affidavit in connection with an arbitration case: "We are receiving considerable less production than in former years, and our records show:

1918	average sheets per hour	767
1919	" " " "	744
(9 mo.)1920	" " " "	742

"This means 200 impressions per day per press, or 10,000 per day for 50 presses, or 3,000,000 impressions less production per year, which clearly shows a lack of interest by our people."

The belief that there has been a falling off in production is not always supported by the figures, as is indicated in the following letter from a leading Middle Western printer:

"Complying with your request, I wish to state that our Linotype and Press Room hour averages for years 1917–20 were as follows:

	Linotype Ems	Press Room Impressions
1917	4143	1049
1918	3987	1026
1919	4180	1044
1920	4167	1078

"When I look at these figures, I see that I was mistaken in stating verbally to you that the average production in these departments had fallen off. In regard to the Linotype average, however, I would state that in 1919 and 1920 we had to pay proportionately larger sums above the scale in order to get this production. I feel sure that I am correct in making the statement that the average of the linotype scale man has fallen off during these recent years."

Owing to the fact that there are in the printing business almost no production records which are related to standards, no means of determining the real fluctuation in production exist. Available chargings per month are misleading, because the work done in any one month may not be charged for several months thereafter. (See Figure 4.)

Craft Distinctions.—Union prohibitions with reference to production and production methods are also a serious matter. The unions insist upon arbitrary distinctions in the kinds of work done by members of the various craft unions, and as to the number of persons employed in connection with certain machines.

Perhaps their most trying practice is the insistence that members of one craft union shall not encroach upon the work of another. In as simple a matter as printing the names of individual firms on catalogue covers, where the imprints are all set up in slugs, after each imprint is run off, the pressroom workers have been known to insist that a compositor be brought from the composing room to make the change to the next imprint, while they stand idly by. In a case of this kind, where the runs are short, it amounts practically to requiring two persons to do the work of one. Similarly with paper handlers, sheet straighteners, feeders and pressmen, it is not at all uncommon to be forced to have men from several different unions participate in a simple piece of work which could be performed more easily and economically by one person.

The disadvantage of extreme craft distinctions is far greater then is immediately apparent. They very greatly increase the amount of supervision necessary, entail wastage of time in going and coming from the different tasks, and make the labor force inflexible and difficult of adjustment within one plant. There is probably no one thing so important in the elimination of waste in productive labor as that it shall be flexible; that is, that each person shall be capable of performing more than one service. When the limits of labor which each group performs are narrowly defined, any variation in the character of work easily throws the supply

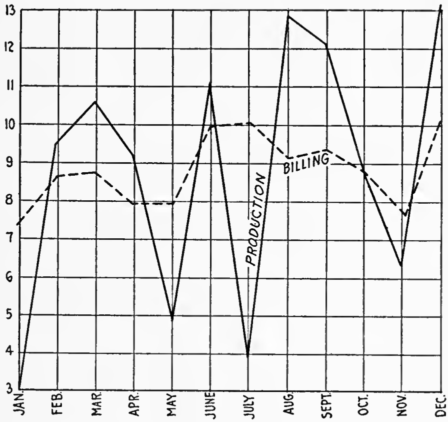


Fig. 4.—Discrepancy between Production and Billing Within the Same Establishment.

of labor out of balance. A plant is frequently "firing" people from one department, and hiring them for another at the same time. One plant employing an average of 2,000 people, goes up to 2,700 in rush seasons and drops to 1,500 in dull. Another plant employing from 700 to 1,800 lays off 1,100 employees twice a year, for periods of three months each, because, of "unbalanced producion."

A large non-union printer who has exceptional conditions throughout his plant, states that the greatest help toward keeping his workers constantly employed without undue cost is his ability to shift them from one task to another. He says that during the present depression it is by no means uncommon to find a compositor in the press room or the bindery. For short periods he frequently disjoints the entire organization of his employees. It is not to the interest of either employer or employee that men should do work other than that for which they are best equipped, but for economy of production and regularity of employment, it is sometimes essential.

In manning machines, the unions require a certain number of men on each machine, regardless of the work performed. The number of press tenders in a press room with a number of automatically fed presses are prescribed on the basis of the number of presses rather than on the amount of work being done. In some cases an effort is even made to demand that a pressman shall limit his work to one or two presses. A printer doing a large amount of periodical work says that he has reduced the makeready on a web press from three days to one by shifting a special makeready crew from press to press.

Compositors have ruled that all advertising matter coming into the office in electrotype form, must be reset in type in each printing office in which the advertisement is used. They permit the use of the electrotype, but insist upon setting and redistributing the type to secure the hours of work involved, sometimes doing it even weeks after the advertisement has appeared in the newspaper.

The localizing of authority and vesting certain functions in the foreman, insisted upon by the unions, makes the installation of proper co-ordination and management methods very difficult. These restrictions by the union made it necessary to abandon the installation of modern methods in a New York City plant after the work was already well advanced. A certain amount of routine handling of copy and issuing of instructions is essential to control and routing, and when the unions insist that this must be done by foremen, or full paid journeymen, it makes the cost prohibitive, and the work itself cumbersome.

While these restrictions are not always insisted upon, they are constantly reverted to, and hang over the head of any employer who attempts to obtain increased production. They are largely protective, necessary to the unions as a basis of trading. The most irksome phases of many of them are rendered ineffective when the workers in a shop feel full confidence in the attitude of their employer toward the union. Yet so long as these and innumerable other similar measures exist and are tolerated, they stand in the way of organized elimination of waste within the industry.

Dual Responsibility.—I am not unmindful of labor's position in this matter. I fully appreciate and wish to emphasize the fact that no device used by labor to maintain itself is any worse than the devices used by the employing printer to protect not only his position with labor, but also his competitive position.

We must face the fact that industry is ruled by competition, supply and demand and the survival of the fittest. An argument based on anything other than these principles is mere camouflage. I do not lose sight of labor's right to object to its service being regarded as a commodity. This is a natural and legitimate objection on its part. On the other hand, it must recognize that however vital the distinction between labor and a commodity may be, none the less labor is ruled and governed by the same three principles, and this applies not only to manual, but also to professional and clerical work. Many of the abuses on both sides were an inevitable by-product of the process of evolution to our present state.

Industrial Suicide.—An officer of the Typothetae states that a survey of 2,000 printing plants made in 1920 shows that there is but one apprentice to every ten journeymen, whereas even the union requirements only held it down to one to five on the average. It is the opinion of those making the survey that even if there were an immediate change of policy, it would take 30 or 50 years to replace an adequate supply of trained help. He sums up this failure to provide for the future with the words, "the industry is committing industrial suicide."

If the statement can be taken at its face value, or even with a considerable modification, the printing unions have nothing to fear through increased production, whatever the situation may be in other industries. Except for the strategic value of these limitations as points to trade on in gaining concessions, there can be no possible justification for these prohibitions.

I am in sympathy with labor in insisting upon and gaining as rapidly as possible, short hours, improved working conditions and the best pay obtainable. I see no reason why they should not adapt to their purposes every means that the employer uses in building up a competency, enabling him to work less intensively, improving his living conditions, raising his social status and even in amassing a reasonable fortune. I do, however, criticise some of the methods resorted to in the printing industry by both sides. As I deplore the profiteering which has existed during the last few years, and the distortion of the law of supply and demand, so I deplore the curtailment of output to which labor has undoubtedly resorted.

Concretely, my recommendation is that the printing unions should insist upon reasonable hours and the best pay obtainable, but that they should also co-operate and even be aggressive in insisting upon the determination and use of production standards in appraising their service, and that they should lend themselves to the greatest possible flexibility in the utilization and economy of the service of their membership. It is distinctly to labor's interest rather than to its detriment that its service should not only be as effective as possible, but also be definitely recorded and understood.

SUMMARY OF RECOMMENDATIONS

To the Manager of an Individual Plant.—

That the large establishments develop a conscious technique of management, including the development and use of production quotas.

To Managers of the Industry as a Whole.—

1. That the United Typothetae of America undertake the development of production quotas for the benefit of the smaller printers along the line of its present work in cost keeping.
2. That the printing and allied trades, including the National Association of Purchasing Agents, in joint action:
    (*a*) Develop and adhere to co-ordinated standards for printing products, materials and machine equipment.
    (*b*) Conduct a publicity campaign for the education of the buyers of printing as to what the standards affecting them are, and the advantage to them in their use.

To Labor.—

1. That labor individually and collectively advocate and co-operate with the employing printer in the establishment of production quotas.
2. That through the Industrial Relations Department of the United Typothetae and through the International Joint Conference Council:
    (*a*) Co-operate in the elimination of restrictions affecting output.
    (*b*) Urge the use of employees within one establishment for more than one class of work.

To the Department of Commerce.—That it co-operate with and support the printing and allied trades in bringing about joint conferences, and in conducting a publicity campaign for the education of buyers as to standards determined upon, and the advantages to be gained through their use.

While it is never possible to predict in figures the savings to be made by application throughout an industry of recommended changes, it may be said that the cost of printing to the ultimate consumer could be reduced on the average at least one-third, if:

1. Newspapers, periodicals, books and catalogues were held within a reasonable number of physical variations.
2. There were a common-sense limitation of sizes of printed forms so that they might all be cut from a limited number of paper sizes.
3. The printing machinery and paper industries took advantage of this standardization to obtain more continuous production and smaller stocks.
4. The printer took advantage of this standardization to eliminate over-equipment, and to use his equipment throughout its normal life.
5. The printer adopted production standards for his own work, and recognized and used the methods already demonstrated in a few cases.

The degree to which this saving will be made effective depends upon the extent to which the printer and paper and printing machinery manufacturers co-operate for the purpose of making an ultimate saving to the consumer, as distinguished from a selfish saving to themselves.

Individual efforts to eliminate waste have proven impotent except for the individual pocket-book. Co-operative effort to eliminate the useless waste of an individualistic industrialism is the need of the hour, and is the theme of this report.

John H. Williams.

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Printing* PLANT NO. *6 KL* EST. BY *C. L. B.* DATE *4/9/21*

KEY: ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste Good = 20% " Fair = 40% " Poor = 60% Waste Bad = 80% Waste a + b + c = d = 100% e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	Management: Assigned Points 1	Management: Est. % Waste 2	Management: Est. % Waste 3	Management: Points Waste 4	Labor: Assigned Points 5	Labor: Est. % Waste 6	Labor: Est. % Waste 7	Labor: Points Waste 8	Outside Contacts: Assigned Points 9	Outside Contacts: Est. % Waste 10	Outside Contacts: Est. % Waste 11	Outside Contacts: Points Waste 12	Total Waste: Assigned Points 13	Total Waste: Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1		30												
	K2		30				80				40				
	K3		30												
	K4		70				80	80	1.6	40		40	1.6	10.0	5.2
	K5	4.0	80	48	2.0	2.0	80								
	K6		80				80	80	4.0					6.0	4.8
	K7	1.0		80	0.8	5.0	80								
	K8		80								80				
	K9		60				30								
	K10		80												
	K11		60				40								
	K12	1.0	80	72	0.7	2.0	40	37	0.7	3.0	80	80	2.4	6.0	3.8
	K13		40				80								
	K14		20				20								
	K15						60								
	K16						40								
	K17						50								
	K18														
	K19		60				80								
	K20		20												
	K21	4.0	40	36	1.4	7.0		55	3.9					11.0	5.3
										2.0	60	60	1.2	2.0	1.2
	TOTAL	10.0			4.9	16.0			10.2	9.0			5.2	a 35.0	e 20.3
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0	20	20	0.6									3.0	0.6
	T2	2.0	5	5	0.1	1.0	30	30	0.3	2.0	20	20	0.4	5.0	0.8
	T3	2.0	30	30	0.6					3.0	80	80	2.4	5.0	3.0
	T4	1.0	50	50	0.5	1.0	50	50	0.5	3.0	80	80	2.4	5.0	3.4
	T5	1.0	20	20	0.2	1.0	40	40	0.4					2.0	0.6
	T6														
	T7	3.0	40	40	1.2					12.0	80	80	9.6	15.0	10.8
	TOTAL	12.0			3.2	3.0			1.2	20.0			14.8	b 35.0	f 19.2
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	2.8	80	80	2.2									2.8	2.2
	U2	0.5	80	80	0.4					2.5	80	80	2.0	3.0	2.4
	U3	1.2	20	20	0.2									1.2	0.2
	U4	2.6	40	40	1.0	2.6	80	80	2.1					5.2	3.1
	U5	0.6	50	50	0.3	0.6	80	80	0.5					1.2	0.8
	U6	0.7	60	60	0.4	1.2	80	80	1.0					1.9	1.4
	U7	1.5	50	50	0.8									1.5	0.8
	U8	1.2	50	50	0.6	1.0	80	80	0.8					2.2	1.4
	U9	1.2	40	40	0.5	1.5	80	80	1.2					2.7	1.7
	U10					2.0	60	60	1.2					2.0	1.2
	U11	1.0	80	80	0.8					2.5	80	80	2.0	3.5	2.8
	U12	0.8	60	60	0.5									0.8	0.5
	U13	0.5	20	20	0.1									0.5	0.1
	U14		10												
	U15	0.5	60	35	0.2									0.5	0.2
	U16		60				60								
	U17		60				60								
	U18	0.5		60	0.3	0.5		60	0.3					1.0	0.6
	TOTAL	15.6			8.3	9.4			7.1	5.0			4.0	c 30.0	g 19.4
GRAND TOTAL		37.6			16.4	28.4			18.5	34.0			24.0	d 100	h 58.9

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Printing* **PLANT NO.** *5 DON* **EST. BY** *C.L.B.* **DATE** *4/5/21*

KEY ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste; Good = 20% ″; Fair = 40% ″; Poor = 60% Waste; Bad = 80% ″; a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT: Assigned Points 1	Est. % Waste 2	Est. % Waste 3	Points Waste 4	LABOR: Assigned Points 5	Est. % Waste 6	Est. % Waste 7	Points Waste 8	OUTSIDE CONTACTS: Assigned Points 9	Est. % Waste 10	Est. % Waste 11	Points Waste 12	TOTAL WASTE: Assigned Points 13	Points Waste 14
ORGANIZATION Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K 1		10												
	K 2		0				0				60				
	K 3		0												
	K 4		0				0								
	K 5	4.0	0	2	0	2.0	0	0	0	4.0		60	2.4	10.0	2.4
	K 6		40				0								
	K 7	1.0	20	30	0.3	5.0		0						6.0	0.3
	K 8		60								60				
	K 9		70				30								
	K 10		60												
	K 11		40				20								
	K 12	1.0	70	60	0.6	2.0		25	0.5	3.0		80	2.4	6.0	3.5
	K 13		0				0								
	K 14		0				0								
	K 15		0				0								
	K 16		40				0								
	K 17		0				0								
	K 18		0				0								
	K 19		0				0								
	K 20		40												
	K 21	4.0	40	13	0.5	7.0		0	0					11.0	0.5
										2.0	50	50	1.0	2.0	1.0
	TOTAL	10.0			1.4	16.0			0.5	9.0			5.8	a 35.0	e 7.7
TECHNICAL Available Engineering Knowledge as to Product, Plant and Materials	T 1	3.0	0	0	0									3.0	0
	T 2	2.0	10	10	0.2	1.0	0	0	0	2.0	40	40	0.8	5.0	1.0
	T 3	2.0	10	10	0.2					3.0	40	40	1.2	5.0	1.4
	T 4	1.0	10	10	0.2	1.0	0	0	0	3.0	20	20	0.6	5.0	0.8
	T 5	1.0	30	30	0.3	1.0	0	0	0					2.0	0.3
	T 6														
	T 7	3.0	40	40	1.2					12.0	80	80	9.6	15.0	10.8
	TOTAL	12.0			2.1	3.0			0.0	20.0			12.2	b 35.0	f 14.3
UTILIZATION Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U 1	2.8	60	60	1.5									2.8	1.5
	U 2	0.5	80	80	0.3					2.5	80	80	2.0	3.0	2.3
	U 3	1.2	30	30	0.4									1.2	0.4
	U 4	2.6	0	0	0	2.6	0	0	0					5.2	0
	U 5	0.6	0	0	0	0.6	0	0	0					1.2	0
	U 6	0.7	0	0	0	1.2	0	0	0					1.9	0
	U 7	1.5	40	40	0.6									1.5	0.6
	U 8	1.2	60	60	0.7	1.0	0	0	0					2.2	0.7
	U 9	1.2	0	0	0	1.5	0	0	0					2.7	0
	U 10					2.0	0	0	0					2.0	0
	U 11	1.0	10	10	0.1					2.5	80	80	2.0	3.5	2.1
	U 12	0.8	40	40	0.3									0.8	0.3
	U 13	0.5	30	30	0.2									0.5	0.2
	U 14														
	U 15	0.5	40	40	0.2									0.5	0.2
	U 16														
	U 17														
	U 18	0.5	40	40	0.2	0.5	0	0	0					1.0	0.2
	TOTAL	15.6			4.5	9.4			0	5.0			4.0	c 30.0	g 8.5
GRAND TOTAL		37.6			8.0	28.4			0.5	34.0			22.0	d 100	h 30.5

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Printing* PLANT NO. *4 QB* EST. BY *C. L. B.* DATE *3/17/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ ; Excellent = 0% Waste ; Good = 20% " ; Fair = 40% " ; Poor = 60% Waste ; Bad = 80% Waste ; a + b + c = d = 100% ; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT: Assigned Points	Est. % Waste		Points Waste	LABOR: Assigned Points	Est. % Waste		Points Waste	OUTSIDE CONTACTS: Assigned Points	Est. % Waste		Points Waste	TOTAL WASTE: Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1		40												
	K2		60				80				40				
	K3		50												
	K4		80				80								
	K5	4.0	80	62	2.6	2.0	80	80	1.6	4.0		40	1.6	10.0	5.8
	K6		80				80								
	K7	1.0		80	0.8	5.0	80	80	4.0					6.0	4.8
	K8		10								80				
	K9		60				20								
	K10		20												
	K11		60				20								
	K12	1.0	30	36	0.4	2.0	30	23	0.5	3.0	60	70	2.1	6.0	3.0
	K13		40				80								
	K14		40				60								
	K15						60								
	K16						80								
	K17		0				40								
	K18						0								
	K19		50				80								
	K20		·5												
	K21	4.0	50	30	1.2	7.0		57	4.0					11.0	5.2
										2.0	50	50	1.0	2.0	1.0
	TOTAL	10.0			5.0	16.0			10.1.	9.0			4.7	a 35.0	e 19.8
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0	50	50	1.5									3.0	1.5
	T2	2.0	80	80	1.6	1.0	20	20	0.2	2.0	10	10	0.2	5.0	2.0
	T3	2.0	20	20	0.4					3.0	20	20	0.6	5.0	1.0
	T4	1.0	60	60	0.6	1.0	80	80	0.8	3.0	60	60	1.8	5.0	3.2
	T5	1.0	30	30	0.3	1.0	80	80	0.8					2.0	1.1
	T6														
	T7	3.0	50	50	1.5					12.0	80	80	9.6	15.0	11.1
	TOTAL	12.0			5.9	3.0			1.8	20.0			12.2	b 35.0	f 19.9
UTILIZATION: Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	2.8	80	80	2.2									2.8	2.2
	U2	0.5	50	50	0.3					2.5	50	50	0.8	3.0	1.1
	U3	1.2	80	80	1.0									1.2	1.0
	U4	2.6	80	80	2.1	2.6	80	80	2.1					5.2	4.2
	U5	0.6	.50	50	0.3	0.6	80	80	0.5					1.2	0.8
	U6	0.7	60	60	0.4	1.2	80	80	1.0					1.9	1.4
	U7	1.5	70	70	1.1									1.5	1.1
	U8	1.2	80	80	1.0	1.0	80	80	0.8					2.2	1.8
	U9	1.2	60	60	0.7	1.5	80	80	1.2					2.7	1.9
	U10					2.0	70	70	1.4					2.0	1.4
	U11	1.0	70	70	0.7					2.5	60	60	1.5	3.5	2.2
	U12	0.8	60	60	0.5									0.8	0.5
	U13	0.5	80	80	0.4									0.5	0.4
	U14 }		80												
	U15 }	0.5	70	75	0.4									0.5	0.4
	U16 }		60				60								
	U17 }		80				80								
	U18 }	0.5		70	0.4	0.5		70	0.4					1.0	0.8
	TOTAL	15.6			11.5	9.4			7.4	5.0			2.3	c 30.0	g 21.2
GRAND TOTAL		37.6			22.4	28.4			19.3	34.0			19.2	d 100.	h 60.9

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Printing* PLANT NO. *3 MOLD* EST. BY *C.L.B.* DATE *3/16/21*

KEY
(1) + (5) + (9) = (13) (4) + (8) + (12) = (14)
Excellent = 0% Waste; Good = 20% "; Fair = 40% "; Poor = 60% Waste; Bad = 80% "
a + b + c = d = 100%
e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES												TOTAL WASTE	
		MANAGEMENT				LABOR				OUTSIDE CONTACTS					
		Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION. Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1		40												
	K2		40				80				80				
	K3		50												
	K4		60				80								
	K5	4.0	80	54	2.2	2.0		80	1.6	4.0		80	3.2	10.0	7.0
	K6		60				80								
	K7	1.0		60	0.6	5.0	80	80	4.0					6.0	4.6
	K8		70								80				
	K9		80				50								
	K10		0												
	K11		80				50								
	K12	1.0	80	62	0.6	2.0	40	46	0.9	3.0	80	80	2.4	6.0	3.9
	K13		40				80								
	K14		40				40								
	K15						50								
	K16						40								
	K17						80								
	K18						80								
	K19		60				80								
	K20		5												
	K21	4.0	40	36	1.4	7.0		64	4.5					11.0	5.9
										2.0	60	60	1.2	2.0	1.2
	TOTAL	10.0			4.8	16.0			11.0	9.0			6.8	a 35.0	e 22.6
TECHNICAL. Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0	20	20	0.6									3.0	0.6
	T2	2.0	40	40	0.8	1.0	40	40	0.4	2.0	20	20	0.4	5.0	1.6
	T3	2.0	50	50	1.0					3.0	80	80	2.4	5.0	3.4
	T4	1.0	50	50	0.5	1.0	80	80	0.8	3.0	80	80	2.4	5.0	3.7
	T5	1.0	40	40	0.4	1.0	50	50	0.5					2.0	0.9
	T6														
	T7	3.0	60	60	1.8					12.0	80	80	9.6	15.0	11.4
	TOTAL	12.0			5.1	3.0			1.7	20.0			14.8	b 35.0	f 21.6
UTILIZATION. Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors.	U1	2.8	80	80	2.2									2.8	2.2
	U2	0.5	80	80	0.4					2.5	80	80	2.0	3.0	2.4
	U3	1.2	70	70	0.8									1.2	0.8
	U4	2.6	70	70	1.8	2.6	80	80	2.1					5.2	3.9
	U5	0.6	70	70	0.4	0.6	80	80	0.5					1.2	0.9
	U6	0.7	60	60	0.4	1.2	80	80	1.0					1.9	1.4
	U7	1.5	40	40	0.6									1.5	0.6
	U8	1.2	70	70	0.8	1.0	80	80	0.8					2.2	1.6
	U9	1.2	80	80	1.0	1.5	80	80	1.2					2.7	2.2
	U10					2.0	70	70	1.4					2.0	1.4
	U11	1.0	70	70	0.7					2.5	80	80	2.0	3.5	2.7
	U12	0.8	40	40	0.3									0.8	0.3
	U13	0.5	30	30	0.2									0.5	0.2
	U14		40												
	U15	0.5	60	50	0.3									0.5	0.3
	U16		50				50								
	U17		80				80								
	U18	0.5		65	0.3	0.5		65	0.3					1.0	0.6
	TOTAL	15.6			10.2	9.4			7.3	5.0			4.0	c 30.0	g 21.5
GRAND TOTAL		37.6			20.1	28.4			20.0	34.0			25.6	d 100	h 65.7

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Printing* **PLANT NO.** *2-DLMR.* **EST. BY** *C.L.B.* **DATE** *3/21/21*

KEY ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste Good = 20% " Fair = 40% " Poor = 60% Waste Bad = 80% " a + b + c = d = 100% e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT, Assigned Points 1	Est. % Waste 2	Est. % Waste 3	Points Waste 4	LABOR, Assigned Points 5	Est. % Waste 6	Est. % Waste 7	Points Waste 8	OUTSIDE CONTACTS, Assigned Points 9	Est. % Waste 10	Est. % Waste 11	Points Waste 12	TOTAL WASTE, Assigned Points 13	Points Waste 14
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship.	K1		40												
	K2		40				80				80				
	K3		50												
	K4		70				80	80	1.6						
	K5	4.0	80	56	2.2	2.0	80			4.0		8.0	3.2	10.0	7.0
	K6		80				80	80	4.0						
	K7	1.0		80	0.8	5.0	80							6.0	4.8
	K8		80								80				
	K9		80				50								
	K10		0												
	K11		80	64	0.6		50								
	K12	1.0	40	64	0.6	2.0	50	50	1.0	3.0	80	80	2.4	6.0	4.0
	K13		40				80								
	K14		40				40								
	K15						50								
	K16						40								
	K17						80								
	K18						80								
	K19		80				80								
	K20		5												
	K21	4.0	60	45	1.8	7.0		64	4.5					11.0	6.3
										2.0	60	60	1.2	2.0	1.2
	TOTAL	10.0			5.4	16.0			11.1	9.0			6.8	a 35.0	e 23.3
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0	50	50	1.5									3.0	1.5
	T2	2.0	40	40	0.8	1.0	40	40	0.4	2.0	20	20	0.4	5.0	1.6
	T3	2.0	40	40	0.8					3.0	80	80	2.4	5.0	3.2
	T4	1.0	30	30	0.3	1.0	70	70	0.7	3.0	80	80	2.4	5.0	3.4
	T5	1.0	40	40	0.4	1.0	50	50	0.5					2.0	0.9
	T6														
	T7	3.0	80	80	2.4					12.0	80	80	9.6	15.0	12.0
	TOTAL	12.0			6.2	3.0			1.6	20.0			14.8	b 35.0	f 22.6
UTILIZATION: Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	2.8	80	80	2.2									2.8	2.2
	U2	0.5	70	70	0.4					2.5	80	80	2.0	3.0	2.4
	U3	1.2	80	80	1.0									1.2	1.0
	U4	2.6	60	60	1.5	2.6	80	80	2.1					5.2	3.6
	U5	0.6	60	60	0.4	0.6	80	80	0.5					1.2	0.9
	U6	0.7	40	40	0.3	1.2	70	70	0.8					1.9	1.1
	U7	1.5	50	50	0.8									1.5	0.8
	U8	1.2	80	80	1.0	1.0	80	80	0.8					2.2	1.8
	U9	1.2	80	80	1.0	1.5	80	80	1.2					2.7	2.2
	U10					2.0	60	60	1.2					2.0	1.2
	U11	1.0	60	60	0.6					2.5	80	80	2.0	3.5	2.6
	U12	0.8	40	40	0.3									0.8	0.3
	U13	0.5	40	40	0.2									0.5	0.2
	U14		40												
	U15	0.5	80	60	0.3									0.5	0.3
	U16		60				60								
	U17		80				80								
	U18	0.5		70	0.4	0.5		70	0.4					1.0	0.8
	TOTAL	15.6			10.4	9.4			7.0	5.0			4.0	c 30.0	g 21.4
GRAND TOTAL		37.6			22.0	28.4			19.7	34.0			25.6	d 100.0	h 67.3

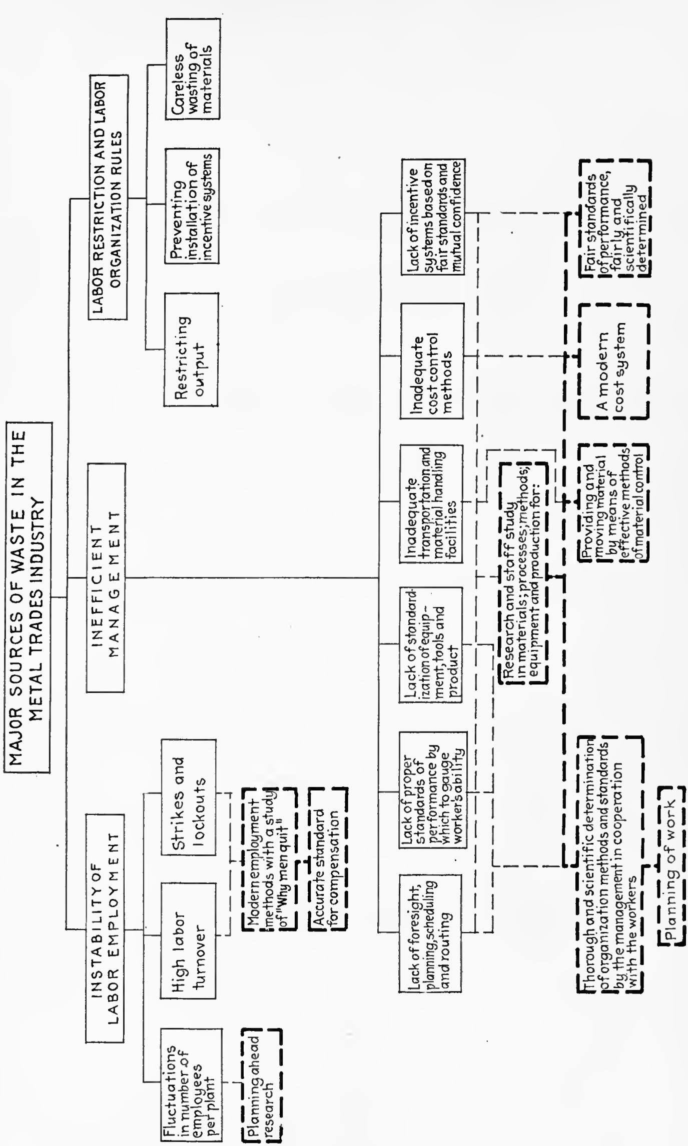
FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Printing* **PLANT NO.** *1 Dv.* **EST. BY** *C.L.B.* **DATE** *3/16/21*

KEY ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste Good = 20% " Fair = 40% " Poor = 60% Waste Bad = 80% " a + b + c = d = 100% e + f + g = h = 0% Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES												TOTAL WASTE	
		MANAGEMENT				LABOR				OUTSIDE CONTACTS					
		Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1		40												
	K2		20				80				40				
	K3		40												
	K4		80				80								
	K5	4.0	80	52	2.1	2.0	80	80	1.6	4.0		40	1.6	10.0	5.3
	K6		80				80								
	K7	1.0		80	0.8	5.0	80	80	4.0					6.0	4.8
	K8		80								80				
	K9		60				30								
	K10														
	K11		40				35								
	K12	1.0	60	48	0.5	2.0	40	35	0.7	3.0	80	80	2.4	6.0	3.6
	K13		40				80								
	K14		40				40								
	K15						50								
	K16						40								
	K17						80								
	K18						80								
	K19		80				80								
	K20		5												
	K21	4.0	60	44	1.8	7.0		64	4.5					11.0	6.3
										2.0		60	1.2	2.0	1.2
	TOTAL	10.0			5.2	16.0			10.8	9.0			5.2	a 35.0	e 21.2
TECHNICAL Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0	20	20	0.6									3.0	0.6
	T2	2.0	40	40	0.8	1.0	40	40	0.4	2.0	10	10	0.2	5.0	1.4
	T3	2.0	40	40	0.8					3.0	80	80	2.4	5.0	3.2
	T4	1.0	20	20	0.2	1.0	70	70	0.7	3.0	80	80	2.4	5.0	3.3
	T5	1.0	20	20	0.2	1.0	40	40	0.4					2.0	0.6
	T6														
	T7	3.0	80	80	2.4					12.0	80	80	9.6	15.0	12.0
	TOTAL	12.0			5.0	3.0			1.5	20.0			14.6	b 35.0	f 21.1
UTILIZATION Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	2.8	80	80	2.2									2.8	2.2
	U2	0.5	80	80	0.4					2.5	80	80	2.0	3.0	2.4
	U3	1.2	50	50	0.6									1.2	0.6
	U4	2.6	60	60	1.6	2.6	80	80	2.1					5.2	3.7
	U5	0.6	60	60	0.4	0.6	80	80	0.5					1.2	0.9
	U6	0.7	40	40	0.3	1.2	80	80	1.0					1.9	1.3
	U7	1.5	40	40	0.6									1.5	0.6
	U8	1.2	50	50	0.6	1.0	80	80	0.8					2.2	1.4
	U9	1.2	80	80	1.0	1.5	80	80	1.2					2.7	2.2
	U10					2.0	60	60	1.2					2.0	1.2
	U11	1.0	50	50	0.5					2.5	80	80	2.0	3.5	2.5
	U12	0.8	30	30	0.2									0.8	0.2
	U13	0.5	40	40	0.2									0.5	0.2
	U14		30												
	U15	0.5	80	55	0.3									0.5	0.3
	U16		60				60								
	U17		80				80								
	U18	0.5		70	0.4	0.5		70	0.4					1.0	0.8
	TOTAL	15.6			9.3	9.4			7.2	5.0			4.0	c 30.0	g 20.5
GRAND TOTAL		37.6			19.5	28.4			19.5	34.0			23.8	d 100.0	h 62.8



MAJOR SOURCES OF WASTE IN THE METAL TRADES INDUSTRY
INSTABILITY OF LABOR EMPLOYMENT
INEFFICIENT MANAGEMENT
LABOR RESTRICTION AND LABOR ORGANIZATION RULES
Fluctuations in number of employees per plant
High labor turnover
Strikes and lockouts
Restricting output
Preventing installation of incentive systems
Careless wasting of materials
Planning ahead research
Modern employment methods with a study of "Why men quit"
Accurate standard for compensation
Lack of foresight, planning, scheduling and routing
Lack of proper standards of performance by which to gauge worker's ability
Lack of standardization of equipment, tools and product
Inadequate transportation and material handling facilities
Inadequate cost control methods
Lack of incentive systems based on fair standards and mutual confidence
Research and staff study in materials; processes; methods; equipment and production for:
Thorough and scientific determination of organization methods and standards by the management in cooperation with the workers
Planning of work
Providing and moving material by means of effective methods of material control
A modern cost system
Fair standards of performance, fairly and scientifically determined

CHAPTER IX

THE METAL TRADES INDUSTRY

By Fred J. Miller assisted by William B. Ferguson

Possible Increased Production.—Study of the Metal Trades Industry and comparison of the factors of waste, or causes of non-production in various representative plants in that industry, lead to the conclusion that, at a conservative estimate, the value of increased production possible in the United States would be over half a billion dollars annually —even in normal times.

At the present time, due to the large unemployment of available men and machinery, the waste is nearer to a billion dollars a year. This estimate covers the value of labor only and does not include the value of materials that would be utilized if the productivity of labor were increased.

Views of Executives in the Industry.—Before giving conclusions as to the major causes of the above mentioned waste, we present the views of some of the managing executives themselves in thirty-two of the plants visited. Being asked their opinion as to the main cause of waste or inefficiency their answers were as follows:

In eight plants the answer referred particularly to present business conditions and was to the effect that " the most important cause is the uneven volume of business or the fluctuation in the demand for the product; lack of enough business to keep going at normal capacity."

In four plants the cause given concerned the railroad situation and the functioning of the Railroad Adjustment Board.

In three plants the cause given was " lack of standardization of design of products."

In two plants the cause given was " labor turnover and strikes," one executive saying that these had been caused by wartime conditions.

In four plants the cause given was " lack of planning "—the exact words used being " lack of proper planning and routing"; " lack of correct planning and material control "; " unscientific planning and management ", and " lack of efficient planning and management methods."

In six plants the cause given was " lack of co-operation between management and labor."

Other causes given in various plants were as follows: "lack of intensive study of methods"; "cost control systems needed"; "daily cost reports needed"; "lack of scientific management applied to all phases of the business"; "inefficiency of labor and excessive overhead."

In other plants special causes in the machine tool business were given as follows:

(1) "The failure of machine tool builders to supply what the public wants."
(2) "Most of the metal trades shops are very small and require personal handling by the manager of such important problems as are handled by our system of production control."
(3) "Insufficient capital to develop sales and to improve facilities."
(4) "Purchasing in small quantities, by the small plants, which places them at a disadvantage as to favorable prices and as to transportation and handling expense."

Present Unemployment.—The major cause of waste or non-production in the metal trades industry at the present time is the unemployment of available labor and equipment, due to general business conditions, which affect all other industries. The U. S. Department of Labor, Bureau of Labor Statistics, reports on a survey of 1,423 firms in the metal trades industry employing 1,643,253 men, that the decreases in the number on the payroll from February, 1920 to February, 1921 were 24.2% in the iron and steel industry, 42.3% in the automobile industry, and 16.6% in the car building and repairing industry. The Employers' Association of Detroit reports on March 10, 1921 that 79 shops were employing 67,137 hands compared to 198,705 employed on April 7, 1920. In Philadelphia, out of the 150,000 hands employed in the metal trades in July 1920, about 30,000 were out of work on March 1, 1921.

The present industrial conditions in the United States and abroad affect the metal trades very seriously and the industry as a whole is operating at only about 60% of normal output. Manufacturers can undoubtedly hasten a return to normal conditions by producing goods as economically as possible, thus being able to make selling prices low enough to be attractive to buyers.

Extent of the Industry.—There are nearly two million people engaged in the establishments of the metal trades industry and it is easily seen by a close study of all the elements involved that an enormous increase in total production is possible. It is estimated that at present about 80% of the responsibility for this waste, or non-production, rests with management; i.e., with the managers and executives in the plants. "Responsibility" here means that the causes of this waste can be removed only by management.

The estimated waste in the fifteen representative plants selected by the Committee is shown graphically in the Chart, Figure 1,—

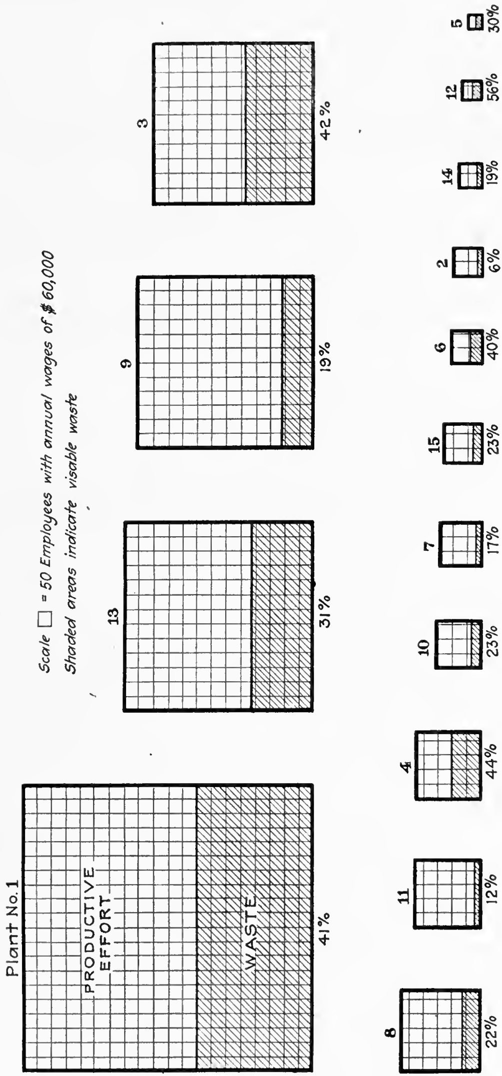

Plant No.1
PRODUCTIVE EFFORT
WASTE
41%
Scale □ = 50 Employees with annual wages of $60,000
Shaded areas indicate visable waste
13
31%
9
19%
3
42%
8
22%
11
12%
4
44%
10
23%
7
17%
15
23%
6
40%
2
6%
14
19%
12
56%
5
30%

Fig. 1.

averaging 28% for them all and ranging from 6% waste for the best plant to 56% for the worst. Figure 2 shows that the size of the plant, whether large, medium or small, does not necessarily affect its efficiency, as some large plants as well as some small ones have a large waste factor.

The metal trades constitute the largest manufacturing industry in the United States, in the number of employees engaged and in the value of products. The principal divisions of this industry are as follows:

(*a*) Metal products, such as plates, shapes, castings, piping and tubing.
(*b*) Machinery and machine tools.
(*c*) Automobiles, trucks and tractors.
(*d*) Engines, locomotives, cars and trucks; street cars and equipment.
(*e*) Machine shop and foundry products, covering a great diversity of products.
(*f*) Shipbuilding and ship repairs.
(*g*) Electrical products including motors, dynamos and electrical instruments.
(*h*) Firearms and ammunition.

FIG. 2.

Location.—The industry is pretty much concentrated east of the Mississippi River, in the New England States, the Middle Atlantic States and in the Middle West. Pennsylvania and Ohio lead in the industry; then follow New York, Illinois, Massachusetts, Connecticut and New Jersey.

The metal making branch of the industry is not included in this survey,—that is the branch which produces what are usually known as "raw materials"—plates, shapes, wire, piping, etc. The largest number of plants or shops are machine shops and foundries, of which there were nearly 17,000 in 1914. The average size of these shops is rather small, with considerably less than 100 employees as the average number.

Fifteen Plants Studied.—A comprehensive study and survey has been made of fifteen representative plants, of various sizes and types, distributed through the states which lead in the industry. In addition to these detailed surveys or assays, a number of other plants were studied, and general information obtained through the co-operation of various metal trades associations. Altogether the investigation has been made as thorough and impartial as possible within the time available, with a view to obtaining at first hand the real facts upon which to base constructive recommendations or suggestions for improvement.

Major Causes of Waste in Normal Times.—The major causes of waste or non-production, applicable to normal times as well as to the present abnormal times, may be classified for convenience as follows:

A. Instability of labor employment,—including both fluctuations in the number of employees in individual plants or shops, and the high labor turnover. Strikes and lockouts come under this heading.

B. Inefficient management, which includes:
   (1) Lack of foresight and planning, scheduling and routing materials effectively.
   (2) Lack or proper standards of performance, by which to gage the ability of the workers.
   (3) Lack of standardization of equipment, tools and product.
   (4) Inadequate transportation and material handling facilities.
   (5) Inadequate cost control methods.
   (6) Lack of proper incentive systems, based upon fair standards and confidence between employers and employed.

C. Labor organization rules or customs,—such as restricting individual output or making it impossible for management to instal proper incentive systems, —due either to lack of mutual confidence or a misunderstanding of the mutual benefits from increased production.

D. Waste of materials, from various reasons,—such as lack of a well-organized inspection system; lack of careful training and instruction of workers; lack of care and interest in the work.

E. Lack of thorough research work or staff study,—including the study of materials, processes and methods, equipment, and production.

Instability of Labor Employment.—Most of the plants surveyed give very little thought to the instability of labor employment. When studies are made in a plant of the fluctuations in the number of employees, the management is usually surprised to find how unstable the working force really is. Four charts (Figures 3, 4 and 5) are shown for four plants taken at random, showing the wide range in the numbers employed during the past two or three years. These fluctuations were not due to seasonal employment, but largely due to lack of planning ahead and scheduling for continuous employment on the contracts in hand.

A study by the management of causes for fluctuations in the working forces for the past four years has led to an investigation of the causes

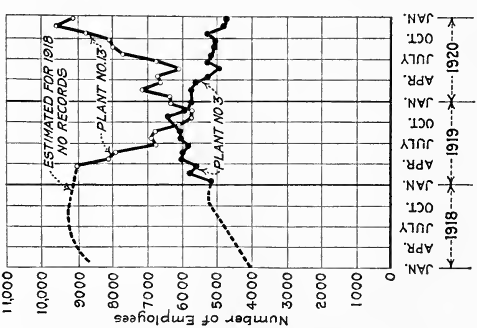


Fig 3

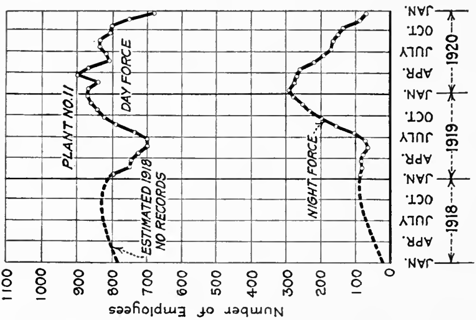


Fig. 4.

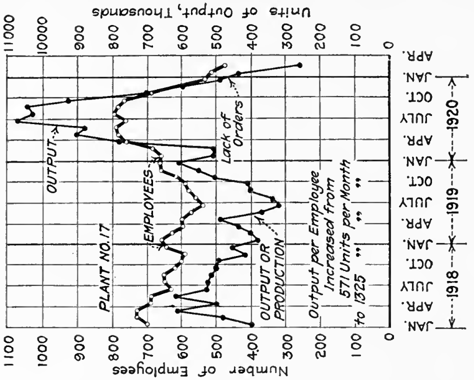


Fig. 5.

for the high labor turnover, and steps are being taken to bring about a better understanding between labor and management. In studying this plant, it was found that relations with labor were practically all handled directly by the foremen, who also set the piece-rates on "judgment," without careful study and observation. Moreover, the planning and routing was not effectively done. This entailed extra burdens on the foremen, and did not give them sufficient time to direct and observe their men.

In many other respects this plant is excellent and the quality of output is second to none.

Several other plants included in these studies have methods similar to the above, and with few exceptions lack an adequate cost system tied in with the production records and with the general works.

Internal Relations.—The proper relationship between management and labor, such as exists in the most productive plants investigated, is more than ever a controlling factor. The plants with the highest labor turnover (which reflects discontent) are in general the most wasteful of human effort; hence secure the smallest production per man-hour. It is further found that generally the best relationship exists and the best understanding and least friction prevail in plants where the most thorough and scientific study of organization methods and standards has been made by the management in co-operation with the workers. The careful planning of work, the providing and the moving of materials by means of effective and organized methods of material control; comparison of output of departments and of individuals with fair standards of performance, fairly and scientifically determined; these are the practices of those concerns which have been most free from labor unrest, and where greatest mutual confidence and co-operation exist between employer and employed.

The provision by the management of proper facilities and convenience for developing the latent productivity of the workers and the provision of fair incentives for those who "make good" play a large part in elimininating waste in the best establishments.

Study of Labor Turnover Needed.—It is shown by experience of the plants visited as well as by general experience that considerable improvement can be brought about by means of modern employment methods, which provide, among other features, for a close study of "why men quit." Only a few of the plants studied had effective employment methods and only three kept a record and made an analysis of the true reasons for men quitting. Men are usually "fired" or quit work without anyone knowing why except their foreman, and often a foreman does not know the real reason why a man quits and no steps are taken to correct the conditions that bring about so many expensive separations.

Cost of Labor Turnover.—In order to visualize the cost of the labor turnover in the metal trades industry, let us take some conservative figures and estimate the "waste" in production in the industry due to this source. The average labor turnover for the year 1920, for the plants covered by these studies (wherever records were kept, which was the case in less than half of the plants), was 160%,—the percentage given in most cases being the ratio between the number of "separations" and the average number on the payroll. The highest turnover was 366%. An estimate by the Metal Manufacturers' Association of Philadelphia for the whole industry is that "it would average between 150 and 170%, for 1920. In the earlier months of the year, when the demand for labor was very great and the supply inadequate, in some shops it ran as high as 300%, on an annual basis. This turnover was computed as the ratio between total separations and total average daily working force."

There is a practical "minimum" to the labor turnover in a shop or factory which we cannot expect to excel except in special cases,—there are "separations" that are unavoidable, due to deaths, marriages, etc., for which 60% may be allowed,—which still leaves an avoidable or preventable turnover of say 100% annually in the metal trades industry. This of course can be done only with a most thorough understanding and co-operation of all concerned: management, labor and the public.

In this industry, then, with its two million employees, with the average plant virtually renewing its entire working force, or filling each position, one-and-a-half times a year, we have two million unnecessary "separations," the equivalent of two million workers annually separated and re-hired elsewhere,—and at what cost? Expert estimates of the cost of labor turnover vary from $50 to $250 per employee hired, trained and separated. An average figure of only $50 each applied to two million employees "turned over," means an average "waste" of one hundred million dollars due to avoidable labor turnover in this one industry.

Co-operation Needed.—Considerable has been done, and more can be done, to reduce the high labor turnover by co-operation between the various plants of the industry, through their trade associations. During the war the Government attempted to stabilize labor employment and discourage men going from plant to plant in search of the highest wage paid for their kind of work, by stabilizing or standardizing the basic wages and rates. But due partly to the lack of thoroughness of the studies made under the conditions prevailing, and due partly to the lack of uniformity of interpretation and application of the general rules made by the Government agencies, the plan was never wholly successful.

Strikes and Lockouts not a Major Factor.—Instability of labor employment resulting from strikes and lockouts has not been as serious in the metal trades industry as in some other industries, with the exception of the shipbuilding branch of this industry. The demand for labor in this branch increased tremendously during the war—far exceeding the supply,—and in the space of two years the number of employees engaged jumped from 100,000 to 400,000. Wages were greatly increased as a natural consequence and questions of wages and piece-rates have been a prolific source of dispute.

The following record of strikes obtained from the Atlantic Coast Shipbuilders' Association gives an idea of the lost time and "waste" in nine shipyards between October 1, 1919 (when an agreement was signed up between some of the shipyards and the labor representatives) and January 1, 1921, a 15-months' period:

40 strikes affecting 21 different trades; total number of men out 10,538; number of hours lost 546,079; earnings lost by the workmen $408,902.

In the machine tool business in Ohio, there was a general machinist strike in the summer of 1920, which affected a number of plants very seriously. In the Philadelphia district, the metal trades have been fairly free from serious strikes (except in shipbuilding) and in the membership of the Metal Manufacturers' Association, in 1920, there were only three strikes, two in small foundries and one in a brass shop.

Management—Handling of Labor.—An open interchange of ideas and business results by managements both in the particular industry and in other industries, should lead to a higher level of methods, service and general business ethics. If carried on through definite channels such interchange might easily result in a combined study of the possibilities of the future and the avoidance, in the years to come, of such conditions as we are now facing. It is evident that management of labor must be elevated to a higher plane. Because labor is the major factor in most if not all industries, it should be led by recognized intelligence rather than by radical agitators on the one hand or by stupid reactionaries on the other. Remarkable and very favorable results have been secured in labor relations and in improvement of efficiency simply by establishing frank and open conference and free interchange of opinions, usually in genuine open shops (shops in which no prejudice or discrimination is allowed to exist either for or against men who do or do not belong to labor organizations) and sometimes by collective bargaining and dealing with a shop committee to which is delegated all responsibility for keeping the men to agreements fairly made between management and employees.

Examples of Waste Elimination.—Figure 5 previously referred to shows the increase in output per employee from 571 units a month in 1918 to 1,325 units a month in 1920, due to the plant's running nearer capacity and due to improved management. This is an example of increasing production per employee over 132%. If production of 1,325 is considered " standard " or excellent, the previous production of 571 was only 43% efficient, or a " waste " of 57%. Numerous other examples of this nature might be given. One of the plants studied had been specializing for many years in a product and the management had believed the operation of the plant to be very efficient. The plant was modern and up-to-date in appearance, had a good labor market, and a year ago they were very well satisfied that they were getting out the maximum production,—which was 20,000 units a week with 1,175 employees,—or 18.7 units per employee. The president of the company engaged an industrial engineer as an assistant to the general manager,—and his duties were purely staff duties, research work and study of the operations of the plant. The general manager and the superintendents adopted some of this engineer's suggestions one after another; the planning of work was improved, the routing of work was simplified and a few machines re-located; there were some improvements made in processes; a better and more careful inspection system for work in process was established under a separate department; the piece-work system was extended, etc. A year later, at the time the survey was made, the production had increased from 22.000 to 34,000, and the number of employees had been reduced from 1,175 to 800. The output per man weekly had increased from 18.7 units to 42.5 units, or an improvement of 121%. No additional equipment had been added. This engineer believes that with the present force production can be increased 50% more.

Some Standardization Possible.—Most of the metal products are manufactured " on order "—the result of the " sell-and-make " policy,—which is one of the causes for the " ups-and-downs " in business. Moreover, many of these orders are more or less special in their character, i.e., departures from what may be considered a standard product are dictated by the buyer. Whatever may be done in the way of standardization of products would enable manufacturers in many cases to feel justified in manufacturing for stock, and thus not only would production be more steadily maintained but goods would be produced at materially lower costs; costs would be lower because of the greatly reduced investment required in buildings and equipment and in raw and finished stock carried in inventories for a given volume of business.

Reduction of Variety of Equipment.—The great variety of designs called for by those who buy street cars, locomotives, trucks and other transportation equipment, is well known to be capable of beneficial limitation if manufacturers and users could, through some agency, get together and by scientific study of the problems, not only from a utility or service standpoint, but from a manufacturing standpoint as well, reduce as much as possible the enormous number of varieties, styles, and types now required to be built. Many of these varieties are largely a matter of personal opinion or judgment of the buyers who have not had the opportunity to study the subject in all its phases. A great deal can be done toward standardizing the designs of these products and thus promoting the best interests of all concerned.

Inefficiency of Management Hitherto Overlooked.—Taylor, Gantt, and others repeatedly declared that the greater part of the failures of industrial establishments to attain high efficiency is caused by failures in management. This has not been generally believed and it so happens that things pertaining to the workman and his contribution to industry have, until recently at least, received most attention in the technical and news press. As a matter of fact it is often somewhat difficult to decide with certainty whether failure to attain a reasonable degree of efficiency is due to shortcomings of the workers or to those of management.

When an establishment is low in efficiency it is usually true that the workers by taking greater interest in their work, or by simply working harder, can bring about some improvement. But on the other hand it is generally conceded that one of the problems of management is to stimulate and maintain the interest and co-operation of workers. When this has been done, as in many cases it has been either by a change in personnel of the management or by a change of attitude and practice without change of personnel, what had appeared to have been entirely the fault of the workers was seen to have been remediable by the management and therefore to have been management's responsibility.

Human Nature in Management.—Regardless of the industry or of the method by which it is conducted, human nature is always to be dealt with and must be taken into account if the highest success is to be attained. Systems of management may help very much if they are fundamentally right and do not create more trouble than they cure, but underlying any system there must be the recognition of the fact that the actual work is done by human beings and that to disregard human nature or to strive against it is as much a hindrance to high efficiency as to strive against or disregard any well-established physical law.

Adequate Cost Control Methods Needed.—In all cases it was found that an adequate cost system was needed. In controlling production through the plant and in judging fairly and accurately when and where progress and improvement are being made, it was found that a modern cost system is a most effective means in some of the plants. The lack of a good cost control system in other plants (in fact the majority of plants lack such a system) is necessarily a source of much waste. This lack prevents accurate and prompt correction of defects because the defects remain hidden and unobserved. A modern good cost system enables costs to be known quickly, from day to day during the progress of a job if desired, and is thus made useful in enabling executives to control and reduce them.

The One-Man Shop.—A small work shop may be very efficiently conducted if it happens that the owner of it " runs it " and if he is naturally a good manager or executive. Such a man personally knows all his employees, spends most of his time with them, teaching, leading and helping them in all their work. He may easily know the capacities and limitations peculiar to each employee. His treatment of them will be such as to reduce " labor turnover " to a negligible quantity and the number of new men employed will be so small that he can, with comparative ease, get good men when he wants them; all his contented and loyal employees become his agents in securing additional help when wanted. The movement of materials from place to place as needed and the planning of operations in proper sequence are easily accomplished by such a man under such conditions.

The Large-Scale Organization.—Beyond a certain magnitude one-man management obviously becomes impossible, and management functions must be delegated to others who must be carefully selected and trained and whose activities must be thoroughly co-ordinated and harmonized. It is the task of the modern industrial leader to delegate the management functions and the problems of human nature, to which many of our industrial difficulties are traceable, to subordinate executives, and to supply them with the means for solving these problems Failure to make such provision must be considered as incompetent management. There is probably a direct connection between the increase in size of industrial plants, and the statement made by " Bradstreet " to the effect that, while " incompetence " had always bulked large as a cause of business failures, by 1912 it had grown to be the chief cause and by 1919, 38.2% of all failures were caused by it. During this period plants were rapidly increasing in size because of the growth of the country and a higher standard of management was at the same time being required.

Variation from Standard.—It is found that the average metal working plant is 25% to 30% behind the best plant in output per employee,—which situation can be greatly improved by a proper understanding between management, labor and the public, and by all co-operating to the same end.

The assay of this industry had for its object to find out:

1. How nearly the methods in use in typical establishments attain to the standards of the best plants in the industry;
2. So far as possible the reasons for failure to attain to them;
3. To whom the responsibility for such failure belongs; and to evaluate that responsibility;
4. What may be done to bring about possible improvement.

It is the difficulty of attaining to, or of even approximating the standards of the best plants in the industry without an adequate organization and the best of methods of administration that gives rise to the belief, quite commonly held, that an establishment can become so large as to be " unwieldy " and " unmanageable," whereas those who know the virtues of thorough orgnaization and of proper distribution of authority and control, place no limitation upon the magnitude of a really well-managed and efficient establishment. But the large establishment must disregard the bugbear of " non-productive labor " and must see to it that each executive, major or minor, must have only as much to attend to as he can attend to thoroughly.

The system of records and reports must be considered only as necessary accessories to the process of production. It must supply to every responsible executive, accurately and promptly, the information he needs to have in order to discharge his responsibilities. No blanks should be used or reports made except such as have a demonstrated value and usefulness. Among them should be by all means, however, records of each employee, showing his attainments with respect to an established and fair standard, known to both management and worker. Wage adjustments, questions of preferment in employment, promotion, etc., should be determined or at least largely influenced by such records. No action in such matters should be taken by any foreman or other executive on mere whim or impulse. When a man is sure that his standing will be fixed and maintained by such a daily record of achievement he will do his best to have that record as good as possible.

Successful Plants Have Management Systems.—So called " systems " of management have been declared to be failures in certain establishments and, as is usually the case with any new thing, these alleged failures are more talked of than the successes. It is clear that many proprietors and workmen are depriving themselves of what would be of the greatest benefit to them, because of prejudice and because the real reasons for the alleged failures are not and can not be made generally known. But the fact is that there are many establishments in which single features borrowed (unwittingly) from these systems are being used with good effect and where the entire co-ordinated system would give correspondingly larger results. Other establishments are using good systems entirely, and among the establishments studied by the Committee are some of these in which the best all round results are being secured, the proprietors of which would not think of such a thing as going back to the older and more primitive practice.

It will take time to bring the entire industry up to the higher level. During that time some establishments will probably be eliminated by the competition of the more advanced, but in this direction lies the only hope of eliminating industrial wastes.

William B. Ferguson.
Fred J. Miller.

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* PLANT NO. *1* EST. BY *H.J.B.* DATE *4/6/21*

KEY
① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste; Good = 20% Waste; Fair = 40% Waste
④ + ⑧ + ⑫ = ⑭ Poor = 60% Waste; Bad = 80% Waste
a + b + c = d = 100%
e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT, Assigned Points	Management, Est. % Waste		Management, Points Waste	LABOR, Assigned Points	Labor, Est. % Waste		Labor, Points Waste	OUTSIDE CONTACTS, Assigned Points	Outside Contacts, Est. % Waste		Outside Contacts, Points Waste	TOTAL WASTE, Assigned Points	Total Waste, Points Waste	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	1.0		80	0.8									1.0	0.8	
	K2	2.0		40	0.8									2.0	0.8	
	K3	1.0		80	0.8									1.0	0.8	
	K4	1.0		80	0.8									1.0	0.8	
	K5	2.0		60	1.2									2.0	1.2	
	K6	1.0		80	0.8									1.0	0.8	
	K7	0.5		60	0.3	0.5	60		0.3					1.0	0.6	
	K8	1.0		60	0.6									1.0	0.6	
	K9	0.5		80	0.4	0.25	80		0.2	0.25	80		0.2	1.0	0.8	
	K10	1.5				0.5								2.0		
	K11	0.5		80	0.4	0.5	80		0.4					1.0	0.8	
	K12	3.0		60	1.8	1.0	60		0.6					4.0	2.4	M
	K13	1.0		20	0.2	0.5	20		0.1	0.5	20		0.1	2.0	0.4	
	K14	1.0		60	0.6	0.5	60		0.3	0.5	60		0.3	2.0	1.2	
	K15															
	K16															
	K17	1.0		20	0.2	0.5	20		0.1	0.5	20		0.1	2.0	0.4	
	K18	1.0		20	0.2	0.5	20		0.1	0.5	20		0.1	2.0	0.4	
	K19	0.5		80	0.4	0.5	80		0.4					1.0	0.8	
	K20	0.5		40	0.2	0.25	40		0.1	0.25	40		0.1	1.0	0.4	
	K21	1.5		60	0.9	0.25	60		0.15	0.25	60		0.15	2.0	1.2	
	TOTAL	21.5			11.45	5.75			2.75	2.75			1.05	a 30.0	e 15.2	
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	0.5		80	0.4					0.5	80		0.4	1.0	0.8	
	T2	2.0		40	0.8									2.0	0.8	
	T3	2.0		20	0.4									2.0	0.4	
	T4	2.0		80	1.6					1.0	80		0.8	3.0	2.4	
	T5	2.0		20	0.4									2.0	0.4	
	T6	0.5		80	0.4					0.5	80		0.4	1.0	0.8	
	T7	2.0		40	0.8					2.0	40		0.8	4.0	1.6	
	TOTAL	11.0			4.8					4.0			2.4	b 15.0	f 7.2	
UTILIZATION: Effectiveness of Technical Knowledge and Organization Direction Control and Accounting Factors	U1	2.0		60	1.2									2.0	1.2	
	U2	2.0		20	0.4									2.0	0.4	
	U3	2.0		80	1.6									2.0	1.6	
	U4	5.0		60	3.0									5.0	3.0	
	U5	2.0		40	0.8									2.0	0.8	
	U6	2.0		60	1.2									2.0	1.2	
	U7	4.0		20	0.8									4.0	0.8	M
	U8	1.0		80	0.8									1.0	0.8	
	U9	1.0		60	0.6									1.0	0.6	
	U10	1.0		20	0.2	1.0	20		0.2					2.0	0.4	
	U11	4.0		20	0.8									4.0	0.8	M
	U12	6.0		20	1.2									6.0	1.2	M
	U13	4.0		60	2.4									4.0	2.4	M
	U14	4.0		40	1.6	2.0	40		0.8					6.0	2.4	M
	U15	1.0								1.0				2.0		
	U16	3.0		20	0.6	1.0	20		0.2	1.0	20		0.2	5.0	1.0	M
	U17	2.0								1.0				3.0		
	U18	1.5		20	0.3					0.5	20		0.1	2.0	0.4	
	TOTAL	47.5			17.5	4.0			1.2	3.5			0.3	c 55	g 19.0	
GRAND TOTAL		80.0			33.7	9.75			3.95	10.25			3.75	d 100.0	h 41.4	

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* **PLANT NO.** *2* **EST. BY** **DATE** *4/6/21*

KEY ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste Good = 20% " Fair = 40% " Poor = 60% Waste Bad = 80% " a + b + c = d = 100% e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT: Assigned Points	MANAGEMENT: Est. % Waste		MANAGEMENT: Points Waste	LABOR: Assigned Points	LABOR: Est. % Waste		LABOR: Points Waste	OUTSIDE CONTACTS: Assigned Points	OUTSIDE CONTACTS: Est. % Waste		OUTSIDE CONTACTS: Points Waste	TOTAL WASTE: Assigned Points	TOTAL WASTE: Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	1	0												
	K2	3	0												
	K3	5	0												
	K4	4	0												
	K5	1	0												
	K6	3	0												
	K7	2	0												
	K8	1	0												
	K9	0	0												
	K10	0	0												
	K11	0	0												
	K12	4	0												
	K13	1	0												
	K14	1	0												
	K15	0	0												
	K16	0	0												
	K17	0	0												
	K18	0	0												
	K19	3	0												
	K20	1	0												
	K21	0	0												
	TOTAL	30												a	e 0
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	5		20	1.0										1.0
	T2	5		0	1.0										1.0
	T3	3		0											
	T4	5		0											
	T5	2		20											
	T6	2		20	0.40										0.4
	T7	5		0											
	TOTAL	27			2.40									b	f 2.4
UTILIZATION — Effectiveness of Technical Knowledge and Organization Direction, Control and Accounting Factors	U1	2		20	0.4										0.4
	U2	1		20											
	U3	1		0											
	U4	5		0											
	U5	5		0											
	U6	2		0											
	U7	5		40	2.0										2.0
	U8	1		0											
	U9	2		0											
	U10	0		0											
	U11	1		0											
	U12	3		0											
	U13	5		0											
	U14	2		60	1.2										1.2
	U15	1		0											
	U16	5		0											
	U17	1		0											
	U18	1		0											
	TOTAL	43			3.6									c	g 3.6
GRAND TOTAL		100			6.0									d	h 6.0

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* **PLANT NO.** 3 **EST. BY** *W. B. F.* **DATE** *3/17/21*

KEY
① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste, Good = 20% ", Fair = 40% ", Poor = 60% Waste, Bad = 80% "
④ + ⑧ + ⑫ = ⑭
a + b + c − d = 100%
e + f + g − h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT: Assigned Points		MANAGEMENT: Est. % Waste	MANAGEMENT: Points Waste	LABOR: Assigned Points		LABOR: Est. % Waste	LABOR: Points Waste	OUTSIDE CONTACTS: Assigned Points		OUTSIDE CONTACTS: Est. % Waste	OUTSIDE CONTACTS: Points Waste	TOTAL WASTE: Assigned Points	TOTAL WASTE: Points Waste	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	2.0		20	0.4									2.0	0.4	
	K2	2.0		40	0.8									2.0	0.8	
	K3	2.0		20	0.4									2.0	0.4	
	K4	1.0		20	0.2									1.0	0.2	
	K5															
	K6	1.0		20	0.2	1.0		20	0.2					2.0	0.4	
	K7	2.0		20	0.4									2.0	0.4	
	K8															
	K9	2.0		60	1.2									2.0	1.2	
	K10															
	K11	1.0		80	0.8									1.0	0.8	
	K12	2.0		60	1.2	1.0		60	0.6					3.0	1.8	
	K13	1.0		40	0.4	1.0		40	0.4	2.0		60	1.2	4.0	2.0	M
	K14									1.0				1.0		
	K15					1.0		40	0.4	1.0		40	0.4	2.0	0.8	
	K16	1.0		20	0.2	1.0		20	0.2					2.0	0.4	
	K17	1.0		60	0.6	2.0		80	1.6	1.0		40	0.4	4.0	2.6	M
	K18															
	K19	2.0		20	0.4									2.0	0.4	
	K20	1.0												1.0		
	K21	2.0		20	0.4									2.0	0.4	
	TOTAL	23 0			7.6	7.0			3.4	5.0			2.0	a 35.0	e 13.0	
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	2.0		40	0.8					2 0		60	1.2	4.0	2.0	M
	T2	2.0		20	0.4									2.0	0.4	
	T3	2.0		20	0.4									2.0	0.4	
	T4	3.0		40	1.2									3.0	1.2	
	T5	2.0		20	0.4									2.0	0.4	
	T6	2.0		20	0.4									2.0	0.4	
	T7	5.0		40	2.0					2.0		40	0.8	7.0	2.8	
	TOTAL	18 0			5.6					4.0			2.0	b 22.0	f 7.6	
UTILIZATION: Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	4.0		20	0.8									4.0	0.8	
	U2									2.0		80	1.6	2.0	1.6	
	U3	1.0		80	0.8									1.0	0.8	
	U4	3.0		60	1.8									3.0	1.8	
	U5	3.0		60	1.8									3.0	1.8	
	U6	1.0		60	0.6	2.0		60	1.2					3.0	1.8	
	U7	3.0		40	1.2									3.0	1.2	
	U8	1.0		60	0.6	1.0		60	0.6					2.0	1.2	
	U9	2.0		40	0.8									2.0	0.8	
	U10															X
	U11	3.0		40	1.2					2.0		40	0.8	5.0	2.0	
	U12	4.0		60	2.4									4.0	2.4	
	U13	3.0		60	1.8									3.0	1.8	
	U14	2.0		40	0.8									2.0	0.8	
	U15	2.0		20	0.4									2.0	0.4	
	U16	2.0		40	0.8					1.0		40	0.4	3.0	1.2	
	U17	1.0		40	0.4					1.0		40	0.4	2.0	0.8	
	U18	1.0		40	0.4									1.0	0.4	
	TOTAL	36.0			16.6	3.0			1.8	6.0			3.2	c 45.0	g 21.6	
GRAND TOTAL		75.0			29.8	10.0			5.2	15.0			7.2	d 100.0	h 42.2	

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* PLANT NO. 4 EST. BY DATE

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ — Excellent = 0% Waste; Good = 20% "; Fair = 40% "; Poor = 60% Waste; Bad = 80% " — a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	Est. % Waste 2	Est. % Waste 3	Points Waste 4	LABOR Assigned Points 5	Est. % Waste 6	Est. % Waste 7	Points Waste 8	OUTSIDE CONTACTS Assigned Points 9	Est. % Waste 10	Est. % Waste 11	Points Waste 12	TOTAL WASTE Assigned Points 13	TOTAL WASTE Points Waste 14	
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	1.0		80										1.0	0	
	K2	2.0		80	1.6									2.0	1.6	
	K3	1.0		80	0.8									1.0	0.8	
	K4	1.0		80	0.8									1.0	0.8	
	K5	1.0		20	0.2									1.0	0.2	
	K6	2.0		80	1.6									2.0	1.6	
	K7	3.0		80	2.4									3.0	2.4	
	K8	1.0		60	0.6									1.0	0.6	X
	K9	1.0		40	0.4									1.0	0.4	
	K10	1.0		0										1.0		
	K11	1.0		0										1.0		
	K12	2.0		80	1.6	2.0		80	1.6					4.0	3.2	
	K13	1.0		80	0.8									1.0	0.8	
	K14	1.0		0										1.0		
	K15	3.0		0										3.0		
	K16	2.0		0										2.0		
	K17	2.0		80	1.6	1.0		80	0.8					3.0	2.4	X
	K18	1.0		80	0.8									1.0	0.8	
	K19	1.0		80	0.8									1.0	0.8	
	K20	2.0		20	0.4									2.0	0.4	X
	K21	2.0		60	1.2									2.0	1.2	
	TOTAL	35.0			15.6	3.0			2.4					a 38.0	e 18.0	
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	6.0		60	3.6									6.0	3.6	
	T2	3.0		0										3.0		
	T3	1.0		60	0.6									1.0	0.6	
	T4	5.0		80	4.0									5.0	4.0	
	T5	2.0		0										2.0		
	T6	6.0		20	1.2									6.0	1.2	
	T7	6.0		80	1.6					4.0		80	3.2	6.0	4.8	X
	TOTAL	29.0			11.0					4.0			3.2	b 33.0	f 14.2	
UTILIZATION — Effectiveness of Technical Knowledge and Organization Direction, Control and Accounting Factors	U1	2.0		20	0.4									2.0	0.4	
	U2	1.0		20	0.2					3.0		20	0.6	4.0	0.8	X
	U3	2.0		80	1.6									2.0	1.6	
	U4	2.0		40	0.8									2.0	0.8	
	U5	2.0		40	0.8									2.0	0.8	
	U6	1.0		20	0.2									1.0	0.2	
	U7	1.0		80	0.8									1.0	0.8	
	U8	1.0		80	0.8									1.0	0.8	
	U9	1.0		20	0.2									1.0	0.2	
	U10	1.0		40	0.4									1.0	0.4	X
	U11	1.0		80	0.8									1.0	0.8	
	U12	1.0		80	0.8									1.0	0.8	
	U13	2.0		80	1.6									2.0	1.6	
	U14	1.0		20	0.2									1.0	0.2	
	U15	1.0		20	0.2									1.0	0.2	X
	U16	6.0		20	1.2									6.0	1.2	X
	U17	5.0		0										5.0		
	U18	2.0		0										2.0		
	TOTAL	36.0			11.0					3.0			0.6	c 39.0	g 11.6	
GRAND TOTAL		100.0			37.6	3.0			2.4	7.0			3.8	d 100.0	h 43.8	

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* **PLANT NO.** *5* **EST. BY** *P. G. S. Jr.* **DATE** *2/16/21*

KEY
① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste; Good = 20% „; Fair = 40% „; Poor = 60% Waste; Bad = 80% Waste; a + b + c = d = 100%
④ + ⑧ + ⑫ = ⑭ e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES — MANAGEMENT: Assigned Points 1	Est. % Waste 2	3	Points Waste 4	LABOR: Assigned Points 5	Est. % Waste 6	7	Points Waste 8	OUTSIDE CONTACTS: Assigned Points 9	Est. % Waste 10	11	Points Waste 12	TOTAL WASTE: Assigned Points 13	Points Waste 14	
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1													0		
	K2	4		40	1.6									4	1.6	M
	K3													0		
	K4	1		20	.2									1	.2	
	K5													0		
	K6													0		
	K7	4		60	2.4									4	2.4	M
	K8													0		
	K9	1		40	.4									1	.4	
	K10													0		
	K11													0		
	K12	2		20	.4					1		40	.4	3	.8	
	K13	2		20	.4					1		20	.2	3	.6	
	K14													0		
	K15	1		0										1		
	K16													0		
	K17													0		
	K18					1		20	.2					1	.2	
	K19													0		
	K20					1		20	.2					1	.2	
	K21	1		40	.4									1	.4	
	TOTAL	16			5.8	2			.4	2			.6	a 20	e 6.8	
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	5		40	2.0					3		40	1.2	8	3.2	M
	T2	5		40	2.0									5	2.0	
	T3	1		0										1		
	T4	6		40	2.4									6	2.4	M
	T5	2		20	.4	1		20	.2					3	.6	
	T6	4		20	.8									4	.8	
	T7	6		0						2		20	.4	8	.4	M
	TOTAL	29			7.6	1			.2	5			1.6	b 35	f 9.4	
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	7		60	4.2									7	4.2	M
	U2	1		0						1		20	.2	2	.2	
	U3													0		
	U4	6		40	2.4									6	2.4	M
	U5													0		
	U6	2		20	.4	1		20	.2					3	.6	
	U7	6		20	1.2									6	1.2	M
	U8													0		
	U9	2		40	.8									2	.8	
	U10	1		20	.2	1		0						2	.2	
	U11	3		40	1.2					3		60	1.8	6	3.0	M
	U12	1		0										1		
	U13	2		0										2		
	U14	1		0										1		
	U15	1		20	.2					1		20	.2	2	.4	
	U16	2		0		1		40	.4					3	.4	X
	U17	1		0										1		
	U18	1		0										1.		
	TOTAL	37			10.6	3			.6	5			2.2	c 45	g 13.4	
GRAND TOTAL		82			24	6			1.2	12			4.4	d 100	h 29.6	

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* PLANT NO. *6* EST. BY *C.S.B* DATE

KEY
① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste, Good = 20% ", Fair = 40% " Poor = 60% Waste, Bad = 80% Waste a + b + c = d = 100%
④ + ⑧ + ⑫ = ⑭ e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT: Assigned Points	Est % Waste		Points Waste	LABOR: Assigned Points	Est. % Waste		Points Waste	OUTSIDE CONTACTS: Assigned Points	Est. % Waste		Points Waste	TOTAL WASTE: Assigned Points	Points Waste	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
ORGANIZATION. Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	1		20	.2									1	.2	
	K2	5		40	2									5	2.0	M
	K3	1		80	.8									1	.8	
	K4	1		20	.2									1	.2	
	K5	4		80	3.2									4	3.2	M
	K6	1		60	.6									1	.6	
	K7	1		60	.6									1	.6	
	K8	1		60	.6									1	.6	
	K9	1		60	.6									1	.6	
	K10	1		40	.4									1	.4	
	K11	1		40	.4									1	.4	
	K12	1		80	.8	2		80	1.6					1	2.4	
	K13	1		80	.8									1	.8	
	K14	1		20	.2									1	.2	
	K15	3		0										3		
	K16	1		0										1		
	K17	1		0										1		
	K18	1		0										1		
	K19	4		0										4		M
	K20	1		60	.6									1	.6	
	K21	0		80												
	TOTAL	34			12	2			1.6					a 36	e 13.6	
TECHNICAL. Available Engineering Knowledge as to Product, Plant and Materials	T1	6		0										6		M
	T2	2		80	1.6									2		
	T3	1		60	.6									1		
	T4	6		80	4.8									6		M
	T5	3		40	1.2									3		
	T6	2		0										2		
	T7	6		0						2		20	.4	6	.4	M
	TOTAL	28			8.2					2			.4	b 30	f 8.6	
UTILIZATION. Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	1		20	.2									1		
	U2	2		0						2		20	.4	2	.4	M
	U3	1		80	.8									1		
	U4	1		80	.8									1		
	U5	6		80	4.8									6		M
	U6	1		40	.4									1		
	U7	1		80	.8									1		
	U8	1		80	.8									1		
	U9	3		80	2.4									3		
	U10	1		40	.4									1		
	U11	1		20	.2									1		
	U12	5		80	4.0									5		M
	U13	2		80	1.6									2		
	U14	1		40	.4									1		
	U15	1		20	.2									1		
	U16	6		0										6		M
	U17	1		0										1		
	U18	1		0										1		
	TOTAL	38			17.8					2			.4	c 40	g 18.2	
GRAND TOTAL		100			37.0	2			1.6	4			.8	d	h 39.4	

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* PLANT NO. *7* EST. BY *P. G. S. Jr.* DATE

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ ; Excellent = 0% Waste, Good = 20% Waste, Fair = 40% Waste, Poor = 60% Waste, Bad = 80% Waste ; a + b + c = d = 100% ; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	MANAGEMENT Est. % Waste 2	3	MANAGEMENT Points Waste 4	LABOR Assigned Points 5	LABOR Est. % Waste 6	7	LABOR Points Waste 8	OUTSIDE CONTACTS Assigned Points 9	OUTSIDE CONTACTS Est. % Waste 10	11	OUTSIDE CONTACTS Points Waste 12	TOTAL WASTE Assigned Points 13	TOTAL WASTE Points Waste 14	
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1													0		
	K2	4	20		.8									4	.8	M
	K3													0		
	K4	2	0											2		
	K5	1	0											1		
	K6													0		
	K7	3	20		.6									3	.6	
	K8													0		
	K9	1	20		.2									1	.2	
	K10													0		
	K11													0		
	K12	1	20		.2	2	20		.4	1	20		.2	4	.8	M
	K13	2	0			1	0			1	0			4		
	K14													0		
	K15	1	0							1	20		.2	2	.2	
	K16													0		
	K17													0		
	K18													1	.2	
	K19	1	20		.2	1	20		.2					1	.2	
	K20	1	20		.2									1	.2	
	K21	1	20		.2									1	.2	
	TOTAL	18			2.4	4			.6	3			.4	a 25	e 3.4	
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	5	0							2	0			7		M
	T2	4	20		.8									4	.8	
	T3	2	40		.8									2	.8	
	T4	6	0											6		M
	T5	3	20		.6									3	.6	
	T6	5	0											5		
	T7	6	0							2	20		.4	8	.4	M
	TOTAL	31			2.2	0			0	4			.4	b 35	f 2.6	
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	5	40		2.0									5	2.0	M
	U2	1	0							1	20		.2	2	.2	
	U3	1	60		.6									1	.6	
	U4	7	40		2.8									7	2.8	M
	U5	2	40		.8									2	.8	
	U6	1	0											1		
	U7	5	40		2.0									5	2.0	M
	U8													0		
	U9	1	0											1		
	U10	1	40		.4									1	.4	
	U11	1	20		.2					2	40		.8	3	1.0	
	U12	1	0											1		
	U13	1	0											1		
	U14	1	0											1		
	U15	1	0											1		
	U16	4	0											4		M
	U17	2	40		.8									2	.8	
	U18	2	0											2		
	TOTAL	37			9.6	0			0	3			1.0	c 40	g 10.6	
GRAND TOTAL		86			14.2	4			6	10			1.8	d 100	h 16.6	

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* PLANT NO. *8* EST. BY *H.J.B.* DATE *4/6/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭
Excellent = 0% Waste; Good = 20% "; Fair = 40% "; Poor = 60% Waste; Bad = 80% Waste
a + b + c = d = 100%
e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	2	Est. % Waste 3	Points Waste 4	LABOR Assigned Points 5	Est. % Waste 6	7	Points Waste 8	OUTSIDE CONTACTS Assigned Points 9	Est. % Waste 10	11	Points Waste 12	TOTAL WASTE Assigned Points 13	TOTAL WASTE Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	1		0										1	0
	K2	2		0										2	0
	K3	1		40	.4									1	.4
	K4	2		60	1.2									2	1.2
	K5	2		40	.8									2	.8
	K6	1		0										1	0
	K7	1.5		0		.5	0							2	0
	K8	1		0										1	0
	K9	1.5		20	.3	.25	20		.05	.25	20		.05	2	.4
	K10	1.5		0		.5	0							2	0
	K11	.5		20	.1	.5	20		.1					1	.2
	K12	3.5		40	1.4	1.5	40		.6					5	2.0
	K13	1.5		20	.3	.25	20		.05	.25	20		.05	2	.4
	K14	1.5		20	.3	.25	20		.05	.25	20		.05	2	.4
	K15													0	0
	K16													0	0
	K17	1		20	.2	1.5	20		.3	.5	20		.1	3	.6
	K18	1.5		20	.3	.5	20		.1					2	.4
	K19	1.5		20	.3	.5	20		.1					2	.4
	K20													0	0
	K21	1		0		.5	0			.5				2	0
	TOTAL	26.5			5.6	6.75			1.35	1.75			.25	a 35	e 7.2
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	.5		20	.1					.5	20		.1	1	.2
	T2	2		20	.4									2	.4
	T3	2		20	.4									2	.4
	T4	1.5		60	.9					.5	60		.3	2	1.2
	T5	1		20	.2									1	.2
	T6	.5		20	.1					.5	20		.1	1	.2
	T7	4		20	.8					.2	20		.4	6	1.2
	TOTAL	11.5			2.9	0			0	3.5			.9	b 15	f 3.8
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	1		40	.4									1	.4
	U2	1		20	.2									1	.2
	U3	1		80	.8									1	.8
	U4	5		20	1									5	1.
	U5	2		20	.4									2	.4
	U6	1		20	.2									1	.2
	U7	4		20	.8									4	.8
	U8	2		60	1.2									2	1.2
	U9	2		40	.8									2	.8
	U10	1		20	.2	1	20		.2					2	.4
	U11	3		20	.6									3	.6
	U12	6		20	1.2									6	1.2
	U13	3		20	.6									3	.6
	U14	4		20	.8	1	20		.2					5	1
	U15	1.5		0						.5	0			2	0
	U16	3		20	.6	1.5	20		.3	.5	20		.1	5	1
	U17	2		0						1.0	0			3	0
	U18	1.5		20	.3					.5	20		.1	2	.4
	TOTAL	44			10.1	3.5			7	2.5			.2	c 50	g 11
GRAND TOTAL		82	–		18.6	10.25			2.05	2.75			1.35	d 100	h 22

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* **PLANT NO.** *9* **EST. BY** *P.G.S.* **DATE** *3/15/21*

KEY ①+⑤+⑨=⑬ ④+⑧+⑫=⑭ Excellent = 0% Waste, Good = 20% Waste, Fair = 40% Waste, Poor = 60% Waste, Bad = 80% Waste. a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT Assigned Points	Est. % Waste		Points Waste	LABOR Assigned Points	Est. % Waste		Points Waste	OUTSIDE CONTACTS Assigned Points	Est. % Waste		Points Waste	TOTAL WASTE Assigned Points	Points Waste	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	1		80	.8									1	.8	
	K2	4		20	.8									4	.8	M
	K3													0		
	K4	1		40	.4									1	.4	
	K5	1		0	0									1		
	K6	1		60	.6									1	.6	
	K7	3		80	2.4									3	2.4	
	K8													0		
	K9	1		60	.6									1	.6	
	K10													0		
	K11													0		
	K12	3		40		1		20	.2					4	.2	M
	K13	1		0						1		20	.2	2	.2	
	K14													0		
	K15					1		0						1		
	K16													0		
	K17					1		0						1		
	K18									1		40	.4	1	.4	
	K19	4		0										4		M
	K20					1		0						1		
	K21	1		0										1		
	TOTAL	21			5.6	4			.2	2			.6	a 27	e 6.4	
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	2		0						3		20	.6	5	.6	M
	T2	3		40	1.2									3	1.2	
	T3	1		0										1		
	T4	5		0										5		M
	T5	2		0										2		
	T6	4		0										4		
	T7	6		0						1		0		7		M
	TOTAL	23			1.2					4			.6	b 27	f 1.8	
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	3		60	1.8									3	1.8	
	U2	1		0						1		0		2		
	U3	1		20	.2									1	.2	
	U4	6		60	3.6									6	3.6	M
	U5	1		0										1		
	U6					1		0						1		
	U7	5		60	3									5	3	M
	U8	1		20	.2									1	.2	
	U9	3		20	.6									3	.6	
	U10	2		40	.8									2	.8	
	U11									2		0		2		
	U12	1		0										1		
	U13	2		0										2		
	U14	1		0										1		
	U15	1		20	.2									1	.2	
	U16	4		0		1		0						5		M
	U17	2		0						1		0		3		
	U18	6		0										6		M
	TOTAL	40			10.4	2			0	4			0	c 46	g 10.4	
GRAND TOTAL		84			17.2	6			.2	10			1.2	d 100	h 18.6	

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* PLANT NO. *10* EST. BY *P.G.S. Jr.* DATE

KEY: ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste, Good = 20% ″, Fair = 40% ″, Poor = 60% Waste, Bad = 80% Waste. a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	Management: Assigned Points	Management: Est. % Waste		Management: Points Waste	Labor: Assigned Points	Labor: Est. % Waste		Labor: Points Waste	Outside Contacts: Assigned Points	Outside Contacts: Est. % Waste		Outside Contacts: Points Waste	Total Waste: Assigned Points	Total Waste: Points Waste	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1													0		
	K2	4		20	.8									4	.8	M
	K3													0		
	K4	1		0										1		
	K5	1		0										1		
	K6	1		40	.4									1	.4	M
	K7	5		60	3.0									5	3.0	
	K8													0		
	K9	1		40	.4									1	.4	
	K10													0		
	K11													0		
	K12	1		40	.4	2		40	.8	1		20	.2	4	1.4	M
	K13					1		20	.2	2		20	.4	3	.6	
	K14	1		0		1		0						2		
	K15													0		
	K16					1		0						1		
	K17					1		0						1		
	K18					1		20	.2					1	.2	
	K19	2		40	.8									2	.8	
	K20	1		0										1		
	K21	2		20	.4									2	.4	
	TOTAL	20			6.2	7			1.2	3			.6	a 30	e 8.0	
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	2		0						2		20	.4	4	.4	
	T2	3		20	.6									3	.6	
	T3	1		0										1		
	T4	4		20	.8									4	.8	
	T5	2		0										2		
	T6	3		20	.6									3	.6	
	T7	6		0						2		0		8		M
	TOTAL	21			2.0					4			.4	b 25	f 2.4	
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	3		60	1.8									3	1.8	
	U2	1		0						2		20	.4	3	.4	
	U3	1		20	.2									1	.2	
	U4	8		60	4.8									8	4.8	M
	U5	1		20	.2									1	.2	
	U6	1		0		1		20	.2					2	.2	
	U7	6		60	3.6									6	3.6	M
	U8													0		
	U9	1		20	.2	1		0						2	.2	
	U10	1		20	.2									1	.2	
	U11	1		0						3		40	1.2	4	1.2	M
	U12	1		0										1		
	U13	1		0										1		
	U14	1		20	.2									1	.2	
	U15	1		0										1		
	U16	4		0		1		0						5		M
	U17	2		0						1				3		
	U18	2		0										2		
	TOTAL	36			11.2	3			.2	6			1.6	c 45	g 13.0	
GRAND TOTAL		77			19.4	10			1.4	13			2.6	d 100	h 23.4	

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* PLANT NO. *11* EST. BY *H.J.B.* DATE *4/6/21*

KEY ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste Good = 20% " Fair = 40% " Poor = 60% Waste Bad = 80% Waste a + b + c = d = 100% e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES — MANAGEMENT: Assigned Points	Est. % Waste		Points Waste	LABOR: Assigned Points	Est. % Waste		Points Waste	OUTSIDE CONTACTS: Assigned Points	Est. % Waste		Points Waste	TOTAL WASTE: Assigned Points	Points Waste	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	1		0										1	0	
	K2	2		0										2	0	
	K3	1		60	.6									1	6	
	K4	2		60	1.2									2	1.2	
	K5	2		40	.8									2	.8	
	K6	1		0										1	0	
	K7	1.5		0		.5		0						2	0	
	K8	1		0										1	0	
	K9	1.5		0		.25		0		.25	0			2	0	
	K10	2		0		1		0						3	0	
	K11	.5		0		.5		0						1	0	
	K12	3		40	1.2	1		40	.4					4	1.6	M
	K13	1		20	.2	.5		20	.1	.5	20		.1	2	.4	
	K14	1		0		.5		0		.5	0			2	0	
	K15													0	0	
	K16													0	0	
	K17	1.5		0		.5		0						2	0	
	K18	1.5		0		.5		0						2	0	
	K19	1.5		0		.5		0						2	0	
	K20	.5		0		.25		0		.25	0			1	0	
	K21	1.5		0		.25		0		.25	0			2	0	
	TOTAL	27			4	6.25			.5	1.75			.1	a 35	e 4.6	
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	5		20	.1					.5	20		.1	1	.2	
	T2	3		20	.6									3	.6	
	T3	2		20	.4									2	.4	
	T4	2.5		0						.5	0			3	0	
	T5	2		20	.4									2	.4	
	T6	2		20	.4					1	20		.2	3	.6	
	T7	3		0						3	0			6	0	
	TOTAL	15			1.9	0				5			.3	b 20	f 2.2	
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	1		40	.4									1	.4	
	U2													0	0	
	U3	1		80	.8									1	.8	
	U4	5		20	1									5	1.	M
	U5	1		0										1	0	
	U6	1		0										1	0	
	U7	4		20	.8									4	.8	M
	U8	1		60	.6									1	.6	
	U9	1		20	.2									1	.2	
	U10	.5		20	.1	.5	20		.1					1	.2	
	U11	3		0										3	0	
	U12	5		0										5	0	M
	U13	4		0										4	0	M
	U14	4		20	.8	1	20		.2					5	1.	M
	U15	.5		20	.1					.5	20		.1	1	.2	
	U16	4		0		1.5	0			.5	0			6	0	M
	U17	1.5		0						1.5	0			3	0	
	U18	1.5		0						.5	0			2	0	
	TOTAL	39			4.8	3			.3	3			.1	c 45	g 5.2	
GRAND TOTAL		81			10.7	9.25			.8	9.75			.5	d 100	h 12.0	

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* **PLANT NO.** *12* **EST. BY** *H. J. B.* **DATE** *4/6/21*

KEY ① + ⑤ + ⑨ = ⑬ ④ + ⑧ + ⑫ = ⑭ Excellent = 0% Waste, Good = 20% ", Fair = 40% ", Poor = 60% Waste, Bad = 80% Waste a + b + c = d = 100% e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT: Assigned Points 1	Est. % Waste 2	3	Points Waste 4	LABOR: Assigned Points 5	Est. % Waste 6	7	Points Waste 8	OUTSIDE CONTACTS: Assigned Points 9	Est. % Waste 10	11	Points Waste 12	TOTAL WASTE: Assigned Points 13	Points Waste 14	
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1													0		
	K2	1		80	.8									1	.8	
	K3													0	0	
	K4	2		80	1.6									2	1.6	
	K5													0	0	
	K6	1		80	.8									1	.8	
	K7	1		80	.8	1	80		.8					2	1.6	
	K8													0	0	
	K9	.5		80	.4	.25	80		.2	.25	80		.2	1	.8	
	K10	2		40	.8	1	40		.4					3	1.2	
	K11	1.5		80	1.2	.5	80		.4					2	1.6	
	K12	3.5		80	2.8	1.5	60		1.2					5	4	
	K13	2		40	.8	1	40		.4	1	40		.4	4	1.6	
	K14	2		60	1.2	.5	60		.3	.5	60		.3	3	1.8	
	K15													0	0	
	K16													0	0	
	K17	3		60	1.8	2	60		1.2					5	3	M
	K18	3.5		0		1.5	0							5	0	M
	K19	.5		60	.3	.5	60		.3					1	.6	
	K20													0	0	
	K21													0	0	
	TOTAL	23.5			13.3	9.75			5.2	1.75			.9	a 35	e 19.4	
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	1		20	.2					1	20		.2	2	.4	
	T2	2		80	1.6									2	1.6	
	T3	1		40	.4									1	.4	
	T4	1.5		80	1.2					.5	80		.4	2	1.6	
	T5													0	0	
	T6	1.5		80	1.2					.5	80		.4	2	1.6	
	T7	4		20	.8					2	20		.4	6	1.2	M
	TOTAL	11			5.4	0				4			1.4	b 15	f 6.8	
UTILIZATION: Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	2		80	1.6									2	1.6	
	U2	1		20	.2									1	.2	
	U3	2		80	1.6									2	1.6	
	U4	4		60	2.4									4	2.4	M
	U5	2		40	.8									2	.8	
	U6	2		60	1.2									2	1.2	
	U7	5		80	4.0									5	4	M
	U8	2		80	1.6	1	60		.6					2	1.6	
	U9	2		80	1.6									2	1.6	
	U10	1		60	.6									2	1.2	
	U11	4		60	2.4									4	2.4	M
	U12	4		80	3.2									4	3.2	M
	U13	2		80	1.6									2	1.6	
	U14	1.5		60	.9	.5	60		.3					2	1.2	
	U15	1.5		80	1.2					.5	80		.4	2	1.6	
	U16	4		40	1.6	.5	40		.2	1.5	40		.6	6	2.4	M
	U17	2.5		20	.5					1.5	20		.3	4	.8	
	U18	1.5		40	.6					.5	40		.2	2	.8	
	TOTAL	44			27.6	2			1.1	4			1.5	c 50	g 30.2	
GRAND TOTAL		78.5			46.3	11.75			6.3	9.75			3.8	d 100	h 56.4	

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* **PLANT NO.** *13* **EST. BY** *C.S.B. W.B.F.* **DATE** *4/11/21*

KEY
① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste, Good = 20% Waste, Fair = 40% Waste
④ + ⑧ + ⑫ = ⑭ Poor = 60% Waste, Bad = 80% Waste
a + b + c = d = 100%
e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT: Assigned Points	Est. % Waste		Points Waste	LABOR: Assigned Points	Est. % Waste		Points Waste	OUTSIDE CONTACTS: Assigned Points	Est. % Waste		Points Waste	TOTAL WASTE: Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	1		0	0									1	
	K2	3		20	.6									3	.6
	K3	1		0	0									1	
	K4	1		20	.2									1	.2
	K5	1		0	0									1	
	K6	1		20	.2									1	.2
	K7	2		40	.8									2	.8
	K8	1		20	.2									1	.2
	K9	1		20	.2									1	.2
	K10	1		0										1	
	K11	1		0										1	
	K12	2		80	1.6	2		80	1.6					4	3.2
	K13	1		40	.4	1		40	.4	2		40	.8	4	1.6
	K14	1		20	.2									1	.2
	K15	1		0										1	
	K16	1		0										1	
	K17	2		60	1.2	2		60	1.2	2		60	1.2	6	3.6
	K18	1		0										1	
	K19	2		0										2	
	K20	1		80	1.6									1	1.6
	K21	1		40	.8									1	.8
	TOTAL	27			8.0	5			3.2	4			2.0	a 36	e 13.2
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	4		20	.8									4	.8
	T2	4		20	.8									4	.8
	T3	2		0										2	
	T4	4		20	.8									4	.8
	T5	3		0										3	
	T6	2		20	.4									2	.4
	T7	6		20	1.2					2		20	.4	8	1.6
	TOTAL	25			4.0					2			.4	b 27	f 4.4
UTILIZATION — Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	2		0										2	
	U2			0						2		40	.8	2	.8
	U3														
	U4	3		60	1.8									3	1.8
	U5	3		40	1.2									3	1.2
	U6	1		0										1	
	U7	3		80	2.4									3	2.4
	U8	1		80	.8	1		80	.8					2	1.6
	U9	1		40	.4									1	.4
	U10	1		0										1	
	U11	2		20	.4					1		20	.2	3	.6
	U12	5		20	1.0									5	1.0
	U13	4		40	1.6									4	1.6
	U14	2		20	.4									2	.4
	U15	1		0										1	
	U16	2		40	.8									2	.8
	U17	1		0										1	
	U18	1		40	.4									1	.4
	TOTAL	33			11.2	1			.8	3			1.0	c 37	g 13.0
GRAND TOTAL		85			23.2	6			4.0	9			3.4	d 100	h 30.6

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* **PLANT NO.** *14* **EST. BY** *P.G.S.Jr.* **DATE** *3/11/21*

KEY			
① + ⑤ + ⑨ = ⑬	Excellent = 0% Waste	Poor = 60% Waste	a + b + c = d = 100%
④ + ⑧ + ⑫ = ⑭	Good = 20% "	Bad = 80% Waste	e + f + g = h = % Waste
	Fair = 40% "		

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES — MANAGEMENT: Assigned Points	Est. % Waste		Points Waste	LABOR: Assigned Points	Est. % Waste		Points Waste	OUTSIDE CONTRACTS: Assigned Points	Est. % Waste		Points Waste	TOTAL WASTE: Assigned Points	Points Waste	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1													0		
	K2	6		0										6		M
	K3													0		
	K4	2		0										2		
	K5													0		
	K6	2		20	.4									2	.4	
	K7	5		40	2									5	2.0	M
	K8													0		
	K9	1		20	.2									1	.2	
	K10													0		
	K11													0		
	K12	2		20	.4	1		60	.6	1		60	.6	4	1.6	M
	K13	2		0		2		20	.4	1		60	.6	5	1.0	M
	K14					1		0		1		0		2		
	K15													0		
	K16					1		60	.6					1	.6	
	K17					1		0						1		
	K18					1		20	.2					1	.2	
	K19	2		60	1.2									2	1.2	
	K20	1		40	.4									1	.4	
	K21	2		40	.8									2	.8	
	TOTAL	25			5.4	7			1.8	3			1.2	a 35	e 8.4	
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	3		20	.6					1		0		4	.6	
	T2	1		20	.2									1	.2	
	T3	1		0										1		
	T4	5		20	1.0									5	1.0	
	T5	1		0										1		
	T6	2		20	.4									2	.4	
	T7	5		20	1.0					1		40	.4	6	1.4	M
	TOTAL	18			3.2	0				2			.4	b 20	f 3.6	
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	5		20	1									5	1.0	M
	U2	2		0						1		40	.4	3	.4	
	U3	1		0										1		
	U4	8		20	1.6									8	1.6	M
	U5	1		20	.2									1	.2	
	U6	1		0		1		20	.2					2	.2	
	U7	6		40	2.4									6	2.4	M
	U8													0		
	U9	3		0		1		0						4		M
	U10	2		0										2		
	U11	1		0						2		40	.8	3	.8	
	U12	1		0										1		
	U13	1		20	.2									1	.2	
	U14	1		0										1		
	U15									1		40	.4	1	.4	
	U16	1		0		1		0						2		
	U17	1		20	.2					1		0		2	.2	
	U18	2		0										2		
	TOTAL	37			5.6	3			.2	5			1.6	c 45	g 7.4	
GRAND TOTAL		80			14.2	10			2.0	10			3.2	d 100	h 19.4	

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* PLANT NO. *15* EST. BY *H. J. B.* DATE *4/6/21*

KEY
①+⑤+⑨ = ⑬ Excellent = 0% Waste, Good = 20% Waste, Fair = 40% Waste, Poor = 60% Waste, Bad = 80% Waste
④+⑧+⑫ = ⑭
a + b + c = d = 100%
e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT				LABOR				OUTSIDE CONT ACTS				TOTAL WASTE		
		Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est % Waste		Points Waste	Assigned Points	Points Waste	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	1		0										1		
	K2	2		20	.4									2	.4	
	K3	1		60	.6									1	.6	
	K4	1		60	.6									1	.6	
	K5	1		80	.8									1	.8	
	K6	2		0										2	0	
	K7	1.5		40	.6	.5	40		.2					2	.8	
	K8	1		0										1	0	
	K9	1		20	.2	.5	20		.1	.5	20		.1	2	.4	
	K10	1.5		0		.5	0							2	0	
	K11	0.5		20	.1	.5	20		.1					1	.2	
	K12	4		60	2.4	1	60		.6					5	3.0	
	K13	1		40	.4	.5	40		.2	.5	40		.2	2	.8	
	K14	1		20	.2	.5	20		.1	.5	20		.1	2	.4	
	K15													0	0	
	K16													0	0	
	K17	1.5		20	.3	1	20		.2					2.5	.5	
	K18	1.5		0		1	0							2.5	0	
	K19	1.5		40	.6	.5	40		.2					2	.8	
	K20	0.5		20	.1	.25	20		.05	.25	20		.05	1	.2	
	K21	1.5		20	.3					.5	20		.1	2	.4	
	TOTAL	26			7.6	6.75			1.75	2.25			0.55	a 35	e 9.9	
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	1.5		20	.3					.5	20		.1	2	.4	
	T2	3		40	1.2									3	1.2	
	T3	2		20	.4									2	.4	
	T4	2.5		20	.5					.5	20		.1	3	.6	
	T5	2		20	.4									2	.4	
	T6	1.5		60	.9					.5	60		.3	2	1.2	
	T7	3.5		0						2.5	0			6	0	M
	TOTAL	16			3.7	0				4			.5	b 20	f 4.2	
UTILIZATION: Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	1		60	.6									1	.6	
	U2													0	0	
	U3	1		80	.8									1	.8	
	U4	6		20	1.2									6	1.2	M
	U5	1		0										1	0	
	U6	2		0										2	0	
	U7	4		20	.8									4	.8	M
	U8	1		60	.6									1	.6	
	U9	1		40	.4									1	.4	
	U10	.5		20	.1	.5	20		.1					1	.2	
	U11	4		40	1.6									4	1.6	M
	U12	5		0										5	0	M
	U13	3		20	.6									3	.6	
	U14	3		20	.6	1	20		.2					4	.8	M
	U15	.5		20	.1					.5	20		.1	1	.2	
	U16	2.5		20	.5	1.5	20		.3	1	20		.2	5	1	M
	U17	2		0						1	0			3	0	
	U18	1.5		0						.5	0			2	0	
	TOTAL	39			7.9	3			.6	3			.3	c 45	g 8.8	
GRAND TOTAL		81			19.2	9.15			2.35	9.25			1.35	d 100	h 22.9	

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* **PLANT NO.** *41* **EST. BY** **DATE** *3/28/21*

KEY

(1) + (5) + (9) = (13) Excellent = 0% Waste; Good = 20% Waste; Fair = 40% Waste; Poor = 60% Waste; Bad = 80% Waste

(4) + (8) + (12) = (14)

a + b + c = d = 100%

e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES												TOTAL WASTE	
		MANAGEMENT				LABOR				OUTSIDE CONT ACTS					
		Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1	1.5		20	.300	0		0	0	0		0	0		
	K2	2.0		20	.400	0		0	0	0		0	0		
	K3	1.5		40	.600	0		0	0	0		0	0		
	K4	1.5		40	.600	0		0	0	0		0	0		
	K5	2.0		20	.400	0		0	0	0		0	0		
	K6	1.5		20	.300	0		0	0	0		0	0		
	K7	1.5		20	.300	1		20	.200	0		0	0		
	K8	1.0		40	.400	1		80	.800	5		80	4.00		
	K9	1.0		40	.400	0.5		20	.100	0		0	0		
	K10	1.0		20	.200	1		60	.600	0		0	0		
	K11	1.0		40	.400	0.5		20	.100	0		0	0		
	K12	1.0		60	.600	1		40	.400	0		0	0		
	K13	1.5		20	.300	1		40	.400	0		0	0		
	K14	1.0		20	.200	1		20	.200	0		0	0		
	K15	1.0		0	.000	1		0	.000	0		0	0		
	K16	1.0		0	.000	1		0	.000	0		0	0		
	K17	1.0	20		.200	1		20	.200	1		40	40		
	K18	0.5	20		.100	1		20	.200	1		40	400		
	K19	1.5		20	.300	0		0	.000	0		0	0		
	K20	0.8	40		.320	1		20	.200	0		0	0		
	K21	0.2	20		.400	1		20	.200	0		0	0		
	TOTAL	25			6.72	13			3.60	7			4.8	a 45	e 15.12
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	1.0		0	0	0		0	0	1.0		20	.200		
	T2	1.0		40	.400	0		0	0	0		0	0		
	T3	1.0		40	.400	0		0	0	0		0	0		
	T4	1.0		40	.400	0		0	0	0		0	0		
	T5	1.0		20	.200	0		0	0	0		0	0		
	T6	1.0		40	.400	0		0	0	0		0	0		
	T7	1.5		40	.600	0		0	0	1.5		20	.300		
	TOTAL	7.5			2.4	0			0	2.5			0.5	b 10	f 2.9
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	2.0		80	1.60	0		0		1		60	.60		
	U2	2.0		40	0.80	0		0		1		40	.40		
	U3	1.5		20	0.30	0		0		0		0	0		
	U4	2.0		20	0.40	0		0		0		0	0		
	U5	1.5		20	0.30	0		0		0		0	0		
	U6	1.5		20	0.30	0		0		0		0	0		
	U7	2.5		80	2.00	0		0		1		60	60		
	U8	1.5		20	0.30	1		20	0.20	0		0	0		
	U9	3.0		40	1.20	2		60	1.20	0		0	0		
	U10	3.0		40	1.20	2		60	1.20	0		0	0		
	U11	2.0		20	0.40	0		0	0.00	0		0	0		
	U12	2.0		20	0.40	0.5		20	0.10	0		0	0		
	U13	1.5		20	0.30	0.5		20	0.10	0		0	0		
	U14	1.5		20	0.30	0.5		20	0.10	0		0	0		
	U15	2.0		20	0.40	0.1		20	0.02	0		0	0		
	U16	2.0		20	0.40	0.2		40	0.08	0		0	0		
	U17	2.0		20	0.40	0.1		20	0.02	0		0	0		
	U18	2.0		20	0.40	0.1		20	0.02	0		0	0		
	TOTAL	35			11.4	7			3.04	3			1.60	c 45	g 16.04
GRAND TOTAL		67.5			20.52	20			6.64	12.5			6.90	d 100	h 34.06

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Metal Trades* PLANT NO. EST. BY DATE

KEY: (1) + (5) + (9) = (13) Excellent = 0% Waste; Good = 20% Waste; Fair = 40% Waste; Poor = 60% Waste; Bad = 80% Waste; a + b + c = d = 100%
(4) + (8) + (12) = (14); e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT				LABOR				OUTSIDE CONTACTS				TOTAL WASTE	
		Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1				0.16				0				0		0.16
	K2				0.71				0				0		0.71
	K3				0.31				0				0		0.31
	K4				0.50				0				0		0.50
	K5				0.46				0				0		0.46
	K6				0.37				0.01				0		0.38
	K7				1.04				0.09				0		1.13
	K8				0.15				0.05				0.25		0.45
	K9				0.37				0.04				0.03		0.44
	K10				0.09				0.06				0		0.15
	K11				0.21				0.07				0		0.28
	K12				1.05				0.69				0.09		1.83
	K13				0.31				0.07				0.26		0.64
	K14				0.18				0.06				0.05		0.29
	K15				0.00				0.03				0.04		0.07
	K16				0.01				0.05				0		0.06
	K17				0.38				0.35				0.14		0.87
	K18				0.09				0.08				0.06		0.23
	K19				0.33				0.06				0		0.39
	K20				0.24				0.03				0.09		0.36
	K21				0.36				0.02				0.02		0.40
	TOTAL				7.32				1.76				1.03	a	e 10.11
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1				0.62				0				0.28		0.90
	T2				0.85				0				0		0.85
	T3				0.30				0				0		0.30
	T4				1.23				0				0.10		1.33
	T5				0.26				0.01				0		0.27
	T6				0.48				0				0.09		0.57
	T7				0.55				0				0.49		1.04
	TOTAL				4.29				0.01				0.96	b	f 5.26
UTILIZATION — Effectiveness of Technical Knowledge and Organization Direction, Control and Accounting Factors	U1				1.15				0				0		1.15
	U2				0.11				0				0.31		0.42
	U3				0.63				0				0		0.63
	U4				1.84				0				0		1.84
	U5				0.76				0				0		0.76
	U6				0.28				0.11				0		0.39
	U7				1.79				0				0		1.79
	U8				0.52				0.10				0		0.62
	U9				0.64				0.08				0		0.72
	U10				0.30				0.15				0		0.45
	U11				0.61				0				0.35		0.96
	U12				0.89				0.06				0		0.95
	U13				0.77				0.06				0		0.83
	U14				0.51				0.11				0		0.62
	U15				0.19				0				0.08		0.27
	U16				0.41				0.09				0.09		0.59
	U17				0.14				0				0.04		0.18
	U18				0.15				0				0.02		0.17
	TOTAL				11.69				0.76				0.89	c	g 13.34
GRAND TOTAL					23.30				2.53				2.88	d	h 28.71

CHAPTER X

THE TEXTILE INDUSTRY

By W. R. Basset

Size of the Textile Industry.—The textile industry, in which are included the makers of fabric for wearing apparel, carpets, draperies, blankets, sheetings and all other woven, knitted and felted fabrics, leads all other industries in the number of establishments employing more than 250 hands each. It leads all industries in the number of plants the product of which has a value of more than $1,000,000. It is second only to the steel and iron industry in the amount of capital represented, which is now conservatively estimated at $3,500,000,000. According to the 1914 census, the value of its products was $3,414,615,000. The estimate is made that in 1920 the value of its products was very close to $7,000,000,000, of which $499,279,939 was exported. Textile plants are scattered from coast to coast and number 12,964. The prosperity and buying power of the managers and workers in the textile industry is, therefore, important to the prosperity of American industry as a whole.

Scope and Limitations of Investigation.—In order to obtain an idea of the sources of waste in the textile industry, an assay was made in thirteen mills manufacturing woolen, cotton and silk cloth, thrown silk and knit goods.

Most of the mills studied are in Massachusetts, New York and Pennsylvania. There is a sufficient diversity of product and location, however, to warrant at least a tentative appraisal of the causes and responsibilities for waste, without implying thereby that these findings represent in any sense a complete and final statement of the case.

All the questions of the standard questionnaire were found to be applicable to the textile industry, except question T6 (Are Tools Standardized?), which was therefore omitted from the final evaluations of waste. In six of the investigations a list of additional questions was used, as being of collateral interest in bringing out points peculiar to this industry. This list could well have been used in all thirteen investigations and is given in Appendix I as a contribution to the preparation of future questionnaires.

Summary of Results of Investigation.—The investigation assessed percentages of waste from various causes against each plant on the basis of a grouping of the answers to the questionnaire as shown in the "Question Number" column of Table I (Determination of Average % Waste—Field Report Evaluation—Textile Industry). The division of responsibility for waste under the three heads "Management," "Labor," and "Outside Contacts" is also indicated here by the column references to Table II (Field Report Evaluation) where the average percentage of waste on a 100% basis for each question or group of questions in Table I is converted into a new percentage on the basis of assigned points of waste as indicated in Table II. Table II, that is, summarizes the essential figures.

WASTE (100% ASSIGNED)

Causes	Responsibilities							
	Management		Labor		Outside Contacts		Total	
	Assigned	Charged	Assigned	Charged	Assigned	Charged	Assigned	Charged
Organization..	14.1	7.3	6.4	2.5	4.5	1.9	25.0	11.7
Technical.....	20.0	9.4	0.0	0.0	25.0	14.2	45.0	23.6
Utilization....	17.3	8.0	5.4	2.2	7.3	3.7	30.0	13.9
Total......	51.4	24.7	11.8	4.7	36.8	19.8	100.0	49.2
Converted to	(100.0)	(48.1)	(100.0)	(39.8)	(100.%)	(53.8)	(100.0)	(49.2)

This summary indicates that the plants studied have been only 50.8% successful in combating waste and still have before them the problem and the possibility of reducing the remaining 49.2% to zero. Without attempting to assign responsibility for the wastes discovered, it would appear that a much heavier share of the burden must be borne by management than by labor. With respect to the responsibility assessed against "Outside Contacts," while a portion of this doubtless represents factors in the situation over which management individually has little or no control, yet much of it could doubtless be overcome through concerted action by the industry as a whole, and to that extent constitutes a charge against management.

Restated in a slightly different form, the findings of the field report evaluations work out to the following:

Responsibility for Waste

Chargeable Against	Per Cent	Per Cent of Total
Management (largely controllable by individual plant)........	24.7	50.2
Outside contacts (largely controllable by the industry as a whole)........	19.8	40.2
Labor (largely controllable by labor itself)......	4.7	9.6
	49.2	100.0

Management, then, appears to be responsible for considerably more than half of all the waste discovered, while labor seems to be a contributory factor in approximately a tenth of the total.

Table III summarizes the results of the individual field report evaluations for each plant by responsibilities and causes. The detailed evaluation sheets from which this summary was taken will be found in Appendix II. The order in which the plants rank on the basis of this summary is as follows:

Plant	% Waste	Plant	% Waste
# 1	27.7	#13	51.9
# 8	28.0	# 4	55.0
# 6	36.3	# 3	56.3
#10	46.1	#11	56.9
#12	47.2	# 5	62.6
# 9	49.9	# 7	72.0
# 2	50.8		

Conclusion.—The placing of responsibility for waste, however, is in some respects the least important phase of the problem. The causes of waste and their elimination are the vital elements of the situation. If they can be determined, in some degree at least, and ways and means found to overcome them, then this investigation may be said to have been truly worth while from a constructive standpoint.

W. R. Basset.

TABLE I—Determination of Average % Waste

Field Report Evaluation

Textile Industry

Class	Question Number	Column	Plant #1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	Average %
Organization	K-1, 2, 3 & 4	2	50	60	60	50	80	60	90	10	90	10	100	20	80	58
	K-5	3	000	100	100	100	100	100	100	20	100	60	100	100	60	80
		11	60	60	60	60	60	60	60	60	60	60	60	60	60	60
	K-6, 7, 8, 9, 11 &12	2	40	80	80	20	80	40	90	10	60	50	90	40	80	58
		6	40	50	50	20	50	40	60	10	40	40	40	40	60	42
		10	40	60	60	40	60	40	60	20	40	40	40	40	60	46
	K-10	3	20	20	40	20	20	20	20	10	20	20	20	20	20	21
		7	20	20	40	20	20	20	20	000	20	000	000	20	20	27
		11	20	40	40	40	40	40	40	10	40	20	20	40	40	33
	K-13, 14 & 15	2	40	40	40	40	40	40	40	10	40	20	20	40	40	35
		6	40	40	40	40	40	40	40	10	40	20	20	40	40	35
		10	50	50	50	50	50	50	50	20	50	40	40	50	50	46
	K-16	3	100	100	100	100	100	100	100	50	100	100	100	20	100	90
		7	100	100	100	100	100	100	100	50	100	100	100	10	100	89
	K-17 & 18	2	000	20	20	20	40	20	50	000	20	000	50	20	20	22
		6	000	20	20	20	50	40	50	10	20	000	50	20	40	26
		10	000	20	20	20	60	20	20	20	20	20	50	20	60	27
	K-19	3	30	70	40	100	40	60	100	000	100	30	100	30	100	62
	K-20	3	10	70	20	40	50	40	70	000	80	40	50	20	40	42
		7	10	70	20	20	50	40	70	10	50	20	50	40	40	38
	K-21	3	40	60	80	40	80	60	80	000	60	40	80	20	80	55
		7	40	60	80	40	40	60	80	20	40	40	80	20	80	55
Technical	T-1	3	20	40	40	20	40	20	20	000	30	000	20	10	30	22
	T-2	3	40	20	100	90	70	100	100	000	40	60	50	20	90	60
	T-3	3	90	40	40	90	70	90	90	000	60	40	40	20	80	58
	T-4	3	60	60	60	60	60	60	60	20	60	60	70	60	80	59
	T-5	3	50	30	50	20	40	20	40	20	20	40	40	20	30	32
	*T-6															
	T-7	3	10	60	70	60	70	10	80	20	40	80	60	60	40	51
		11	10	70	70	70	70	10	80	60	70	60	60	70	40	57
Utilization	U-1	3	40	60	80	100	90	100	100	10	60	20	90	70	80	71
	U-2	3	20	20	40	40	50	10	20	20	30	20	50	40	40	31
		11	50	70	70	70	50	10	80	60	80	80	60	70	60	62
	U-3 & 8	2	50	60	100	80	80	20	80	40	100	80	100	60	80	72
		6	20	40	60	60	60	20	60	20	40	60	60	40	40	45
		10	40	40	80	40	80	20	80	40	80	80	80	40	40	57
	U-4 & 5	2	40	20	60	80	70	40	90	10	30	60	60	60	60	52
	U-6	3	90	40	40	40	80	60	80	10	40	20	60	60	80	57
	U-7	3	30	10	10	90	80	80	100	30	20	10	60	50	80	50
		11	30	50	50	50	50	60	90	60	80	60	50	60	60	58
	U-9	3	40	60	60	100	60	100	100	20	100	40	60	60	100	70
	U-10	3	50	50	40	50	50	50	100	50	50	80	60	50	50	56
		7	50	50	50	50	70	100	100	50	80	80	80	50	50	56
		11	50	50	50	50	50	50	50	50	50	80	60	50	50	53
	U-11	3	20	40	20	40	20	10	60	10	50	30	60	20	20	31
		11	40	40	40	40	40	20	60	40	60	60	60	40	40	40
	U-12	3	30	20	20	40	50	60	60	20	20	30	50	20	20	34
		7	30	20	20	40	40	40	50	20	20	40	50	20	20	32
	U-13	3	20	20	20	40	60	20	60	10	000	40	40	20	20	18
		7	20	20	20	40	80	20	80	10	20	40	40	20	20	34
		11	20	20	20	40	60	20	80	20	20	40	40	20	20	32
	U-14	3	20	20	40	20	60	000	60	20	20	20	40	40	40	31
	U-15	3	000	50	20	50	40	20	20	20	20	100	50	20	20	34
		11	80	80	80	80	80	80	80	80	80	80	80	80	80	80
	U-16	3	20	60	40	40	60	40	60	10	10	40	50	40	60	48
		7	40	60	40	40	60	40	80	20	20	60	50	40	40	45
		11	20	40	40	40	40	20	60	20	30	40	50	40	40	37
	U-17	3	10	20	40	40	30	20	40	10	10	30	30	40	40	28
		7	20	40	40	40	30	30	40	20	20	50	40	40	40	35
	U-18	3	000	20	80	60	100	40	60	10	10	40	40	70	30	4?

* Does not apply to Textile Industry.

TABLE II—FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY

AMERICAN ENGINEERING COUNCIL

OF

THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY, Textile PLANT NO. Composite 13 Plants EST. BY Miller, Franklin, Basset & Co., New York City. DATE, Feb. & Mar. 1921

KEY: (1) + (5) + (9) = (13); (4) + (8) + (12) = (14) | EXCELLENT = 0% Waste; GOOD = 20%; FAIR = 40% | POOR = 60% Waste; BAD = 80% | $a+b+c=d=100\%$; $e+f+g=h=\%$ Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT: Assigned Points	Management: Est. Per Cent Waste	Management: Est. Per Cent Waste	Management: Points Waste	LABOR: Assigned Points	Labor: Est. Per Cent Waste	Labor: Est. Per Cent Waste	Labor: Points Waste	OUTSIDE CONTACTS: Assigned Points	Outside Contacts: Est. Per Cent Waste	Outside Contacts: Est. Per Cent Waste	Outside Contacts: Points Waste	Total Waste: Assigned Points	Total Waste: Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship.	K 1, K 2, K 3, K 4	3.0	58	......	1.8	......	......	......	......	......	......	......	......	3.0	1.7
	K 5	1.5	......	80	1.2	......	......	......	......	.5	......	60	.3	2.0	1.5
	K 6, K 7, K 8, K 9	4.0	58	......	2.3	2.5	42	......	1.0	1.5	46	......	.7	8.0	4.1
	K10	.5	......	21	.1	.2	......	27	0.0	1.3	......	33	.5	2.	.6
	K11, K12, K13, K14, K15	1.0	35	......	.3	1.0	35	......	.3	.2	46	......	.1	2.2	.7
	K16	.3	......	90	.3	.2	......	89	.2	......	......	......	......	.5	.5
	K17, K18	2.0	22	......	.4	1.0	26	......	.3	1.0	27	......	.3	4.0	10
	K19	.3	......	62	.2	......	......	......	......	......	......	......	......	.3	.2
	K20	1.0	......	42	.4	1.0	......	38	.4	......	......	......	......	2.0	.8
	K21	.5	......	55	.3	.5	......	55	.3	......	......	......	......	1.0	.6
	Total.....	14.1	......	......	7.3	6.4	......	......	2.5	4.5	......	......	1.9	a25.0	11.7

TECHNICAL Available Engineering Knowledge as to Product, Plant & Materials.	*T*1	3.0	......	22	.6	......	......	......	......	......	......	......	......	3.0	.6
	*T*2	3.0	......	60	1.8	......	......	......	......	......	......	......	......	3.0	1.8
	*T*3	3.0	......	58	1.7	......	......	......	......	......	......	......	......	3.0	1.7
	*T*4	3.0	......	59	1.8	......	......	......	......	......	......	......	......	3.0	1.8
	*T*5	3.0	......	32	.9	......	......	......	......	......	......	......	......	3.0	9
	*T*6 *														
	*T*7	5.0	......	51	2.6	......	......	......	......	25.0	......	57	14.2	30.0	16.8
	Total......	20.0	......	......	9.4	......	......	......	......	25.0	......	......	14.2	*b* 45.0	*f* 23.6
UTILIZATION Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors.	*U* 1	2.0	......	71	1.4	......	......	......	......	......	......	......	......	2.0	1.4
	U 2	1.0	......	31	.3	......	......	......	......	1.0	......	62	.6	2.0	.9
	U 3														
	U 4	2.0	52	......	1.1	......	......	......	......	......	......	......	......	2.0	1.1
	U 5														
	U 6	.5	......	57	.3	......	......	......	......	......	......	......	......	.5	.3
	U 7	3.0	......	50	1.5	......	......	......	......	2.0	......	58	1.1	5.0	2.6
	U 8	.5	72	......	3	.5	45	......	.2	1.0	57	......	.6	2.0	1.1
	U 9	.5	......	70	.3	......	......	......	......	......	......	......	......	.5	.3
	*U*10	.4	......	56	.2	.4	......	56	.3	.2	......	53	.1	1.0	.6
	*U*11	1.0	......	31	.3	......	......	......	......	1.5	......	40	.6	2.5	.9
	*U*12	1.0	......	34	.3	1.0	......	32	.3	......	......	......	......	2.0	.6
	*U*13	.5	......	18	.1	.5	......	34	.2	.5	......	32	.2	1.5	.5
	*U*14	.5	......	31	.1	......	......	......	......	......	......	......	......	.5	.1
	*U*15	.4	......	34	.1	......	......	......	......	.1	......	80	.1	.5	.2
	*U*16	2.0	......	48	1.0	2.0	......	45	.9	1.0	......	37	.4	5.0	2.3
	*U*17	1.0	......	28	.3	1.0	......	35	.3	......	......	......	......	2.0	.6
	*U*18	1.0	......	43	.4	......	......	......	......	......	......	......	......	1.0	.4
	Total.....	17.3	......	......	8.0	5.4	......	......	2.2	7.3	......	......	3.7	*c* 30.0	*g* 13.9
Grand Total		51.4	......	......	24.7	11.8	......	......	4.7	36.8	......	......	19.8	*d* 100.0	*h* 49.2

* Does not apply to the Textile Industry.

TABLE III—SUMMARY OF POINTS WASTE
FIELD REPORT EVALUATION
TEXTILE INDUSTRY

Responsibilities and Causes	Responsibilities											Causes			Total Waste
	Management				Labor			Outside Contacts							
	Organ.	Tech.	Util.	Total	Organ.	Util.	Total	Organ.	Tech.	Util.	Total	Total Organ.	Total Tech.	Total Util.	
Assigned Points	14.1	20.0	17.3	51.4	6.4	5.4	11.8	4.5	25.0	7.3	36.8	25.0	45.0	30.0	100.0
Column No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Plant # 1	4.3	8.3	5.0	17.6	2.0	1.7	3.7	1.3	2.5	2.6	6.4	7.6	10.8	9.3	27.7
# 2	8.9	8.7	5.7	23.3	3.2	2.3	5.5	2.0	17.5	2.5	22.0	14.1	26.2	10.5	50.8
# 3	8.5	12.2	7.5	28.2	2.8	2.0	4.8	2.0	17.5	3.8	23.3	13.3	29.7	13.3	56.3
# 4	5.7	11.4	11.1	28.2	1.8	2.3	4.1	1.7	17.5	3.5	22.7	9.2	28.9	16.9	55.0
# 5	9.5	11.9	11.4	32.8	3.2	2.9	6.1	2.4	17.5	3.8	23.7	15.1	29.4	18.1	62.6
# 6	7.0	9.2	8.7	24.9	2.8	2.1	4.9	1.7	2.5	2.3	6.5	11.5	11.7	13.1	36.3
# 7	11.0	13.3	12.8	37.1	3.8	3.6	7.4	2.0	20.0	5.5	27.5	16.8	33.3	21.9	72.0
# 8	1.4	2.2	2.9	6.5	.7	1.2	1.9	1.3	15.0	3.3	19.6	3.4	17.2	7.4	28.0
# 9	9.2	8.4	5.4	23.0	2.6	1.4	4.0	1.7	16.5	4.7	22.9	13.5	24.9	11.5	49.9
#10	4.5	10.0	5.8	20.3	1.8	2.9	4.7	1.5	15.0	4.6	21.1	7.8	25.0	13.3	46.1
#11	10.9	9.6	9.9	30.4	2.8	2.7	5.5	1.8	15.0	4.2	21.0	15.5	24.6	16.8	56.9
#12	5.2	6.9	8.3	20.4	2.1	1.9	4.0	1.7	17.5	3.6	22.8	9.0	24.4	13.8	47.2
#13	8.8	11.3	9.8	29.9	3.3	1.9	5.2	3.3	10.0	3.5	16.8	15.4	21.3	15.2	51.9
Average	7.3	9.4	8.0	24.7	2.5	2.2	4.7	1.9	14.2	3.7	19.8	11.7	23.6	13.9	49.2

Organ. = Organization
Tech. = Technical
Util. = Utilization

Col. 1+2+3=4
" 5+6=7
" 8+9+10=11

Col. 4+7+11=15
" 12+13+14=15

APPENDIX I

Supplemental Questions for Questionnaire

Materials

A. Principal raw materials purchased, and quantities in pounds per year (estimated).
B. Kinds of cotton and wool purchased and length of staple used.
C. Numbers or counts of yarns spun and purchased.
D. Average number of days required for delivery of raw materials.
E. Materials in process in pounds and dollars (estimated).
F. Material needed to keep mill threaded up, in pounds (estimated).
G. Material turnover.
  1. Per year.
  2. From receiving to shipping.
H. Loss on cotton or wool.
  1. Measured.
  2. Accounted for.
I. Total stock on hand of cotton or wool in pounds by months, 1918, 1919, 1920
J. Variety of styles manufactured at one time.
K. Number of styles per year.
L. Number of styles added per year.
M. Number of styles dropped per year.

Labor and Mill activities.

A. Average number of overseers, second and third hands, and number of employees by departments.
B. 1. Total number of cards
   spindles
   looms
  2. Number tended per operator—cards
   spindles
   looms
C. Source of power.
  Manufactured Water
  Purchased Steam
D. Square feet of floor space.

APPENDIX II

Individual Field Report Evaluations. (13 charts).

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* PLANT NO. *1* EST. BY *M.F.B. & Co.* DATE *2/11/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ ; Excellent = 0% Waste; Good = 20% "; Fair = 40% "; Poor = 60% Waste; Bad = 80% "; a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	MANAGEMENT Est. % Waste 2	MANAGEMENT Est. % Waste 3	MANAGEMENT Points Waste 4	LABOR Assigned Points 5	LABOR Est. % Waste 6	LABOR Est. % Waste 7	LABOR Points Waste 8	OUTSIDE CONTACTS Assigned Points 9	OUTSIDE CONTACTS Est. % Waste 10	OUTSIDE CONTACTS Est. % Waste 11	OUTSIDE CONTACTS Points Waste 12	TOTAL WASTE Assigned Points 13	TOTAL WASTE Points Waste 14
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1														
	K2	3.0	50		1.5									3.0	1.5
	K3														
	K4														
	K5	1.5								0.5		60	0.3	2.0	0.3
	K6														
	K7														
	K8	4.0	40		1.6	2.5	40		1.0	1.5	40		0.6	8.0	3.2
	K9														
	K10	0.5		20	0.1	0.2		20	0.1	1.3		20	0.3	2.0	0.5
	K11														
	K12														
	K13														
	K14	1.0	40		0.4	1.0	40		0.4	0.2	50		0.1	2.2	0.9
	K15														
	K16	0.3		100	0.3	0.2		100	0.2					0.5	0.5
	K17	2.0				1.0				1.0				4.0	
	K18														
	K19	0.3		30	0.1									0.3	0.1
	K20	1.0		10	0.1	1.0		10	0.1					2.0	0.2
	K21	0.5		40	0.2	0.5		40	0.2					1.0	0.4
	TOTAL	14.1			4.3	6.4			2.0	4.5			1.3	a 25.0	e 7.6
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0		20	0.6									3.0	0.6
	T2	3.0		40	1.2									3.0	1.2
	T3	3.0		90	2.7									3.0	2.7
	T4	3.0		60	1.8									3.0	1.8
	T5	3.0		50	1.5									3.0	1.5
	T6 X	'DOES NOT APPLY TO THE TEXTILE INDUSTRY													
	T7	5.0		10	0.5					25.0		10	2.5	30.0	3.0
	TOTAL	20.0			8.3					25.0			2.5	b 45.0	f 10.8
UTILIZATION: Effectiveness of Technical Knowledge and Organization Direction, Control and Accounting Factors	U1	2.0		40	0.8									2.0	0.8
	U2	1.0		20	0.2					1.0		50	0.5	2.0	0.7
	U3														
	U4	2.0	40		0.8									2.0	0.8
	U5														
	U6	0.5		90	0.4									0.5	0.4
	U7	3.0		30	0.9					2.0		30	0.6	5.0	1.5
	U8	0.5	50		0.3	0.5	20		0.1	1.0	40		0.4	2.0	0.8
	U9	0.5		40	0.2									0.5	0.2
	U10	0.4		50	0.2	0.4		50	0.2	0.2		50	0.1	1.0	0.5
	U11	1.0		20	0.2					1.5		40	0.6	2.5	0.8
	U12	1.0		30	0.3	1.0		30	0.3					2.0	0.6
	U13	0.5		20	0.1	0.5		20	0.1	0.5		20	0.1	1.5	0.3
	U14	0.5		20	0.1									0.5	0.1
	U15	0.4								0.1		80	0.1	0.5	0.1
	U16	2.0		20	0.4	2.0		40	0.8	1.0		20	0.2	5.0	1.4
	U17	1.0		10	0.1	1.0		20	0.2					2.0	0.3
	U18	1.0												1.0	
	TOTAL	17.3			5.0	5.4			1.7	7.3			2.6	c 30.0	g 9.3
GRAND TOTAL		51.4			17.6	11.8			3.7	36.8			6.4	d 100.0	h 27.7

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* **PLANT NO.** 2 **EST. BY** *M. F. B. & Co.* **DATE** 2/17/21

KEY: ① + ⑤ + ⑨ = ⑬ ; ② + ⑧ + ⑫ = ⑭
Excellent – 0% Waste; Good = 20% "; Fair = 40% "; Poor – 60% Waste; Bad – 80% "
a + b + c = d = 100% ; e + f + g = h = 0%

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	Est. % Waste 2	3	Points Waste 4	LABOR Assigned Points 5	Est. % Waste 6	7	Points Waste 8	OUTSIDE CONTACTS Assigned Points 9	Est. % Waste 10	11	Points Waste 12	TOTAL WASTE Assigned Points 13	Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship.	K1														
	K2	3.0	60		1.8									3.0	1.8
	K3														
	K4														
	K5	1.5		100	1.5					0.5		60	0.3	2.0	1.8
	K6														
	K7														
	K8	4.0	80		3.2	2.5	50		1.3	1.5	60		0.9	8.0	5.4
	K9														
	K10	0.5		20	0.1	0.2		20	0.1	1.3		40	0.5	2.0	0.7
	K11														
	K12														
	K13														
	K14	1.0	40		0.4	1.0	40		0.4	0.2	50		0.1	2.2	0.9
	K15														
	K16	0.3		100	0.3	0.2		100	0.2					0.5	0.5
	K17	2.0	20		0.4	1.0	20		0.2	1.0	20		0.2	4.0	0.8
	K18														
	K19	0.3		70	0.2									0.3	0.2
	K20	1.0		70	0.7	1.0		70	0.7					2.0	1.4
	K21	0.5		60	0.3	0.5		60	0.3					1.0	0.6
	TOTAL	14.1			8.9	6.4			3.2	4.5			2.0	a 25.0	e 14.1
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0		40	1.2									3.0	1.2
	T2	3.0		20	0.6									3.0	0.6
	T3	3.0		40	1.2									3.0	1.2
	T4	3.0		60	1.8									3.0	1.8
	T5	3.0		30	0.9									3.0	0.9
	T6 X	DOES NOT APPLY TO THE TEXTILE INDUSTRY													
	T7	5.0		60	3.0					25.0		70	17.5	30.0	20.5
	TOTAL	20.0			8.7					25.0			17.5	b 45.0	f 26.2
UTILIZATION — Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors.	U1	2.0		60	1.2									2.0	1.2
	U2	1.0		20	0.2					1.0		70	0.7	2.0	0.9
	U3														
	U4	2.0	20		0.4									2.0	0.4
	U5														
	U6	0.5		40	0.2									0.5	0.2
	U7	3.0		10	0.3					2.0		50	0.1	5.0	0.4
	U8	0.5	60		0.3	0.5	40		0.2	1.0	40		0.4	2.0	0.9
	U9	0.5		60	0.3									0.5	0.3
	U10	0.4		50	0.2	0.4		50	0.2	0.2		50	0.1	1.0	0.5
	U11	1.0		40	0.4					1.5		40	0.6	2.5	1.0
	U12	1.0		20	0.2	1.0		20	0.2					2.0	0.4
	U13	0.5		20	0.1	0.5		20	0.1	0.5		20	0.1	1.5	0.3
	U14	0.5		20	0.1									0.5	0.1
	U15	0.4		50	0.2					0.1		80	0.1	0.5	0.3
	U16	2.0		60	1.2	2.0		60	1.2	1.0		40	0.4	5.0	2.8
	U17	1.0		20	0.2	1.0		40	0.4					2.0	0.6
	U18	1.0		20	0.2									1.0	0.2
	TOTAL	17.3			5.7	5.4			2.3	7.3			2.5	c 30.0	g 10.5
GRAND TOTAL		51.4			23.3	11.8			5.5	36.8			22.0	d 100.0	h 50.8

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* PLANT NO. 3 EST. BY *M.F.B.& Co.* DATE *3/1/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ ; Excellent = 0% Waste; Good = 20% Waste; Fair = 40% Waste; Poor = 60% Waste; Bad = 80% Waste; a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT: Assigned Points	MANAGEMENT: Est. % Waste		MANAGEMENT: Points Waste	LABOR: Assigned Points	LABOR: Est. % Waste		LABOR: Points Waste	OUTSIDE CONTACTS: Assigned Points	OUTSIDE CONTACTS: Est. % Waste		OUTSIDE CONTACTS: Points Waste	TOTAL WASTE: Assigned Points	TOTAL WASTE: Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1														
	K2	3.0	60		1.8									3.0	1.8
	K3														
	K4														
	K5	1.5		100	1.5					0.5		60	0.3	2.0	1.8
	K6														
	K7														
	K8	4.0	80		3.2	2.5	50		1.3	1.5	60		0.9	8.0	5.4
	K9														
	K10	0.5		40	0.2	0.2		40	0.1	1.3		40	0.5	2.0	0.8
	K11														
	K12														
	K13														
	K14	1.0	40		0.4	1.0	40		0.4	0.2	50		0.1	2.2	0.9
	K15														
	K16	0.3		100	0.3	0.2		100	0.2					0.5	0.5
	K17	2.0	20		0.4	1.0	20		0.2	1.0	20		0.2	4.0	0.8
	K18														
	K19	0.3			0.1									0.3	0.1
	K20	1.0		20	0.2	1.0		20	0.2					2.0	0.4
	K21	0.5		80	0.4	0.5		80	0.4					1.0	0.8
	TOTAL	14.1			8.5	6.4			2.8	4.5			2.0	a 25.0	e 13.3
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0		40	1.2									3.0	1.2
	T2	3.0		100	3.0									3.0	3.0
	T3	3.0		40	1.2									3.0	1.2
	T4	3.0		60	1.8									3.0	1.8
	T5	3.0		50	1.5									3.0	1.5
	T6 X	DOES NOT APPLY TO THE TEXTILE INDUSTRY													
	T7	5.0		70	3.5					25.0		70	17.5	30.0	21.0
	TOTAL	20.0			12.2					25.0			17.5	b 45.0	f 29.7
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	2.0		80	1.6									2.0	1.6
	U2	1.0		40	0.4					1.0		70	0.7	2.0	1.1
	U3														
	U4	2.0	60		1.2									2.0	1.2
	U5														
	U6	0.5		40	0.2									0.5	0.2
	U7	3.0		10	0.3					2.0		50	1.0	5.0	1.3
	U8	0.5	100		0.5	0.5	60		0.3	1.0	80		0.8	2.0	1.6
	U9	0.5		60	0.3									0.5	0.3
	U10	0.4		40	0.2	0.4		50	0.2	0.2		50	0.1	1.0	0.5
	U11	1.0		20	0.2					1.5		40	0.6	2.5	0.8
	U12	1.0		20	0.2	1.0		20	0.2					2.0	0.4
	U13	0.5		20	0.1	0.5		20	0.1	0.5		20	0.1	1.5	0.3
	U14	0.5		40	0.2									0.5	0.2
	U15	0.4		20	0.1					0.1		80	0.1	0.5	0.2
	U16	2.0		40	0.8	2.0		40	0.8	1.0		40	0.4	5.0	2.0
	U17	1.0		40	0.4	1.0		40	0.4					2.0	0.8
	U18	1.0		80	0.8									1.0	0.8
	TOTAL	17.3			7.5	5.4			2.0	7.3			3.8	c 30.0	g 13.3
GRAND TOTAL		51.4			28.2	11.8			4.8	36.8			23.3	d 100	h 56.3

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* PLANT NO. *4* EST. BY *M.F.B.&Co.* DATE *2/28/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ ; Excellent = 0% Waste; Good = 20% Waste; Fair = 40% Waste; Poor = 60% Waste; Bad = 80% Waste; a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	Est. % Waste 2	Est. % Waste 3	Points Waste 4	LABOR Assigned Points 5	Est. % Waste 6	Est. % Waste 7	Points Waste 8	OUTSIDE CONTACTS Assigned Points 9	Est. % Waste 10	Est. % Waste 11	Points Waste 12	TOTAL WASTE Assigned Points 13	Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1														
	K2	3.0	50		1.5									3.0	1.5
	K3														
	K4														
	K5	1.5		100	1.5					0.5		60	0.3	2.0	1.8
	K6														
	K7														
	K8	4.0	20		0.8	2.5	20		0.5	1.5	40		0.6	8.0	1.9
	K9														
	K10	0.5		20	0.1	0.2		20	0.1	1.3		40	0.5	2.0	0.7
	K11														
	K12														
	K13														
	K14	1.0	40		0.4	1.0	40		0.4	0.2	50		0.1	2.2	0.9
	K15														
	K16	0.3		100	0.3	0.2		100	0.2					0.5	0.5
	K17	2.0	20		0.2	1.0	20		0.2	1.0	20		0.2	4.0	0.6
	K18														
	K19	0.3		100	0.3									0.3	0.3
	K20	1.0		40	0.4	1.0		20	0.2					2.0	0.6
	K21	0.5		40	0.2	0.5		40	0.2					1.0	0.4
	TOTAL	14.1			5.7	6.4			1.8	4.5				a 25.0	e 9.2
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0		20	0.6									3.0	0.6
	T2	3.0		90	2.7									3.0	2.7
	T3	3.0		90	2.7									3.0	2.7
	T4	3.0		60	1.8									3.0	1.8
	T5	3.0		20	0.6									3.0	0.6
	T6 X	DOES NOT APPLY TO THE TEXTILE INDUSTRY													
	T7	5.0		60	3.0					25.0		70	17.5	30.0	20.5
	TOTAL	20.0		-	11.4					25.0				b 45.0	f 28.9
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	2.0		100	2.0									2.0	2.0
	U2	1.0		40	0.4					1.0		70	0.7	2.0	1.1
	U3														
	U4	2.0	80		1.6									2.0	1.6
	U5														
	U6	0.5		40	0.2									0.5	0.2
	U7	3.0		90	2.7					2.0		50	1.0	5.0	3.7
	U8	0.5	80		0.4	0.5	60		0.3	1.0	40		0.4	2.0	1.1
	U9	0.5		100	0.5									0.5	0.5
	U10	0.4		50	0.2	0.4		50	0.2	0.2		50	0.1	1.0	0.5
	U11	1.0		40	0.4					1.5		40	0.6	2.5	1.0
	U12	1.0		40	0.4	1.0		40	0.4					2.0	0.8
	U13	0.5		40	0.2	0.5		40	0.2	0.5		40	0.2	1.5	0.6
	U14	0.5		20	0.1									0.5	0.1
	U15	0.4		50	0.2					0.1		80	0.1	0.5	0.3
	U16	2.0		40	0.8	2.0		40	0.8	1.0		40	0.4	5.0	2.0
	U17	1.0		40	0.4	1.0		40	0.4					2.0	0.8
	U18	1.0		60	0.6									1.0	0.6
	TOTAL	17.3			11.1	5.4			2.3	7.3			3.5	c 30.0	g 16.9
GRAND TOTAL		51.4			28.2	11.8			4.1	36.8			22.7	d 100	h 55.0

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* PLANT NO. *5* EST. BY *M. F. B. & Co.* DATE *3/3/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ ; Excellent = 0% Waste, Good = 20% " , Fair = 40% " , Poor = 60% Waste, Bad = 80% " ; a + b + c = d = 100% ; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES												TOTAL WASTE	
		MANAGEMENT				LABOR				OUTSIDE CONTACTS					
		Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Est. % Waste		Points Waste	Assigned Points	Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1														
	K2	3.0	80		2.4									3.0	2.4
	K3														
	K4														
	K5	1.5		100	1.5					0.5		60	0.3	2.0	1.8
	K6														
	K7														
	K8	4.0	80		3.0	2.5	50		1.3	1.5	60		0.9	8.0	5.2
	K9														
	K10	0.5		20	0.1	0.2		20	0.1	1.3		40	0.5	2.0	0.7
	K11														
	K12														
	K13														
	K14	1.0	40		0.4	1.0	40		0.4	0.2	50		0.1	2.2	0.9
	K15														
	K16	0.3		100	0.3	0.2		100	0.2					0.5	0.5
	K17	2.0	40		0.8	1.0	50		0.5	1.0	60		0.6	40	1.9
	K18														
	K19	0.3		40	0.1									0.3	0.1
	K20	1.0		50	0.5	1.0		50	0.5					2.0	1.0
	K21	0.5		80	0.4	0.5		40	0.2					1.0	0.6
	TOTAL	14.1			9.5	6.4			3.2	4.5			2.4	a 25.0	e 15.1
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0		40	1.2									3.0	1.2
	T2	3.0		70	2.1									3.0	2.1
	T3	3.0		70	2.1									3.0	2.1
	T4	3.0		60	1.8									3.0	1.8
	T5	3.0		40	1.2									3.0	1.2
	T6 X	DOES NOT APPLY TO THE TEXTILE INDUSTRY													
	T7	5.0		70	3.5					25.0		70	17.5	30.0	21.0
	TOTAL	20.0			11.9					25.0			17.5	b 45.0	f 29.4
UTILIZATION — Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	2.0		90	1.8									2.0	1.8
	U2	1.0		50	0.5					1.0		50	0.5	2.0	0.1
	U3														
	U4	2.0	70		1.4									2.0	1.4
	U5														
	U6	0.5		80	0.4									0.5	0.4
	U7	3.0		80	2.4					2.0		50	1.0	5.0	3.4
	U8	0.5	80		0.4	0.5	60		0.3	1.0	80		0.8	2.0	1.5
	U9	0.5		60	0.3									0.5	0.3
	U10	0.4		50	0.2	0.4		70	0.3	0.2		50	0.1	1.0	0.6
	U11	1.0		20	0.2					1.5		40	0.6	2.5	
	U12	1.0		50	0.5	1.0		40	0.4					2.0	0.9
	U13	0.5		60	0.3	0.5		80	0.4	0.5		60	0.3	1.5	1.0
	U14	0.5		60	0.3									0.5	0.3
	U15	0.4		40	0.2					0.1		80	0.1	0.5	0.3
	U16	2.0		60	1.2	2.0		60	1.2	1.0		40	0.4	5.0	2.8
	U17	1.0		30	0.3	1.0		30	0.3					2.0	0.6
	U18	1.0		100	1.0									1.0	1.0
	TOTAL	17.3			11.4	5.4			2.9	7.3			3.8	c 30.0	g 18.1
GRAND TOTAL		51.4			32.6	11.8			6.1	36.8			23.7	d 100	h 62.6

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* PLANT NO. *6* EST. BY *M.F.B. & Co* DATE *3/7/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ ; Excellent = 0% Waste, Good = 20% ", Fair = 40% ", Poor = 60% Waste, Bad = 80% " ; a + b + c = d = 100% ; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	MANAGEMENT Est. % Waste 2	MANAGEMENT Est. % Waste 3	MANAGEMENT Points Waste 4	LABOR Assigned Points 5	LABOR Est. % Waste 6	LABOR Est. % Waste 7	LABOR Points Waste 8	OUTSIDE CONTACTS Assigned Points 9	OUTSIDE CONTACTS Est. % Waste 10	OUTSIDE CONTACTS Est. % Waste 11	OUTSIDE CONTACTS Points Waste 12	TOTAL WASTE Assigned Points 13	TOTAL WASTE Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K 1														
	K 2	3.0	60		1.8									3.0	1.8
	K 3														
	K 4														
	K 5	1.5		100	1.5					0.5		60	0.3	2.0	1.8
	K 6														
	K 7														
	K 8	4.0	40		1.6	2.5	40		1.0	1.5	40		0.6	8.0	3.2
	K 9														
	K 10	0.5		20	0.1	0.2		20	0.1	1.3		40	0.5	2.0	0.7
	K 11														
	K 12														
	K 13														
	K 14	1.0	40		0.4	1.0	40		0.4	0.2	50		0.1	2.2	0.9
	K 15														
	K 16	0.3		100	0.3	0.2		100	0.2					0.5	0.5
	K 17	2.0	20		0.4	1.0	40		0.4	1.0	20		0.2	4.0	1.0
	K 18														
	K 19	0.3		60	0.2									0.3	0.2
	K 20	1.0		40	0.4	1.0		40	0.4					2.0	0.8
	K 21	0.5		60	0.3	0.5		60	0.3					1.0	0.6
	TOTAL	14.1			7.0	6.4			2.8	4.5			1.7	a 25.0	e 11.5
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T 1	3.0		20	0.6									3.0	0.6
	T 2	3.0		100	3.0									3.0	3.0
	T 3	3.0		90	2.7									3.0	2.7
	T 4	3.0		60	1.8									3.0	1.8
	T 5	3.0		20	0.6									3.0	0.6
	T 6 X	DOES NOT APPLY TO TEXTILE INDUSTRY													
	T 7	5.0		10	0.5					25.0		10	2.5	30	3.0
	TOTAL	20.0			9.2					25.0			2.5	b 45.0	f 11.7
UTILIZATION — Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U 1	2.0		100	2.0									2.0	2.0
	U 2	1.0		10	0.1					1.0		10	0.1	2.0	0.2
	U 3														
	U 4	2.0	40		0.8									2.0	0.8
	U 5														
	U 6	0.5		60	0.3									0.5	0.3
	U 7	3.0		80	2.4					2.0		60	1.2	5.0	3.6
	U 8	0.5	20		0.1	0.5	20		0.1	1.0	20		0.2	2.0	0.4
	U 9	0.5		100	0.5									0.5	0.5
	U 10	0.4		50	0.2	0.4		100	0.4	0.2		50	0.1	1.0	0.7
	U 11	1.0		10	0.1					1.5		20	0.3	2.5	0.4
	U 12	1.0		60	0.6	1.0		40	0.4					2.0	1.0
	U 13	0.5		20	0.1	0.5		20	0.1	0.5		20	0.1	1.5	0.3
	U 14	0.5		000	0.0									0.5	0.0
	U 15	0.4		20	0.1					0.1		80	0.1	0.5	0.2
	U 16	2.0		40	0.8	2.0		40	0.8	1.0		20	0.2	5.0	1.8
	U 17	1.0		20	0.2	1.0		30	0.3					2.0	0.5
	U 18	1.0		40	0.4									1.0	0.4
	TOTAL	17.3			8.7	5.4			2.1	7.3			2.3	c 30.0	g 13.1
GRAND TOTAL		51.4			24.9	11.8			4.9	36.8			6.5	d 100	h 36.3

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* PLANT NO. 7 EST. BY *M. F. B. & Co.* DATE *3/10/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ ; Excellent = 0% Waste; Good = 20% "; Fair = 40% "; Poor = 60% Waste; Bad = 80% "; a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	MANAGEMENT Est. % Waste 2	MANAGEMENT Est. % Waste 3	MANAGEMENT Points Waste 4	LABOR Assigned Points 5	LABOR Est. % Waste 6	LABOR Est. % Waste 7	LABOR Points Waste 8	OUTSIDE CONTACTS Assigned Points 9	OUTSIDE CONTACTS Est. % Waste 10	OUTSIDE CONTACTS Est. % Waste 11	OUTSIDE CONTACTS Points Waste 12	TOTAL WASTE Assigned Points 13	TOTAL WASTE Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1														
	K2	3.0	90		2.7									3.0	2.7
	K3														
	K4														
	K5	1.5		100	1.5					0.5		60	0.3	2.0	1.8
	K6														
	K7														
	K8	4.0	90		3.6	2.5	60		1.5	1.5	60		0.9	8.0	6.0
	K9														
	K10	0.5		20	0.1	0.2		20	0.1	1.3		40	0.5	2.0	0.7
	K11														
	K12														
	K13														
	K14	1.0	40		0.4	1.0	40		0.4	0.2	50		0.1	2.2	0.9
	K15														
	K16	0.3		100	0.3	0.2		100	0.2					0.5	0.5
	K17	2.0	50		1.0	1.0	50		0.5	1.0	20		0.2	4.0	1.7
	K18														
	K19	0.3		100	0.3									0.3	0.3
	K20	1.0		70	0.7	1.0		70	0.7					2.0	1.4
	K21	0.5		80	0.4	0.5		80	0.4					1.0	0.8
	TOTAL	14.1			11.0	6.4			3.8	4.5			2.0	a 25.0	e 16.8
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0		20	0.6									3.0	0.6
	T2	3.0		100	3.0									3.0	3.0
	T3	3.0		90	2.7									3.0	2.7
	T4	3.0		60	1.8									3.0	1.8
	T5	3.0		40	1.2									3.0	1.2
	T6 X	DOES NOT APPLY TO TEXTILE INDUSTRY													
	T7	5.0		80	4.0					25.0		80	20.0	30.0	24.0
	TOTAL	20.0			13.3					25.0			20.0	b 45.0	f 33.3
UTILIZATION — Effectiveness of Technical Knowledge and Organization Direction, Control and Accounting Factors	U1	2.0		100	2.0									2.0	2.0
	U2	1.0		20	0.2					1.0		80	0.8	2.0	1.0
	U3														
	U4	2.0			1.8									2.0	1.8
	U5														
	U6	0.5		80	0.4									0.5	0.4
	U7	3.0		100	3.0					2.0		90	1.8	5.0	4.8
	U8	0.5			0.4	0.5	60		0.3	1.0	80		0.8	2.0	1.5
	U9	0.5		100	0.5									0.5	0.5
	U10	0.4		100	0.4	0.4		100	0.4	0.2		50	0.1	1.0	0.9
	U11	1.0		60	0.6					1.5		60	0.9	2.5	1.5
	U12	1.0		60	0.6	1.0		50	0.5					2.0	1.1
	U13	0.5		60	0.3	0.5		80	0.4	0.5		80	0.4	1.5	1.1
	U14	0.5		60	0.3									0.5	0.3
	U15	0.4		20	0.1					0.1		80	0.1	0.5	0.2
	U16	2.0		60	1.2	2.0		80	1.6	1.0		60	0.6	5.0	3.4
	U17	1.0		40	0.4	1.0		40	0.4					2.0	0.8
	U18	1.0		60	0.6									1.0	0.6
	TOTAL	17.3			12.8	5.4			3.6	7.3			5.5	c 30.0	g 21.9
GRAND TOTAL		51.4			37.1	11.8			7.4	36.8			27.5	d 100	h 72.0

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* PLANT NO. *8* EST. BY *M. F. B. & Co.* DATE *3/23/21*

KEY
① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste; Good = 20% "; Fair = 40% "; Poor = 60% Waste; Bad = 80% Waste; a + b + c = d = 100%
④ + ⑧ + ⑫ = ⑭ e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	Est. % Waste 2	Est. % Waste 3	Points Waste 4	LABOR Assigned Points 5	Est. % Waste 6	Est. % Waste 7	Points Waste 8	OUTSIDE CONTACTS Assigned Points 9	Est. % Waste 10	Est. % Waste 11	Points Waste 12	TOTAL WASTE Assigned Points 13	Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1														
	K2	3.0	10		0.3									3.0	0.3
	K3														
	K4														
	K5	1.5		20	0.3					0.5		60	0.3	2.0	0.6
	K6														
	K7														
	K8	4.0	10		0.4	2.5	10		0.2	1.5	20		0.3	8.0	0.9
	K9														
	K10	0.5		10	0.1	0.2		000	0.0	1.3		10	0.1	2.0	0.2
	K11														
	K12														
	K13														
	K14	1.0	10		0.1	1.0	10		0.1	0.2	20		0.4	2.2	0.6
	K15														
	K16	0.3		50	0.2	0.2		50	0.1					0.5	0.3
	K17	2.0	000		0.0	1.0	10		0.1	1.0	20		0.2	4.0	0.3
	K18														
	K19	0.3		000	0.0									0.3	0.0
	K20	1.0		000	0.0	1.0		10	0.1					2.0	0.1
	K21	0.5		000	0.0	0.5		20	0.1					1.0	0.1
	TOTAL	14.1			1.4	6.4			0.7	4.5			1.3	a 25.0	e 3.4
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0		000	0.0									3.0	0.0
	T2	3.0		000	0.0									3.0	0.0
	T3	3.0		000	0.0									3.0	0.0
	T4	3.0		20	0.6									3.0	0.6
	T5	3.0		20	0.6									3.0	0.6
	T6 X	DOES NOT APPLY TO THE TEXTILE INDUSTRY													
	T7	5.0		20	1.0					25.0		60	15.0	30.0	16.0
	TOTAL	20.0			2.2					25.0			15.0	b 45.0	f 17.2
UTILIZATION — Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	2.0		10	0.2									2.0	0.2
	U2	1.0		20	0.2					1.0		60	0.6	2.0	0.8
	U3														
	U4	2.0	10		0.2									2.0	0.2
	U5														
	U6	0.5		10	0.1									0.5	0.1
	U7	3.0		30	0.9					2.0		60	1.2	5.0	2.1
	U8	0.5	40		0.1	0.5	20		0.1	1.0	40		0.4	2.0	0.6
	U9	0.5		20	0.1									0.5	0.1
	U10	0.4		50	0.2	0.4		50	0.2	0.2		50	0.1	1.0	0.5
	U11	1.0		10	0.1					1.5		40	0.6	2.5	0.7
	U12	1.0		20	0.2	1.0		20	0.2					2.0	0.4
	U13	0.5		10	0.0	0.5		10	0.1	0.5		20	0.1	1.5	0.2
	U14	0.5		20	0.1									0.5	0.1
	U15	0.4		20	0.1					0.1		80	0.1	0.5	0.2
	U16	2.0		10	0.2	2.0		20	0.4	1.0		20	0.2	5.0	0.8
	U17	1.0		10	0.1	1.0		20	0.2					2.0	0.3
	U18	1.0		10	0.1									1.0	0.1
	TOTAL	17.3			2.9	5.4			1.2	7.3			3.3	c 30.0	g 7.4
GRAND TOTAL		51.4			6.5	11.8			1.9	36.8			19.6	d 100	h 28.0

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* **PLANT NO.** *9* **EST. BY** *M. F. B & Co.* **DATE** *3/15/21*

KEY
① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste; Good = 20% "; Fair = 40% " — Poor = 60% Waste; Bad = 80% " — a + b + c = d = 100%
④ + ⑧ + ⑫ = ⑭ — e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT Assigned Points 1	MANAGEMENT Est. % Waste 2	MANAGEMENT Est. % Waste 3	MANAGEMENT Points Waste 4	LABOR Assigned Points 5	LABOR Est. % Waste 6	LABOR Est. % Waste 7	LABOR Points Waste 8	OUTSIDE CONTACTS Assigned Points 9	OUTSIDE CONTACTS Est. % Waste 10	OUTSIDE CONTACTS Est. % Waste 11	OUTSIDE CONTACTS Points Waste 12	TOTAL WASTE Assigned Points 13	TOTAL WASTE Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1														
	K2	3.0	90		2.7									3.0	2.7
	K3														
	K4														
	K5	1.5		100	1.5					0.5		60	0.3	2.0	1.8
	K6														
	K7														
	K8	4.0	60		2.4	2.5	40		1.0	1.5	40		0.6	8.0	4.0
	K9														
	K10	0.5		20	0.1	0.2		20	0.1	1.3		40	0.5	2.0	0.7
	K11														
	K12														
	K13														
	K14	1.0	40		0.4	1.0	40		0.4	0.2	50		0.1	2.2	0.9
	K15														
	K16	0.3		100	0.3	0.2		100	0.2					0.5	0.5
	K17	2.0	20		0.4	1.0	20		0.2	1.0	20		0.2	4.0	0.8
	K18														
	K19	0.3		100	0.3									0.3	0.3
	K20	1.0		80	0.8	1.0		50	0.5					2.0	1.3
	K21	0.5		60	0.3	0.5		40	0.2					1.0	0.5
	TOTAL	14.1			9.2	6.4			2 6	4 5			1.7	a 25.0	e 13.5
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0		30	1.0									3.0	1.0
	T2	3.0		40	1.2									3.0	1.2
	T3	3.0		60	1.8									3.0	1.8
	T4	3.0		60	1.8									3.0	1.8
	T5	3.0		20	0.6									3.0	0.6
	T6 X	DOES NOT APPLY TO THE TEXTILE INDUSTRY													
	T7	5.0		40	2.0					25.0		70	16.5	30.0	18.5
	TOTAL	20.0			8.4					25.0			16.5	b 45.0	f 24.9
UTILIZATION — Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	2.0		60	1.2									2.0	1.2
	U2	1.0		30	0.3					1.0		80	0.8	2.0	1.1
	U3														
	U4	2.0			0.6									2.0	0.6
	U5														
	U6	0.5		40	0.2									0.5	0.2
	U7	3.0		20	0.6					2.0		80	1.6	5.0	2.2
	U8	0.5	100		0.5	0.5	40		0.2	1.0	80		0.8	2.0	1.5
	U9	0.5		100	0.5									0.5	0.5
	U10	0.4		50	0.2	0.4		80	0.3	0.2		50	0.1	1.0	0.6
	U11	1.0		50	0.5					1.5		60	0.9	2.5	1.4
	U12	1.0		20	0.2	1.0		20	0.2					2.0	0.4
	U13	0.5				0.5		20	0.1	0.5		20	0.1	1.5	0.2
	U14	0.5		20	0.1									0.5	0.1
	U15	0.4		20	0.1					0.1		80	0.1	0.5	0.2
	U16	2.0		10	0.2	2.0		20	0.4	1.0		30	0.3	5.0	0.9
	U17	1.0		10	0.1	1.0		20	0.2					2.0	0.3
	U18	1.0		10	0.1									1.0	0.1
	TOTAL	17.3			5.4	5.4			1.4	7.3			4.7	c 30.0	g 11.5
GRAND TOTAL		51.4			23.0	11.8			4.0	36.8			22.9	d 100.0	h 49.9

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* PLANT NO. *10* EST. BY *M.F.B. & Co.* DATE *3/11/21*

KEY: ① + ⑤ + ⑨ = ⑬ ; ④ + ⑧ + ⑫ = ⑭ ; Excellent = 0% Waste, Good = 20% Waste, Fair = 40% Waste, Poor = 60% Waste, Bad = 80% Waste ; a + b + c = d = 100% ; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT: Assigned Points 1	Est. % Waste 2	Est. % Waste 3	Points Waste 4	LABOR: Assigned Points 5	Est. % Waste 6	Est. % Waste 7	Points Waste 8	OUTSIDE CONTACTS: Assigned Points 9	Est. % Waste 10	Est. % Waste 11	Points Waste 12	TOTAL WASTE: Assigned Points 13	Points Waste 14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1														
	K2	3.0	10		0.3									3.0	0.3
	K3														
	K4														
	K5	1.5		60	0.9					0.5		60	0.3	2.0	1.2
	K6														
	K7														
	K8	4.0	50		2.0	2.5	40		1.0	1.5	40		0.6	8.0	3.6
	K9														
	K10	0.5		20	0.1	0.2				1.3		20	0.3	2.0	0.4
	K11														
	K12														
	K13														
	K14	1.0	20		0.2	1.0	20		0.2	0.2	40		0.1	2.2	0.5
	K15														
	K16	0.3		100	0.3	0.2		100	0.2					0.5	0.5
	K17	2.0				1.0				1.0	20		0.2	4.0	0.2
	K18														
	K19	0.3		30	0.1									0.3	0.1
	K20	1.0		40	0.4	1.0		20	0.2					2.0	0.6
	K21	0.5		40	0.2	0.5		40	0.2					1.0	0.4
	TOTAL	14.1			4.5	6.4			1.8	4.5			1.5	a 25.0	e 7.8
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0												3.0	
	T2	3.0		60	1.8									3.0	1.8
	T3	3.0		40	1.2									3.0	1.2
	T4	3.0		60	1.8									3.0	1.8
	T5	3.0		40	1.2									3.0	1.2
	T6 X	DOES NOT APPLY TO THE TEXTILE INDUSTRY													
	T7	5.0		80	4.0					25.0		60	15.0	30.0	19.0
	TOTAL	20.0			10.0					25.0			15.0	b 45.0	f 25.0
UTILIZATION — Effectiveness of Technical Knowledge and Organization Direction, Control and Accounting Factors	U1	2.0		20	0.4									2.0	0.4
	U2	1.0		20	0.2					1.0		80	0.8	2.0	1.0
	U3														
	U4	2.0	60		1.2									2.0	1.2
	U5														
	U6	0.5		20	0.1									0.5	0.1
	U7	3.0		10	0.3					2.0		60	1.2	5.0	1.5
	U8	0.5	80		0.4	0.5	60		0.3	1.0	80		0.8	2.0	1.5
	U9	0.5		40	0.1									0.5	0.1
	U10	0.4		80	0.3	0.4		80	0.3	0.2		80	0.2	1.0	0.8
	U11	1.0		30	0.3					1.5		60	0.9	2.5	1.2
	U12	1.0		30	0.3	1.0		40	0.4					2.0	0.7
	U13	0.5		40	0.2	0.5		40	0.2	0.5		40	0.2	1.5	0.6
	U14	0.5		20	0.1									0.5	0.1
	U15	0.4		100	0.4					0.1		80	0.1	0.5	0.5
	U16	2.0		40	0.8	2.0		60	1.2	1.0		40	0.4	5.0	2.4
	U17	1.0		30	0.3	1.0		50	0.5					2.0	0.8
	U18	1.0		40	0.4									1.0	0.4
	TOTAL	17.3			5.8	5.4			2.9	7.3			4.6	c 30.0	g 13.3
GRAND TOTAL		51.4			20.3	11.8			4.7	36.8			21.1	d 100.0	h 46.1

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* **PLANT NO.** *11* **EST. BY** *M. F. B. & Co.* **DATE** *3/15/21*

KEY
①+⑤+⑨=⑬ ④+⑧+⑫=⑭
Excellent = 0% Waste; Good = 20% "; Fair = 40% "; Poor = 60% Waste; Bad = 80% "
a + b + c = d = 100%
e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT: Assigned Points	MANAGEMENT: Est. % Waste		MANAGEMENT: Points Waste	LABOR: Assigned Points	LABOR: Est. % Waste		LABOR: Points Waste	OUTSIDE CONTACTS: Assigned Points	OUTSIDE CONTACTS: Est. % Waste		OUTSIDE CONTACTS: Points Waste	TOTAL WASTE: Assigned Points	TOTAL WASTE: Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1														
	K2	3.0	100		3.0									3 0	3 0
	K3														
	K4														
	K5	1.5		100	1.5					0.5		60	0.3	2.0	1.8
	K6														
	K7														
	K8	4.0	90		3 6	2.5	40		1.0	1.5	40		0.6	8.0	5.2
	K9														
	K10	0.5		20	0.1	0.2		0.0	0.0	1.3		20	0.3	2.0	0.4
	K11														
	K12														
	K13														
	K14	1.0	20		0.2	1.0	20		0.2	0.2	40		0.1	2.2	0.5
	K15														
	K16	0.3		100	0.3	0.2		100	0.2					0.5	0.5
	K17	2 0	50		1.0	1.0	50		0 5	1.0	50		0.5	4.0	2.0
	K18														
	K19	0.3		100	0.3									0.3	0.3
	K20	1.0		50	0 5	1.0		50	0.5					2 0	1.0
	K21	0 5		80	0 4	0 5		80	0 4					1.0	0 8
	TOTAL	14.1			10.9	6.4			2.8	4.5			1.8	a 25.0	e 15.5
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0		20	0.6									3.0	0.6
	T2	3.0		50	1.5									3.0	1.5
	T3	3.0		40	1.2									3 0	1.2
	T4	3.0		70	2.1									3.0	2.1
	T5	3.0		40	1.2									3.0	1.2
	T6 X	DOES NOT APPLY TO THE TEXTILE INDUSTRY													
	T7	5.0		60	3.0					25.0		60	15.0	30.0	18.0
	TOTAL	20.0			9.6					25.0			15.0	b 45.0	f 24.6
UTILIZATION: Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	2.0		90	1.8									2.0	1.8
	U2	1.0		50	0.5					1.0		60	0.6	2.0	1.1
	U3														
	U4	2.0	60		1.2									2.0	1.2
	U5														
	U6	0.5		60	0.3									0.5	0.3
	U7	3.0		60	1.8					2.0		50	1.0	5.0	2.8
	U8	0.5	100		0.5	0 5	60		0.3	1.0	80		0.8	2.0	1.6
	U9	0.5		60	0.3									0.5	0.3
	U10	0.4		60	0.1	0.4		80	0.3	0.2		60	0.1	1.0	0.5
	U11	1.0		60	0.6					1.5		60	0.9	2.5	1 5
	U12	1.0		50	0.5	1.0		50	0.5					2.0	1.0
	U13	0.5		40	0.2	0.5		40	0.2	0.5		40	0.2	1.5	0.6
	U14	0.5		40	0.2									0.5	0.2
	U15	0.4		50	0.2					0.1		80	0.1	0.5	0.3
	U16	2 0		50	1.0	2.0		50	1.0	1.0		50	0.5	5.0	2.5
	U17	1.0		30	0.3	1.0		40	0.4					2.0	0.7
	U18	1.0		40	0.4									1.0	0.4
	TOTAL	17.3			9.9	5.4			2.7	7.3			4.2	c 30.0	g 16.8
GRAND TOTAL		51.4			30.4	11.8			5.5	36.8			21.0	d 100	h 56.9

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* PLANT NO. *12* EST. BY *M. F. B. & Co.* DATE *3/29/21*

KEY: ① + ⑤ + ⑨ = ⑬; ④ + ⑧ + ⑫ = ⑭; Excellent = 0% Waste; Good = 20% Waste; Fair = 40% Waste; Poor = 60% Waste; Bad = 80% Waste; a + b + c = d = 100%; e + f + g = h = % Waste

CAUSES	Guide Questions for Field Investigator	MANAGEMENT: Assigned Points (1)	Est. % Waste (2)	Est. % Waste (3)	Points Waste (4)	LABOR: Assigned Points (5)	Est. % Waste (6)	Est. % Waste (7)	Points Waste (8)	OUTSIDE CONTACTS: Assigned Points (9)	Est. % Waste (10)	Est. % Waste (11)	Points Waste (12)	TOTAL WASTE: Assigned Points (13)	Points Waste (14)
ORGANIZATION: Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1														
	K2	3.0	20		0.6									3.0	0.6
	K3														
	K4														
	K5	1.5		100	1.5					0.5		60	0.3	2.0	1.8
	K6														
	K7														
	K8	4.0	40		1.6	2.5	40		1.0	1.5	40		0.6	8.0	3.2
	K9														
	K10	0.5		20	0.1	0.2		20	0.0	1.3		40	0.5	2.0	0.6
	K11														
	K12														
	K13														
	K14	1.0	40		0.4	1.0	40		0.4	0.2	50		0.1	2.2	0.9
	K15														
	K16	0.3		20	0.1	0.2		10	0.0					0.5	0.1
	K17	2.0	20		0.4	1.0	20		0.2	1.0	20		0.2	4.0	0.8
	K18														
	K19	0.3		30	0.1									0.3	0.1
	K20	1.0		30	0.3	1.0		40	0.4					2.0	0.7
	K21	0.5		20	0.1	0.5		20	0.1					1.0	0.2
	TOTAL	14.1			5.2	6.4			2.1	4.5			1.7	a 25.0	e 9.0
TECHNICAL: Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0		10	0.3									3.0	0.3
	T2	3.0		20	0.6									3.0	0.6
	T3	3.0		20	0.6									3.0	0.6
	T4	3.0		60	1.8									3.0	1.8
	T5	3.0		20	0.6									3.0	0.6
	T6 X	DOES NOT APPLY TO THE TEXTILE INDUSTRY													
	T7	5.0		60	3.0					25.0		70	17.5	30.0	20.5
	TOTAL	20.0			6.9					25.0			17.5	b 45.0	f 24.4
UTILIZATION: Effectiveness of Technical Knowledge and Organization. Direction, Control and Accounting Factors	U1	2.0		70	1.4									2.0	1.4
	U2	1.0		40	0.4					1.0		70	0.7	2.0	1.1
	U3														
	U4	2.0	60		1.2									2.0	1.2
	U5														
	U6	0.5		60	0.3									0.5	0.3
	U7	3.0		50	1.5					2.0		60	1.2	5.0	2.7
	U8	0.5	60		0.3	0.5	40		0.2	1.0	40		0.4	2.0	0.9
	U9	0.5		60	0.3									0.5	0.3
	U10	0.4		50	0.2	0.4		50	0.2	0.2		50	0.1	1.0	0.5
	U11	1.0		20	0.2					1.5		40	0.6	2.5	0.8
	U12	1.0		20	0.2	1.0		20	0.2					2.0	0.4
	U13	0.5		20	0.1	0.5		20	0.1	0.5		20	0.1	1.5	0.3
	U14	0.5		40	0.2									0.5	0.2
	U15	0.4		20	0.1					0.1		80	0.1	0.5	0.2
	U16	2.0		40	0.8	2.0		40	0.8	1.0		40	0.4	5.0	2.0
	U17	1.0		40	0.4	1.0		40	0.4					2.0	0.8
	U18	1.0		70	0.7									1.0	0.7
	TOTAL	17.3			8.3	5.4			1.9	7.3			3.6	c 30.0	g 13.8
GRAND TOTAL		51.4			20.4	11.8			4.0	36.8			22.8	d 100	h 47.2

FIELD REPORT EVALUATION

COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY
AMERICAN ENGINEERING COUNCIL
OF
THE FEDERATED AMERICAN ENGINEERING SOCIETIES

INDUSTRY *Textile* **PLANT NO.** *13* **EST. BY** *M. F. B. & Co.* **DATE** *3/29/21*

KEY
① + ⑤ + ⑨ = ⑬ Excellent = 0% Waste, Good = 20% ", Fair = 40% ", Poor = 60% Waste, Bad = 80% "
④ + ⑧ + ⑫ = ⑭ a + b + c = d = 100%, e + f + g = h = 0% Waste

CAUSES	Guide Questions for Field Investigator	RESPONSIBILITIES: MANAGEMENT — Assigned Points	MANAGEMENT — Est. % Waste		MANAGEMENT — Points Waste	LABOR — Assigned Points	LABOR — Est. % Waste		LABOR — Points Waste	OUTSIDE CONTACTS — Assigned Points	OUTSIDE CONTACTS — Est. % Waste		OUTSIDE CONTACTS — Points Waste	TOTAL WASTE — Assigned Points	TOTAL WASTE — Points Waste
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
ORGANIZATION — Mechanism of Industry as to Type, Methods (Paper Work) and Personnel, Assignment and Discharge of Responsibility and Relationship	K1														
	K2	30	80		24									3.0	2.4
	K3														
	K4														
	K5	1.5		60	0.9					0.5		60	0.3	2.0	1.2
	K6														
	K7														
	K8	4.0	80		3.2	2.5	60		1.5	1.5	60		0.9	8.0	5.6
	K9														
	K10	0.5		20	0.1	0.2		20		1.3		40	0.5	2.0	0.6
	K11														
	K12														
	K13														
	K14	1.0	40		0.4	1.0	40		0.4	0.2	50		1.0	2.2	1.8
	K15														
	K16	0.3		100	0.3	0.2		100	0.2					0.5	0.5
	K17	2.0	20		0.4	1.0	40		0.4	1.0	60		0.6	4.0	1.4
	K18														
	K19	0.3		100	0.3									0.3	0.3
	K20	1.0		40	0.4	1.0		40	0.4					2.0	0.8
	K21	0.5		80	0.4	0.5		80	0.4					1.0	0.8
	TOTAL	14.1			8.8	6.4			3.3	4.5			3.3	a 25.0	e 15.4
TECHNICAL — Available Engineering Knowledge as to Product, Plant and Materials	T1	3.0		30	0.9									3.0	0.9
	T2	3.0		90	2.7									3.0	2.7
	T3	3.0		80	2.4									3.0	2.4
	T4	3.0		80	2.4									3.0	2.4
	T5	3.0		30	0.9									3.0	0.9
	T6 X	*DOES NOT APPLY TO THE TEXTILE INDUSTRY*													
	T7	5.0		40	2.0					25.0		40	10.0	30.0	12.0
	TOTAL	20.0			11.3					25.0			10.0	b 45.0	f 21.3
UTILIZATION — Effectiveness of Technical Knowledge and Organization, Direction, Control and Accounting Factors	U1	2.0		80	1.6									2.0	1.6
	U2	1.0		40	0.4					1.0		60	0.6	2.0	1.0
	U3														
	U4	2.0	60		1.2									2.0	1.2
	U5														
	U6	0.5		80	0.4									0.5	0.4
	U7	3.0		80	2.4					2.0		60	1.2	5.0	3.6
	U8	0.5	80		0.4	0.5	40		0.2	1.0	40		0.4	2.0	1.0
	U9	0.5		100	0.5									0.5	0.5
	U10	0.4		50	0.2	0.4		50	0.2	0.2		50	0.1	1.0	0.5
	U11	1.0		20	0.2					1.5		40	0.6	2.5	0.8
	U12	1.0		20	0.2	1.0		20	0.2					2.0	0.4
	U13	0.5		20	0.1	0.5		20	0.1	0.5		20	0.1	1.5	0.3
	U14	0.5		40	0.2									0.5	0.2
	U15	0.4		20	0.1					0.1		80	0.1	0.5	0.2
	U16	2.0		60	1.2	2.0		40	0.8	1.0		40	0.4	5.0	2.4
	U17	1.0		40	0.4	1.0		40	0.4					2.0	0.8
	U18	1.0		30	0.3									1.0	0.3
	TOTAL	17.3			9.8	5.4			1.9	7.3			3.5	c 30.0	g 15.2
GRAND TOTAL		51.4			29.9	11.8			5.2	36.8			16.8	d 100.0	h 51.9

PART III

GENERAL REPORTS

INTRODUCTORY NOTE

The topical reports in this section are markedly different from the engineering reports which go before. The Committee's plan for the investigation of waste provided not only for a series of intensive field studies made at first-hand by engineers, but also for general summaries of available information on special topics compiled by statisticians, economists and others. Original research was out of the question. A digest of matter easily available was all that the Committee asked or expected, and the writers of the reports which follow would be the first to point out that their contributions are neither exhaustive nor new. The Committee believes they are valuable because they are an attempt to bring up to date in small compass certain broad aspects of waste in industry and its elimination.

The author of each report is solely responsible for its accuracy and fairness.

CHAPTER XI

UNEMPLOYMENT

By John Koren and Others

INTRODUCTORY

Lack of Systematized Elemental Information.—An exact measurement of unemployment and the causes underlying it are lacking for the country as a whole and even for individual industries. Nor has there been a thorough-going test of the means whereby employment generally can be stabilized and industries put on a basis that will secure an even flow of productive activity. Seasonal, mechanical and other factors that necessarily make for unemployment are easily demonstrated, but little attempt has been made to record their influence as revealed by an intensive inquiry conducted along broad lines; our knowledge is in consequence fragmentary and cannot point to remedial practices that have stood every test.

Need for Continuous Information.—For the United States as a whole there has been no single agency charged with the collection of unemployment statistics and other data for their proper interpretation. From time to time, the Bureau of Labor Statistics compiles unemployment figures for a number of establishments in some of the leading industries; and in a very few states public offices systematically gather information about the employment situation. For particular industries data on the subject are secured by employers' associations. Trade unions also concern themselves with unemployment statistics of most crafts; indeed, in some states the trade union statistics are regularly published by the official labor bureaus. Employment facts are also gathered by private organizations, which supply such data to their clients on a commercial basis.

In short, the fundamental knowledge required to present a survey of the unemployment situation at any period must be pieced together from the gleanings of many agencies, which are not subject to any central control.

Employment figures comparable, for instance, to those collected in England by the Board of Trade are not compiled in the United States. The recently inaugurated plans of the United States Employment Service aim to remedy this lack through regular bulletins, which will contain:

1. A graphic line showing the national trend of employment.
2. A table showing the percentage of increase or decrease from the preceding period in the fourteen industrial groups set up by the United States Bureau of the Census.
3. A table showing a geographical analysis of the first table, indicating the areas of increase or decrease in employment.
4. Comment on the employment situation in 231 leading industrial centers.
5. Data regarding registrations, requirements and placements of labor by federal, state and municipal bureaus.
6. Immigration and emigration data.

Need for Regularizing Employment.—It would be a long step forward to get continuous information about unemployment conditions throughout our vast territory. The next and more important step would be to devise means for regularizing employment in the principal industries—a task to be undertaken by those who conduct them.

This report on unemployment and on attempts to alleviate it is divided as follows:

- *I*. Intermittent Employment
  - A. Temporary Shutdowns and Layoffs
  - B. Seasonal Employment
    - 1. Seasonal Industries Employing Skilled Workers
      - (*a*) The Building and Allied Trades
      - (*b*) Coal Mining
      - (*c*) The Clothing Industry
    - 2. Seasonal Trades Employing Unskilled Labor
      - (*a*) Agriculture
      - (*b*) Canning and Preserving
      - (*c*) The Lumber Industry
      - (*d*) Dock Labor
      - (*e*) Employment of Casual Labor in Winter
- *II*. Climacteric Unemployment
- *III*. Residual Unemployment
- *IV*. Employment Exchanges
  - A. In United States
    - 1. Public
      - (*a*) Federal
      - (*b*) State
      - (*c*) Municipal
    - 2. Semi-public
    - 3. Private
      - (*a*) Commercial Employment Agencies
      - (*b*) Employers' Associations' Employment Bureaus
      - (*c*) Trade Union Employment Bureaus
  - B. In Foreign Countries
    - 1. Great Britain
    - 2. Canada
    - 3. Italy
    - 4. Other Foreign Countries
- *V*. Public Works

VI. Unemployment Insurance
VII. Spreading out the Job
VIII. Immigration and Unemployment

I. INTERMITTENT EMPLOYMENT

A. Temporary Shutdowns and Layoffs.—An element frequently overlooked in the unemployment situation is what opportunity do workers nominally employed have to work a full week and to draw a full week's pay. For instance, a report of the Connecticut Commission on the Condition of Wage-earning Women and Minors in 1913 showed that for 942 females in the cotton industry, the weekly earnings were 13.9 % less than full-time earnings; in the silk industry, 1,175 females received 18.2% less than full-time earnings; in brass factories, 662 females received 14.1% less; and in the metal trades, 2,541 females received less than 13.9% full-time earnings. The frequent layoffs for half-days and days in the bituminous coal industry are another case in point.[1]

During 1919 in the paper box industry,[2] 4,311 employees in 77 establishments averaged 90% of full time; in the women's clothing industry, 6,772 women workers employed in 157 establishments averaged 91%; in the confectionery industry, 12,152 workers in 101 establishments averaged 87%; and in the overall industry, 6,546 workers in 129 establishments averaged 87% of full time. In the brick, [3] chemical and glass industries the percentage of full time worked was 85, 84 and 87 respectively. When this record is examined in detail, it appears that some classes of workers are more frequently put on short time than others. White goods finishers averaged 79% of full time, though the average for the women's clothing industry as a whole was 91%. Laborers in the brick industry worked 77% of full time, while the average for the industry as a whole was 85%. Any number of similar examples might be cited.

Causes of Temporary Shutdowns and Layoffs.—Among the leading external factors resulting in temporary shutdowns and layoffs are transportation difficulties. The consequences of car shortage are well known in reference to the bituminous coal industry. In other industries delayed deliveries have the same disorganizing effect, frequently resulting in partial or total plant shutdowns for lack of fuel or raw materials.

Restriction of production by the manufacturer in order to secure price control is another cause of temporary unemployment. The present attempt of the Japanese silk industry artificially to maintain prices is an instance in point.

[1] Tonnage Output per Pick Miner per Day in Bituminous Coal Fields. Ethelbert Stewart. Monthly Labor Review, February, 1921.

[2] Monthly Labor Review, April, 1920.

[3] Monthly Labor Review, May, 1920.

Even when it is the purpose of the management to insure regularity of employment there are many failures in the performance. The failure of the sales department to secure orders may disturb the continuity of factory operation. In the aggregate a large amount of time is lost through layoffs of men in a single department or sections of a department through inefficient management manifested by poor stock methods, inefficient routing, neglect of equipment and the like. The failure to have necessary parts in stock, the irregular flow of material, machine breakdowns and similar accidents, which an efficient organization should eliminate, result in a continual nibbling at the employees' time. Shutdowns for the annual inventory are another survival of the past, which mean a total in all industries of many lost days in the year.

Methods of scientific management have greatly reduced the layoffs resulting from lack of organization. The chief service of scientific management in eliminating layoffs and shutdowns is the removal of the unexpected through the standardization of all elements in the manufacturing process.

B. Seasonal Employment.—Seasonal industries may be divided for convenience into two general classes:

1. Those employing a large number of skilled and semi-skilled workers who depend upon the industry for livelihood during the year. Such industries are the building trades, coal mining, the clothing trade, etc.
2. Those employing casual unskilled laborers who travel from place to place as the demand appears, such as farming, lumbering, canning, etc.

Workers engaged in the industries in class 1 either must be paid a wage substantially above that prevailing in other industries or must suffer great privation during the periods of unemployment now inherent to the industry.

1. SEASONAL INDUSTRIES EMPLOYING SKILLED WORKERS

(*a*) *The Building and Allied Trades.*—The building trades form the most important of the industries included in class 1. According to the latest available census figures,[1] there were 1,779,964 skilled workers and 934,909 unskilled workers depending on these trades for a livelihood. The total is 3.8% of the classified population in 1910. Due to war activities this proportion of building workers has possibly increased.

Although somewhat in conflict with recent tendencies toward specialization in construction work, some measures taken to regularize employment in building have met with success according to the testimony of a number of contractors. Briefly stated they are:

1. To bid for varied types of construction.

[1] U. S Census, 1910.

2. To shave down bids for contracts to carry their organization through dull periods.
3. To accept the policy of taking small and perhaps unremunerative contracts so that the working force not engaged in the large undertakings may be utilized.

Brick and Tile Products.—The manufacture of brick and tile products is more seasonal in character than building as it depends on construction work for its market and is more or less affected by weather conditions.

According to the U. S. Census of Manufactures, 1914, there were 100,182 workers employed in this industry. It is estimated that not more than 50,000 of them are employed in the mid-winter months.

(*b*) *Coal Mining.*—Next to the building and allied trades, coal mining is the most important industry in the first class of seasonal industries. There are over 750,000 men employed in coal mining who are idle during a substantial portion of the year.

The number of employees and the average number of days worked for a 6-year period are reported as follows by the U. S. Geological Survey.[1]

Year	Anthracite		Bituminous	
	Men Employed	Days Worked	Men Employed	Days Worked
1913	175,745	257	571,882	232
1914	179,679	245	583,506	195
1915	176,552	230	557,456	203
1916	159,869	253	561,102	230
1917	154,174	285	603,143	243
1918	147,121	293	605,000	252

During this 6 year period anthracite miners worked on an average of 260.5 days out of a possible 308, thus losing an average of 15.5% of working days. Bituminous miners worked on an average of 226 days and thus lost 26.7% of possible working days.

Bituminous Coal Mining.—The principal causes of irregularity of employment in bituminous coal mining are the seasonal character of the market and the inadequacy and irregularity of car supply. Another effect of the seasonal character of the industry is that it breeds unrest among the workers who are constrained to much idleness.

The report of the United States Bituminous Coal Commission says, 1920:

[1] United States Geological Survey Preliminary Report on the Mineral Resources of the United States in 1918, 1919.

"The coal industry is a part-time industry. The number of idle days, out of a possible 308 working days, being 63 in 1918 and 115 in 1919. On the average for the past 30 years, the number of possible working days, when the mines were not in operation, was 93."

It was estimated that America requires less than 500,000,000 tons of bituminous coal a year, while the capacity of the mines in operation is over 700,000,000 tons. In regard to foreign consumption the Commission said:

"It is not to be expected that exports of coal will increase sufficiently to absorb a perceptible proportion of the gap between the demand for coal and the capacity of mines, as our shipping-terminal facilities are such that not more than 25,000,000 tons of coal a year can at present be exported."

Means proposed for standardizing coal production include a plan advocated by the miners for an adjustment of work hours and an appeal to industrial consumers and to the railroads to co-operate in bringing about an even demand for coal.

The union miners proposed as a solution a 6-hour work day of 5 days per week, with penal rates for overtime. They claim that the 30-hour week would be sufficient to produce all bituminous coal needed for the country and that it would tend to distribute production more evenly through the year.

Any plan to regularize the demand for coal chiefly involves increased facilities for storage, not only at the mines but at railroad terminals and industrial plants.

Anthracite Coal Mining.—While the causes of irregularity of employment in anthracite coal mining are not precisely the same as in bituminous coal mining, the degree of irregularity is at least as great. According to the report made to the United States Anthracite Coal Commission by W. Jett Lauck, on behalf of the United Mine Workers of America, the anthracite mine workers have suffered more from irregularity of employment than have the bituminous mine workers. The report says:

"During the period since 1881 the anthracite workers have had an opportunity to work on an average only 212 days out of each year. This means 92 days of idleness, 30 per cent of the working year during which they have no opportunity to earn a living wage."

The fundamental cause of irregular employment in anthracite mining has been "no market," according to the report quoted above.

"In other words the equipment and labor force have been more than adequate to produce the supply which the market has been ready to absorb. . . . In order to estimate the probable number of days which will be averaged in future years, it will be necessary to form a judgment as to the probable future of the market in relation to possible production. From this and from data for the last decade it would appear that the market for anthracite in the future will remain in a state of equilibrium at about the level for the years 1910 and 1916, inclusive.

"This will mean that the maximum average days per year to be expected will be about 242, leaving the worker to face unemployment for 20 per cent of the working year."

The problem of car shortage, so important in the bituminous industry, has played a small part in the anthracite industry. Regularization, therefore, depends chiefly on the even placement of orders through the year.

(*c*) *The Clothing Industry.*—The clothing industry has been and still is to a considerable extent a seasonal industry.

The manufacture of men's clothing employed 173,747 workers according to the U. S. Census of Manufacturers, 1914. The manufacture of women's clothing employed 168,907 at the time this census was taken. There are ordinarily two busy seasons and two dull seasons in the clothing trade. The busy seasons extend from about the middle of June to the first of September, and from the first of December to the latter part of February.

The causes of these fluctuations in employment conditions of the clothing industry are found in the seasonal demands by the retail trade. Constant variations in style lead to caution in buying until the market is reasonably assured to the retail merchants.

An attempt towards abolishing the seasonal character of the clothing industry in Cleveland is summarized by W. J. Mack [1] as follows:

"The distinctive feature of the situation in Cleveland is the system now being installed in the hope of eliminating so far as possible this seasonal difficulty—avoiding on the one hand the evils of under-productivity on the part of the workers, and on the other hand the lack of continuity of employment during the slack periods. It provides that the union and the association shall jointly engage and pay industrial engineers who, under the supervision of the Impartial Chairman, shall establish for each of the factories fair and accurate standards of average production for a minimum weekly wage, each worker to receive additional pay for every unit he or she produces in excess of the minimum standard. It has been further understood that the employers will guarantee each permanent worker at least forty weeks' employment and one week's vacation with pay."

The chief efforts to regularize employment conditions in the clothing trade may be outlined as follows:

1. The elimination of the sub-contract system, and the abolition of the "sweat shop."
2. Co-operation among manufacturers in setting standards.

[1] Mack, W. J., Industrial Peace in Cleveland, The Nation, February 16, 1921.

3. The manufacture of plain, conservative models during the dull seasons.
4. The scientific analysis of trade conditions for the anticipation of market demands.
5. Strict adherence to contracts made by manufacturers with buyers.

The above methods, if effected, would permit the manufacturer to make up a proportion of his products before the actual orders have been placed.

Millinery and Hat Manufacture.—The average length of yearly employment in the velvet and felt hat establishments ranges from 8 to 10 months. The rush period comes during the summer in preparation for the autumn trade. The dull season occurs after November. In women's millinery the seasons in flower and feather factories are different, the flower factory season occurring in January to April or May, the feather factory season extending from August to December. The straw hat factories have a busy season of approximately six months, extending through the late fall, winter and early spring.

Efforts to maintain steady production in the hat industry have been made chiefly from the point of view of factory overhead rather than for the purpose of continuously employing the working force. Many felt hat factories manufacture straw hats in otherwise dull seasons. This, however, necessitates a partial reorganization of the work force each year.

Seasonal Nature of all Industries.—Although the several industries vary greatly in the degree to which they are affected by seasons it might be said that practically all industries are seasonal; there are few trades which do not pass through dull periods at regular intervals. The shoe trade, the textile industries, the steel industry, slaughtering and meat packing, etc., all have regular intervals of slack time as well as those resulting from major industrial depressions.

2. SEASONAL TRADES EMPLOYING UNSKILLED LABOR

(*a*) *Agriculture.*—The farming of the country is carried on by local labor supplemented chiefly by the casual unskilled labor. It is with the latter class that the present survey chiefly has to deal. An indication of the demand for farm labor for the first half of the year is afforded by a report made by the U. S. Employment Service, 1918.[1]

Number of farm laborers called for during:

January	98
February	1,296
March	8,784
April	18,458
May	23,081
June	69,577
July 1st to 13th inclusive	28,089

[1] U. S. Empoyment Service, Annual Report of the Director General. Fiscal year ended June 30, 1918.

These figures reflect the demand for the country as a whole. The seasonal demand varies with the section of the country. In the New England states, for instance, it is greatest in April for the first half of the year considered, while in the winter wheat belt the peak of the demand comes in June.

The greatest single agricultural requirement for casual labor in this country is found in the harvesting of the winter wheat crop. In 1920 the U. S. Employment Service[1] directed 53,072 harvest hands in the wheat belt.

"During a normal season, harvest should start in north central Oklahoma about June 5 to 8, reaching the southern Kansas counties about June 15 to 18; the central Kansas counties about 10 days later, and the north central and northwestern territory about July 1 to 5. Under these conditions, it becomes possible to utilize the services of many men, who start in Oklahoma in the southern or central Kansas counties, and those who commence in southern Kansas finish in time to assist in the harvest in the north central and northwestern districts."

The problem of efficient use of casual labor to supplement local agricultural labor is largely one of distribution through adequate machinery for transportation and placement at points where labor is temporarily required. In the nature of things agricultural labor cannot be regularized, but it is possible to provide for a better distribution of casual workers and the temporarily unemployed industrials.

(*b*) *Canning and Preserving.*—The canning of food products is necessarily seasonal because it must be accomplished when fruits and vegetables ripen.

The fish canning industry located on the Atlantic and Pacific seaboards, is intermittent to a less degree than fruit and vegetable canning. Different kinds of fish are handled at different periods of the year, this permitting a long season. The season at best extends over ten months of the year. Midwinter is the time of maximum employment, a period of idleness occurring in the spring months. The canning season is considerably shorter than the curing and packing seasons. Much of the extra labor taken on in rush seasons is local, and where possible women are employed.

Fruit and berry canning is largely done in eastern and far western states; vegetable canning in the central portions of the country. California is the most important state in which fruit and berry canning is undertaken. Over 55% of the total product is canned within a maximum of eight weeks. Similar conditions exist in the fruit and berry canning industry in the eastern states.

[1] U. S. Employment Service, Annual Report of the Director General. Fiscal year ended June 30, 1920.

Fluctuations in employment in the canning and preserving industry for the country as a whole have been compiled by the U. S. Census of Manufactures, 1914. The number employed varied from 27,917 on January 15 to 185,724 on September 15. In the middle western and western states the greatest number are employed in canning in July, August, and September, but in the eastern states during August, September and October. A large percentage of the workers employed are women.

Efficient adjustment in the canning of the various products as the season advances has been found effective particularly in California in lengthening the season of employment. The increased use of cold storage also effects a steadier employment condition in the canning industry.

(c) *The Lumber Industry.*—The total number of men employed in the United States in 1910 as lumbermen, raftsmen and woodchoppers was reported to be 161,191, by the U. S. Census. No recent figures have been compiled from authoritative sources covering the whole country. The number of lumbermen, however, has probably increased to a considerable extent.

The greater part of the lumber cut is made in the winter months. Many woodsmen are found in the wheat belt in summer. Many others might be utilized in other agricultural work. In winter these men could again be recruited for the woods.

(d) *Dock Labor.*—The work of stevedores is necessarily intermittent, depending on the amount of shipping in harbor at any given time. To meet the emergencies of rush seasons a large surplus of labor is essential.

Measures looking towards regularization of this work might be undertaken similar to those carried out by the U. S. Employment Service to meet wartime requirements.

"It was agreed that there should be formed an elastic labor pool, and that the United States Employment Service should organize and direct the activities of the new division, and that henceforth men would shift not only from one dock to another nearby, but also from one side of Manhattan to the other, from Hoboken to South Brooklyn, should it be found necessary, and, as one of the representatives of the longshoremen said, from one port to another, making the Atlantic coast one dock.

"There were established in New York seven branches of the Stevedores and Marine Workers' Division, with the clearing house for the labor pool located in the Bowling Green Building, New York City. Other branches were established at Philadelphia, Baltimore, Norfolk, Newport News, Charleston, S. C., Mobile, New Orleans, Galveston, Boston, Portland, Buffalo, Seattle, and Duluth.

"That the service was a success can be measured by the statements frequently made that the port of New York increased its efficiency at least 30%, by the elastic labor pool for longshoremen and marine workers developed by the Employment Service."

(*e*) *Employment of Casual Labor in Winter.*—The fact that the basic industries of the country, including agricultural and railroad construction work, are absolutely dependent upon migratory workers, points to the necessity of solving the winter unemployment problem of casual labor.

As emphasized by Pigou [1] the winter months offer fewest employment opportunities for casual labor. Outside of logging, ice cutting and snow shovelling there is small requirement for this type of supplementary labor. These workers tend to concentrate in the large cities, depending on odd jobs, on charity, and sometimes on crime for a livelihood.

The report of the Commission on Industrial Relations outlined [2] the problem of migratory labor and recommended a national distribution agency.

"The movement of these migratory workers at the present time is practically unorganized and unregulated. Workmen in large numbers go long distances in the hope of finding employment on the basis of a mere rumor, and frequently find that there is either no work or work for only a few. At the same time, the demand for labor in a given locality or industry remains unfilled because the workers have failed to hear of the opportunity. . . .

"The attempts to regulate the movements of migratory workers by local organizations have, without exception, proved failures. This must necessarily be true no matter how well planned or well managed such local organizations may be.

"The problem cannot be handled except on a national scale and by methods and machinery which are proportioned to the enormous size and complexity of the problem."

II. CLIMACTERIC UNEMPLOYMENT

The two main causes of climacteric unemployment are: (1) international dislocations resulting from a great war; (2) the alternation of business expansion and business depression inherent in the complicated modern industrial structure. Remedies suggested for this are numerous and diverse.

The underlying causes of cyclical depressions have been attributed to numerous factors, ranging from crop failures to sun spots. The generally accepted theory seems to be that depressions result from too rapid trade and industrial expansions. That they should be ascribed to over-production of commodities at any given time has been repudiated by economists.

The major industrial disturbances occurring in this country in the last hundred years took place in 1837, 1873, 1893, 1907–1908, 1914–1915

[1] Pigou, A. C. Unemployment. New York, 1914.

[2] United States Commission on Industrial Relations, Final Report, 1915.

and 1919. Unemployment figures for the country as a whole are not available for the earlier periods of depression. According to estimates of Hornell Hart [1] there were 3,500,000 unemployed, averaged by months, in 1908. The greatest number unemployed in this year was 4,200,000 in April.

In both 1914 and 1915 there was an average of about 4,500,000 idle The high point was reached in January, 1915, with 6,500,000 idle.

Estimates made by the U. S. Employment Service and by the American Federation of Labor place the number of unemployed in January and February, 1921, at from 4,000,000 to 5,000,000.

The total amount of unemployment cannot be attributed solely to the respective periods of depression. The months which show highest unemployment figures are those of winter or early spring when many of the seasonal industries are at a low ebb. In a severe period of depression, however, it may be expected that the normal average amount of unemployment in any month will be about doubled.

While it is not within the province of this report to discuss the fundamental causes of industrial depressions, some suggestions for overcoming, at least in part, periods of economic stagnation are repeated here. Ordway Tead and H. C. Metcalf [2] express themselves as follows:

> "One of the conspicuous things that happens is that each individual competing plant loses sight of the total real demand, or imagines that it can capture a larger proportion of the demand than it ever did before. The total demand, even if known, is not related to the producing capacity of an entire industry."

A regularization of this point could best be brought about, according to Tead and Metcalf, by the establishment of national industrial councils similar to the English councils established by the Ministry of Reconstruction. Experiments with such councils have been made in the United States, notably in the printing and electrical trades, and these attempts might be used as the basis for further undertakings.

Another suggestion which bears upon the reduction of the cyclical depression involves a publicity campaign for the education of investors. The too rapid expansion of any industry can be prevented by a careful restriction of capitalization.

At present the country is not prepared to apply more than palliatives to climacteric unemployment, while the only permanent remedy lies in eliminating the underlying economic causes.

[1] Hart, Hornell, Fluctuations in Unemployment in Cities of the United States, 1902 to 1917. Cincinnati, 1918.

[2] Tead, Ordway, and Henry C. Metcalf, Personnel Administration, Its Principles and Practice. New York. 1920.

III. RESIDUAL UNEMPLOYMENT

Hornell Hart[1] has estimated that between 1902 and 1917 there was never a period when less than a million wage-earners were out of work. The average proportion unemployed fluctuated from 16% of the total supply of possible workers in 1915 to 4.7% in 1917, but even then, at the climax of the wartime industrial activity, over a million wage-earners were out of work. It was stated[2] at the National Employment Service Hearings in 1919 that unemployment reached its lowest point for the last 20 years in 1917 and 1918. The reports of the New York State Department of Labor show, however, that in the year 1918, employers called for 779,972 workers; that 443,782 applied for employment, and that 183,640 were actually placed. This leaves a surplus of 160,142 applicants who could not find work from the employment offices, in spite of the fact that employers requested approximately 500,000 more men and women from the offices than they obtained.

This permanent labor reserve is largely drawn from certain definite groups, chief among which is that of the casual workers. Among these the unskilled laborers predominate, although there is a certain proportion of skilled men who through fluctuation of employment, or changes in manufacturing methods, or through their own defects of character, have been led into irregular habits of work. Other groups who contribute to the residue of labor are the mentally and the physically deficient.

Experience has repeatedly shown that common laborers are the first to be laid off in dull times and the last to be taken on when business improves. The situation revealed by a survey[3] in twelve Rocky Mountain and Pacific Coast cities in June and July, 1914, is typical. It showed that of 5,830 persons out of work the largest proportion, 16.8% were laborers.

According to the Industrial Relations Commission:[4]

> "The permanently unemployed are really people who have dropped out of the ranks of industry, broken down by the unsteadiness of employment or other causes. Some are mentally defective or physically incapable or both. Others are 'downs and outs' who have lost the habit of working. Still others live by their wits, by begging, or by crime. During the most prosperous times, when labor is in great demand, these same people do not work."

[1] Hart, Hornell, Fluctuations in Unemployment in Cities of the United States, 1902 to 1917. Cincinnati, 1919.

[2] United States National Employment Service, Hearings—Washington, 1919.

[3] U. S. Bureau of Labor Statistics. Bulletin No. 195. Unemployment in the United States, Washington, 1916.

[4] U. S. Commission on Industrial Relations. Final Report, Washington, 1916.

A large number of workers will refuse employment except at their own trade. The fact that there are vacant positions does not help the man who has not the qualifications to fill any one of them. Mechanical inventions and improved methods of management, however much they may contribute to the final progress of our civilization, have the immediate effect of adding very considerably to the residue of unemployed. The resulting difficulties in securing and holding employment, the declassed feeling which the skilled man experiences when he can no longer obtain a position worthy of his training, and the irregular life and uncertainty of earnings tend to destroy the inclination for steady work. It is among the unskilled that unemployment is always most acute, and all additions to this class make the problem more serious. A witness before the New York Commission on Unemployment in 1911 testified [1]:

"I have very many cases which I could cite of men, intelligent, capable fellows, who have become virtually tramps because of their continued search for work, and trying to readapt or readjust themselves to changed conditions."

A still larger proportion of the casual laborers who form the residue of unemployables have never received training for a definite job. This group is continually re-enforced by incoming immigrants, a large proportion of whom are qualified to work only as common laborers. For instance, only 14.5% of immigrants entering this country between 1910–1914 and only 16.3% entering in 1920 were classified [2] as skilled workers.

To reduce unemployment among casual workers restriction of immigration is the remedy usually proposed by the trade unions. The present Commissioner of Immigration, and others, advocate distribution of immigrants to work on the land, placing them in small farm communities.

The excessive turnover [3] among juvenile workers also indicates the difficulties of the untrained. Many children enter blind alley occupations and find themselves at 18 or 20 years of age unqualified for any position.

Among the physically incapacitated are the victims of industrial accidents and soldiers disabled in the war. While these handicapped workers were formerly relegated to the human scrap of industry, at present comprehensive efforts for their vocational rehabilitation are being made through co-operation of federal and state agencies. The sum of $750,000 was appropriated for this purpose by Congress for 1920 and $1,000,000 for each of the three succeeding years. The minimum allotment to a state is $5,000 and each dollar of federal funds must be matched by the

[1] New York Commission on Employers' Liability and Unemployment. Report, April, 1911.

[2] U. S. Commissioner General of Immigration. Annual Report, 1920. Washington, 1920.

[3] United States. Children's Bureau. No. 74. Industrial Instability of Child Workers. Washington, 1920.

state. Several states had already undertaken reeducation of handicapped workers previous to the passage of the Industrial Rehabilitation Act.[1]

Increasing attention is being turned toward mental deficiencies as an element in the employment situation. One labor manager has estimated that 90% of turnover is due to mental causes. Investigation[2] of the record of a young man suffering from paranoid dementia præcox showed that he had held 123 positions with 103 firms in 33 different occupations during a 10-year period. Important as is their relation to labor turnover, the usual place of mentally abnormal workers is among the permanently unemployed.

IV. EMPLOYMENT EXCHANGES—(A) IN THE UNITED STATES

Employment exchanges in the United States may be grouped as follows: (1) public; (2) semi-public; and (3) private. The first group—public employment exchanges in the United States—has, for purposes of discussion in this report, been subdivided into (*a*) Federal, (*b*) State, and (*c*) Municipal.

1. Public.—(*a*) *Federal.*—Up to the end of 1917 there were no employment offices in the United States organized on a national scale. Some were administered by the Immigration Department, others were under state control, and there were many private agencies. The unemployment accompanying the disorganization of business after the outbreak of the war in Europe led to the creation of many special committees, which together with established philanthropic agencies, endeavored to stabilize the labor market. When industry began to fill war orders and especially after the entry of the United States into the war and the conscription for the army, the country experienced a labor scarcity instead of a labor surplus. This labor scarcity, however, was more apparent than real, as it resulted chiefly from the unregulated methods of recruiting labor on the part of both government and employers.

To meet this emergency, the U. S. Employment Service was organized within the Department of Labor, and all employment work was transferred to it from the Bureau of Immigration.

In addition to the paid personnel of the Service, there were gradually developed volunteer state advisory boards and community labor boards on which the federal government, employers, workers and women were represented. These volunteer boards were effective in determining policies and especially in winning employers to regard the Service more favorably.

[1] Passed June 26, 1920. Public Document No. 236—66th Congress.

[2] Powers, Margaret J. The Industrial Cost of the Psychopathic Employee. Mental Hygiene, Oct. 1920.

Subsequent to October 1, 1919, the employment offices were under state operation, with federal co-operation. A general view of its activities through the three-year period from 1917 to 1920 is offered by the following figures.[1]

ACTIVITIES OF THE U. S. EMPLOYMENT SERVICE, 1917–1920

Fiscal Year Ending June 30	Help Wanted	Registrations	Number referred	Number reported placed
1918	2,993,798	2,381,392	2,112,139	1,890,593
1919	10,701,447	6,166,447	5,646,353	4,267,350
1920	2,589,145	3,165,559	2,458,809	2,020,252

After the war financial support was practically withdrawn, and the funds appropriated last year were $400,000 instead of the $4,600,000 requested of Congress. At present only a skeleton service is maintained. Several bills are pending which propose the reorganization of the Employment Service.

" A 'Junior Division' to select 'the right kind of employment for boys and girls entering occupational life and to offer employers the best possible facilities for the selection of their junior employees' " is maintained by the U. S. Employment Service. It is still in the organization stage.

From study of national employment offices as operated abroad and from observation of war experience in the United States, Professor Lescohier[2] has worked out certain general recommendations which he believes should be embodied in any new organization of the Employment Service. He holds it essential that the Service be impartial, under a neutral administration representing both parties in industry. For this purpose he recommends the creation of a National Employment Service Council. This Council, Professor Lescohier holds, should receive complaints and suggestions, suggest changes in personnel or policies, advice in the selection of the Director-General and in the distribution of funds and prepare recommendations to Congress for the improvement or development of the service. Subordinate to the National Council would be state and local advisory councils similar to those developed during the war.

With regard to financial responsibility for a national system of employment offices, Professor Lescohier favors co-operation of federal, state and local governmental units, the federal government to pay for the central

[1] United States. Employment Service. Annual Reports of the Director General. Fiscal years ending June 30, 1918, 1919, 1920.

[2] Lescohier, Don D. The Labor Market. New York, 1919.

office general administrative expenses; at least one federal official in each state; and to subsidize the central state office. The general principle is that efficiency must be maintained in the local offices on penalty of losing the federal subsidy. At the same time the state and local units, which are contributing their share, will naturally demand a similar efficiency from federal officials.

Among the leading functions of the Employment Service should be the compilation of accurate employment statistics, the education of employers and employees in practices that encourage stability of employment, the encouragement of specialized plant employment departments and vocational guidance not only for juveniles but also for adults. The fulfilment of these functions demands from employment officials the widest possible personal contact with employers, civic and labor organizations and the whole economic life of the community and the strictest impartiality in all issues between employers and employees.

Under a properly administered national organization of employment offices industry would operate with a much lower labor reserve, as the need for accumulating local labor reserves would disappear with the better co-ordination of demand and supply of labor and its prompt distribution over larger areas; unemployment and underemployment would be reduced, and the efficiency of the available workers increased by their being directed to the positions for which they are best fitted.

(*b*) *State Employment Exchanges.*—Previous to the world war a number of states had established systems of employment exchanges, but their work was limited in scope. Dr. Edward T. Devine [1] reported that the Ohio system was the only one found to be adequately equipped, "New York, Massachusetts, Wisconsin, and a few other states—ten at the outside—had what might be called systems of free public employment bureaus. Twenty-six states had passed laws of some kind authorizing their establishment."

At the beginning of 1919, there were twenty states which contributed to the support of public employment offices. Arranged in the order of the size of their appropriations for 1919, the state making the largest appropriation being placed first, these states were as follows: New York, Illinois, California, Pennsylvania, Ohio, Indiana, Massachusetts, South Dakota, New Jersey, Minnesota, Michigan, Connecticut, Missouri, Colorado, Oklahoma, Rhode Island, Arizona, Kentucky, and Kansas. The Wisconsin legislation appropriated $100,000 but the bill was not signed by the governor. The largest amount appropriated was $253,000; the smallest $1,400; the total amount, $785,254. In 1919, New York, Illinois, Pennsylvania, California, and Michigan conducted ten or more offices. In all there were 129.

[1] The Survey, April 5, 1919.

In 1920, the financial support to state employment offices was materially increased. The total appropriations amounted to nearly $300,000 more than in 1919. The number of offices decreased by ten, consolidations having been made in some states which at the same time increased appropriations.

These offices have developed the technique of employment service. Wisconsin, Massachusetts, New York and Ohio have secured co-ordination and co-operation of their various exchanges, so that men are transferred from one exchange to another. Among the methods worked out in Massachusetts were the specialization of departments for handling skilled and unskilled workers, women and juveniles respectively; a record system, which has become the basis of most public employment records; vocational guidance; the use of interpreters to deal with aliens; and co-operation with employment managers.

Criticism of State Systems.—Among the criticisms directed against state employment systems is their liability to political control; lack of adequately trained personnel due to shortage of funds; and inability to meet interstate needs, or even to any great extent those within the state.[1]

The difficulty of state offices in making interstate placement is two-fold. First, without a general employment system, they lack information. There may be unemployed carpenters in one state and a demand for them in the next, but if employment records are not exchanged the two state offices are equally powerless to place the workers or supply the employers. Second, there is a natural tendency to oppose the spending of state funds for placements outside the state.

Some of the basic defects of public employment offices in general were analyzed by the director[2] of the New York State Bureau of Employment at the annual meeting of the American Association of Public Employment Offices in 1915. His conclusions were based on intensive personal investigation of a large number of bureaus and on the evidence presented in a three-day hearing before the U. S. Commission on Industrial Relations. Conditions in the majority of public employment offices showed, in the director's opinion, that they were a "distinct failure" and "not doing the thing for which they were established."

Poor statistical methods were characteristic. In many offices it was customary to count the number of men sent out as actual placements, although in numerous instances they did not even go to the places

[1] United States National Employment System. Hearings before the Joint Committees on Labor. 66th Cong., 1st. Session, Washington, 1919.

[2] U. S. Bureau of Labor Statistics. Bulletin No. 192. A Report on the Condition and Management of Public Employment Offices in the United States, together with some Account of the Private Employment Agencies of the Country. Charles E. Barnes. Washington, 1916.

designated. Generally lack of clerical help prevented accurate returns about the men sent out. Many offices did not get sufficient information either about the requirements of the jobs or the qualifications and experience of the applicants. A large proportion of the offices were found to be handling chiefly casual labor. This practice tends to keep away employers in want of skilled workers. At the same time, workers of the better class avoid the offices both from pride and because few suitable positions are available there.

The general opinion of the public employment offices was discovered to be a low one. Organized labor regarded them " With mild contempt and considerable suspicion"; employers knew little of them and were also inclined to be suspicious of the neutrality of their attitude. The inferior class of their clients, the inadequate training of the officials employed, and the insufficient appropriations combined to lower the standing of the public offices and to keep them from being of much real value in the labor market. At the same time, it was admitted that there were exceptions which suggested the hope that other offices may be greatly improved through the correction of some of the defects noted.

(*c*) *Municipal Employment Exchanges.*—In addition to public employment bureaus managed by the federal and state authorities, a very considerable number are carried on by cities. In some instances the municipality works in co-operation with the federal service, the state, and occasionally with some private organization. In general, the characterizations of public employment offices which have been made of the state bureaus are also applicable to those under municipal authority.

2. Semi-Public.—The second group of employment exchanges in the United States to be considered are the semi-public, for example, the philanthropic societies making the placement of workers a part of their activities. Organizations like the Y.M.C.A., the Y.W.C.A., the Knights of Columbus, and some of the Jewish societies have done much in this direction. Their service is either free or at least the fees are nominal in amount. Their effectiveness, however, is limited to comparatively small groups, as some workers avoid them because they regard the service as a charity, and because of religious and other reasons.

The bureaus maintained by universities, colleges and schools, which usually aim to take care of only their own graduates, also perform only a limited and specialized service.

3. Private.—Private agencies comprise the third group of employment exchanges in the United States. In this report three types of private employment agencies are discussed: (*a*) commercial employment agencies, (*b*) employers' associations' employment bureaus, and (*c*) trade union employment bureaus.

(*a*) *Commercial Employment Agencies.*—There were between 4,000 and 5,000 commercial employment agencies[1] in the United States at the beginning of 1919. No figures are available as to the total annual profits of these fee-charging agencies. Charles B. Barnes, in the New York *Tribune* of February 6, 1919, estimated that employment offices in New York City numbering about 600 collected $2,500,000 yearly. The manager of a private agency in Minneapolis estimated that his annual collections amounted to $500,000.

The basic defect in commercial employment agencies as a means of reducing unemployment is that their profits depend on the number, not the permanence, of the placements made. Hence it pays the agency to entice men from one place to another and to stimulate turnover rather than to reduce it.[2]

Much evidence has been collected to prove the abuses carried on by private agencies. Typical practices are the misrepresentation of wages and working conditions, extortionate fees, splitting fees with foremen to secure frequent discharges and opportunities for new placements, and the shipment of men to distant points where no jobs are really available. The New York City Commission of Licenses investigated 1,932 complaints against commercial employment agencies in one year,[3] ordered the refunding of over $3,000 to clients of these bureaus, revoked 13 licenses, and secured the conviction of 9 employment agents. Such a record is an index of the abuses which obtain in the country at large.

With regard to the amount demanded for placements, the following statement, made specifically concerning commercial agencies in Minnesota, has been found descriptive of methods in a very considerable proportion of the private fee-charging bureaus:[4]

> "The lack of any standard of legal fees to be charged enables the agency to fix the fee according to conditions of the labor market and in individual cases according to the intelligence of the man seeking the job. When many men are out of work, and employment scarce, a high fee is charged. When men are scarce and jobs plentiful they charge a low fee. Even in times when work is plentiful, exorbitant fees are charged if the applicant is unfamiliar with our language, feeble-minded, intoxicated, or otherwise unable to protect his rights."

The abuses have resulted in restrictive legislation in a majority of the states. The laws generally require the licensing of commercial employment agencies, frequently regulate their location, and often fix the maximum which may be charged as fee.

[1] United States National Employment System. Hearings.—Washington, 1919.

[2] Lescohier, Don D. A Clearing House for Labor. The Atlantic Monthly, June, 1918.

[3] New York City. Report of the Commissioner of Licenses, 1913.

[4] United States National Employment System. Hearings—Washington, 1919.

Whatever the provisions of state law for the regulation of employment agencies, these restrictions have no force on interstate business in which the abuses occur most frequently.[1]

"The almost unanimous testimony of investigators and public officials, however, is that these provisions (legal restrictions) have not been successful in stamping out the abuses of private offices, and the result has been a widespread movement for the abolition of such offices altogether."

A referendum in Washington in 1914 resulted in prohibiting the collection of fees from workers by employment agents on the ground that the system frequently resulted "in their becoming the victims of imposition and extortion and is therefore detrimental to the welfare of the state." In 1917 this measure was declared [2] unconstitutional by the United States Supreme Court on the ground that it violated the fourteenth amendment. In Wisconsin, a law passed in 1919 gives the State Industrial Commission power to refuse licenses to commercial agencies at its discretion. Several foreign countries have taken steps to restrict or suppress private agencies, especially where public employment agencies are maintained.

(*b*) *Employers' Associations' Employment Bureaus.*—Dissatisfaction with existing employment agencies, a disposition to centralize and organize employment, and perhaps in some instances the desire to control the type of labor employed have led to the establishment of employment offices by employers' associations and chambers of commerce. While in many instances these offices serve only the members, this is not invariably the case. The offices are often well organized and have performed a very appreciable service for their particular clients. The number of bureaus maintained by such organizations is considerable. For instance, the National Metal Trades Association has fourteen employment branches. In some instances employment bureaus are managed in co-operation with local employers' organizations.

In contrast to privately managed bureaus, no fee is charged either employer or applicant. The employers benefit by the careful rating of applicants based on an examination of their qualifications. This saves the employer the investigation of references and insures his receiving exactly the kind and grade of workman he requires. The worker, on his part, has better opportunities to secure work with much less expenditure of time and energy than if he had to search from one factory to another.

Lescohier, to be sure, maintains [3] that "workmen in general will not patronize an office maintained by employers." They are afraid

[1] Commons and Andrews, Principles of Labor Legislation. New York, 1920.
[2] Adams v. Tanner, 244 U. S. 590, 37 Sup. Ct. 662 (1917).
[3] Lescohier, Don D., The Labor Market. New York, 1919.

that it will be used "for blacklisting, breaking strikes, and beating down wages." This belief, he holds, makes the field of usefulness for offices maintained by groups of employers "very limited." It is probable that few trade unionists are willing to register. The experience of some such bureaus indicates, however, that a considerable number of workers do make use of their facilities.

For instance, in a typical year just before the war the Metal Trades' bureaus in Indianapolis registered[1] 8,230 applicants, of which 3,659 had previously applied, 1,736 were new applicants, while 2,835 additional applications were received at the shops through members who secured and forwarded them to the bureaus. During this same 12-month period 5,174 employees were reported hired by members, of whom 3,679 were old applicants and the remainder new ones who had registered for the first time. The total registration of the two bureaus maintained in Indianapolis included from 50,000 to 60,000 names, comprising many hundred of occupations, trades and specialties grading from executive positions to the better class of common labor.

How far employers make use of these bureaus to the exclusion of other sources of labor supply is not certain. Experience in Indianapolis indicated that some members of the employers' association hire practically all their workers through the bureaus, one stating that in a given period only 5 out of 1,200 were secured elsewhere. The secretary estimated that in general from a third to one-half of the total employed by members were secured through the employment bureaus.

The general inquiries made of the applicants at bureaus maintained by the National Metal Trades Association are described as follows:

> "These bureaus require each applicant to give the name of his last employer, together with two additional such references, his age, occupation, experience, whether married or single, and wages wanted. He is not asked as to his union affiliations, although it is sometimes advantageous that this information be had, because it is a waste of the applicant's time to send a union man to a non-union job, or a non-union man to a union job. . . . Neither do these bureaus ever place men in strike jobs, under false pretenses. The applicant is invariably fully advised and left to his own judgment and pleasure in the matter. Nor is the attempt ever made to replace strikers with other men where it is evident there is a likelihood of their soon being thrown out of work through re-employment of the strikers.
>
> "The references of each applicant as to his skill, productive ability, and general character of service are fully investigated."

In addition to its primary function as a free employment office, the Des Moines bureau investigates complaints of employees and secures from workers their reasons for quitting and also for refusing positions for which they are qualified.

[1] U. S. Bureau of Labor Statistics. Bulletin No. 192.

The knowledge acquired in this way enables the bureau to adjust many cases satisfactorily to both parties. Sometimes a straightforward talk with the worker shows him the error of his opinion; in other instances, the bureau takes up the matter with the employer, especially when the dissatisfaction refers to supervision, hours, working conditions, or wages.

(*c*) *Trade Union Employment Bureaus.*—The limitations of trade union employment bureaus are somewhat similar to those of offices maintained by employers' associations and chambers of commerce. Just as some of the workers will not use the employers' offices, so a large proportion of the employers will not apply to the trade union employment bureaus for workers. Nevertheless, a very large proportion of the trade unions make some organized effort to place their members in employment. The state of development and the efficiency of these agencies varies from one craft to another. In practically every organized trade, however, there are some local unions which provide for an official, usually the business agent, who gives his whole time to employment work.

This practice is most common in the building trades because of the frequent changes from one job to another. The Ladies Garment Workers, the United Garment Workers, the Lithographers and the Cigarmakers require their local unions to "establish labor bureaus for the purpose of designating work to the unemployed." In general, the local unions must themselves take the initiative, although in a few cases the national unions help to pay expenses. The Machinists, the Pattern Makers, Molders, Teamsters, Metal Polishers, Brass Workers and others have furnished financial aid either regularly or occasionally. As the expenditure for a business agent amounts to about $2,000 a year, only large local unions can afford the full time of such an official.

The business agent keeps in touch with developments of his trade so that he may know where work is to be had and the chances of securing employment for the members of his union. He visits employers and foremen, consults members at their places of employment and follows the newspaper advertisements. An inconsiderable number of closed shop unions require employers to secure workers through the union. The union business agent does not await applications of workers, but often solicits them from employers, who are notified that telephone requests in regular office hours will meet with immediate attention. As members who are out of work generally congregate at union headquarters, the promptness of the service is a convenience which attracts some employers, especially in emergencies. Another advantage arises from the ability of the business agent, through personal knowledge of men and work, to select the best worker for the place.

Where a full time business agent cannot be employed, the secretary or president of the local union receives applications from employers, and confers with unemployed members in his spare time. In some trades a shop steward is appointed for each establishment where union men are at work, one of whose duties is to find out opportunities for employment and to report them at regular meetings of the local union. Since most labor organizations emphasize that their members shall assist one another in obtaining work, much information regarding unfilled positions is reported by individuals at union meetings or passed around among union men.

Comparatively few unions have attempted to systematize the distribution of employment on more than a local scale. Among these which have established national employment bureaus to serve all their members are the Granite Cutters, Glass Bottle Blowers, Flint Glass Workers, Lithographers, Photo-Engravers, Potters and Pattern Makers. A number of other unions have maintained central employment offices but have subsequently discontinued them. The general system is that the local unions report weekly to national headquarters the number of members employed, the number unemployed, and give detailed descriptions of the opportunities for employment. In most cases the general secretary then notifies the unemployed member nearest the possible job. If work is not found directly in that way, the secretary proceeds to circularize the trade. The Pattern Makers classify these weekly reports and distribute them among the local unions, but they also deal directly with unemployed members and with employers. The Granite Cutters urge their unemployed members to telegraph or write the employer before moving, in order to avoid disappointment. In the Photo-Engravers' Union no one is allowed to accept a job without notifying the local secretary, thus preventing injustice to local members.

Much information regarding employment opportunities is published in the trade union journals. The state of the trade, whether good, fair or dull, and the number of members employed and unemployed are reported by all local secretaries in a large number of these publications. Several organizations publish addresses of employers who maintain union shops, to which members may apply individually for employment.

State and district building trades councils often issue periodic bulletins regarding trade conditions and local opportunities for work. Some district councils, such as the New England Typographical Union and the Indiana Typographical Conference, support employment offices; and in certain instances a number of local unions have combined to support such bureaus.

Distribution of unemployed workers has been facilitated by some unions through the payment of loans to furnish transportation expenses to members in search of work. At one time or another this system has been in use among the Cigar Makers, Flint Glass Makers, Granite Cutters, Leather Workers on Horse Goods, Lithographers, Machinists, Typographers, and White Rats. In some years the sum expended for this purpose by unions affiliated with the American Federation of Labor amounted to $70,000. On the whole, the plan has not been successful and has been discontinued by all unions except the Cigar Makers and Typographers. Its failure was due to the inefficiency of local secretaries who did not make proper investigation as to the need for traveling, to the granting of unauthorized loans, and to the difficulties in securing their repayment. Moreover, through jealousy among local unions, hindrances were often put in the way of the movement of workers from one city to another.

IV. EMPLOYMENT EXCHANGES—(B) FOREIGN

1. *Great Britain.*—Previous to the establishment of the United States Employment Service as a wartime measure for distributing labor, other countries tried out labor exchanges of nation-wide scope. By a law passed in 1909, Great Britain provided for a system of exchanges[1] administered by the Board of Trade. Since the Board of Trade deals with business as well as with labor affairs, the exchanges were placed under a jurisdiction in which both employers and workers are represented. When the Ministry of Labour was formed, it took over the exchanges.

The main objects of the Labour Exchanges Act was to bring together employers and employees, to assist especially unorganized and casual workers in finding employment; to administer the system of unemployment insurance which was introduced at the same time, and to enable the government to measure unemployment and make provisions accordingly.

On March 31, 1910, 214 labor exchanges were open, with a staff numbering 528, of whom 425 were working in the exchanges, 75 at the divisional offices and 28 at headquarters. At the beginning of June, 1920, there were 395 employment exchanges and 1,049 branch offices, with a staff of 12,631, of whom 8,484 worked in exchanges and branch offices, 1,330 at the divisional offices, 974 at headquarters and 1,843 at the central claims and records office for unemployment insurance. During the same period the activities and cost of the employment exchanges increased as follows:

Year	Individuals applying for work	Individuals found work	Aggregate cost for financial year
1913–14 Average.....	1,930,069	713,350	£766,873
1915–18 "	2,636,643	1,261,217	1,201,873
1919................	4,774,011	1,111,847	3,616,140
1920 (six months)....	1,234,241	445,806	....

[1] Great Britain. Ministry of Labour. Report of the Committee of Enquiry into the Work of the Employment Exchanges. London, 1920.

The estimated annual cost in a normal year, according to the Minister of Labour, is £2,200,000. A portion of this expenditure is chargeable to unemployment insurance administration, which in the year 1919–1920, for instance, cost £458,663.

The exchanges have served chiefly the unskilled and the unorganized. Nevertheless, organized labor coming under the unemployment insurance acts has made considerable use of the exchanges. Records for the first 6 months of 1920 show that the exchanges were most used by the building trades, the engineering and iron founding industries, by employers of general labor and by the transport industries. Domestic service accounted for two-thirds of the female placements and for 24.7% of all placements, engineering and iron for 13%, building 9.5% and general labor 9.3% of all placements.

In 1917, local employment committees were established in connection with the employment exchanges, and usually consisted of representatives of the employers and workers in equal numbers, with a chairman appointed by the employment department. Their function was to advise and assist in the work of the exchanges. In 1920 there were 302 local employment committees, with 7,158 members; and 246 women's subcommittees with 1,700 members.

Since the war the exchanges have administered out-of-work donations and the placement of ex-service men. Each employment exchange has a department for juvenile employment. There are also 245 juvenile employment committees co-operating with the exchanges.

A committee of inquiry, which investigated the whole British employment system last year, summarized various criticisms directed against it and offered recommendations, but concluded that the exchanges must be retained as "a necessary corollary to the state system of unemployment insurance." A minority report held that the exchanges had largely failed as placing agencies, and recommended efforts to cut expenses and reliance upon trade unionists to place their members in the highly organized trades.

2. *Canada.*—The Canadian government organized a national employment service in 1918. It operates the central office and clearing house and subsidizes the provincial government office systems. Some 90 free employment offices were established throughout Canada in all cities, beginning in March, 1919. A contract is entered into between the Dominion government and the provincial governments which requires each province to maintain a provincial clearing house and to co-operate with the other provinces and with the Dominion in shifting labor from one province to another. Expenses are shared equally by the Dominion government and the provinces. The Canadian government[1] appro-

[1] United States Monthly Labor Review, October 1918; February, 1919.

priated $50,000 for the fiscal year 1918–1919; $100,000 for 1919–1920; and $150,000 for 1920–1921 and for each year thereafter.

A National Advisory Council, which meets once or twice a year and determines the general policies of the service, is composed of the superintendents of the Provincial Employment Office systems, representatives of the Canadian Manufacturers' Association and the lumbering and mining interests, of the Canadian Trades and Labour Congress, the Railway Board, the Railway Brotherhoods, the Council of Agriculture, the Department of Labour, and certain women's organizations. Each province has a provincial advisory council composed in equal numbers of representatives of employers and employees. Local advisory boards are attached to the local offices.

During the first 15 months after the employment service was established, over 600,000 persons were placed in positions, without cost to the employer and workman, and at a cost to the government of less than one-half the amount per person formerly paid by the individual as commission to the private employment agent. Five provinces have, by legislation, abolished private employment agencies and another has this under consideration. Others have substantially reduced the number of licenses issued to them. A recent resolution by the executive of the Employment Service Council urges the Ontario and Quebec government to abolish private employment offices.

Offices in each province report to a provincial superintendent and a telegraphic synopsis of labor supply and requirements is sent daily to the federal clearing house. By this clearing house system a surplus supply of labor in one locality or province can readily be transferred to another where it is in demand. Without this connecting link unemployed labor might exist in one locality and a demand for labor in another, without either the unemployed workman or the employer desiring labor knowing where their needs could be met. Special rates are in effect whereby a workman sent to employment over a hundred miles distant travels at reduced rates on railways, on presentation of a certificate from a government employment office, showing destination, and indicating that the bearer is sent by the employment office. More than 30,000 men have been placed in employment at distant points who could not have been provided with employment within the territory served by an individual office. This does not include the anual flow of harvest labor from Eastern Canada to the Western prairies.

Under arrangements with the railway companies for special trains at reduced rates to carry harvest workers, the employment offices are able to control the supply and distribution of harvest hands.

At the end of last winter representatives of the Employment Service were placed in lumber camps and when the workers were paid off by the lumber companies, they obtained jobs on farms and in other industries from the representatives of the Employment Service in the camp, and were then able to go directly to the next job.

Much skilled labor of a particular kind which employers have asked to import from Europe or elsewhere, has been located in Canada and supplied locally through the clearing house service. During 1920 applications to import some 5,000 skilled workers of various sorts, under contract, were received by the Immigration Department from employers, who could not obtain the labor required locally. The Immigration Department first refers such requests to the Department of Labour, and importation is authorized only when requirements cannot be filled in Canada. As a result, only in 770 cases was it necessary to go outside of Canada to fill the requirements.

During the winter of 1919-1920 the Dominion government rendered aid by way of cash gratuities to unemployed returned soldiers, but they were required to register at one of the 90 employment offices and were entitled to aid only on presentation of a certificate that employment was unobtainable. It was estimated that $45,000,000 would be necessary to meet this situation but, largely owing to this precautionary measure against abuse, the amount actually disbursed was less than $5,000,000.

In the present unemployment crisis when emergency relief is necessary, the Dominion government pays one-third of the money disbursed, provided relief is given, on presentation of a certificate from the employment service showing that the bearer applied for, but could not be given, employment. The Purchasing Commission, which supervises the buying of government supplies, co-operates with the Director of the Employment Service, and places orders in slack industries where employment is most needed.

The junior employment division [1] of the Employment Service Branch of the Department of Labour was first organized last spring and so far its functions have been largely advisory. It has already completed a survey, however, of employment of juvenile workers in Winnipeg to which over 1,400 industrial establishments contributed information regarding the processes within various industries and the necessary qualifications of young workers for particular occupations.

The aims of the junior employment division are:

(1) To refer back to school every boy or girl not yet ready for employment;

(2) To know the prospective worker through his physical, mental and social records in order to become acquainted with his special ability, adaptability, inclination and ambition; to know the opportunities afforded by industry, the requirements and character of each position

[1] Canada. Labour Gazette, December, 1920.

offered, and by means of this knowledge of the worker and of the position offered, to refer intelligently the worker to the job;

(3) To assist the young worker by means of "follow-up" work so that by taking advantage of the educational resources and the facilities for suitable recreation, he may develop greater efficiency in his work; and to continue with further care until he becomes able to mark out for himself his own progress in the field of industry.

In addition to making an industrial survey in order to discover industrial opportunities, full information regarding each child will be obtained by the placement officer through contact and co-operation with parents, teachers and officers of organizations dealing with children. At a later stage it is planned that physical and mental tests of each child shall contribute to the knowledge necessary for his proper placement. It is advised that a junior advisory council be organized wherever a junior placement office is established.

3. *Italy.*—The complete prohibition of commercial employment exchanges, the subvention by government funds of approved employment offices and the compulsory use of these government controlled agencies are stipulations of the Italian legislative decree [1] of October 19, 1919, under which the present system of employment exchanges is operating. From the creation of the employment exchanges at the end of October, 1919, to the end of April, 1920, 150,238 persons were placed in employment and 431,900 lire had been expended in government subventions.

Government-aided Exchanges.—Four types of employment exchanges are approved by the government and eligible for financial aid from the government.

(a) Those established by the provinces or communes.

(b) Those established by mutual agreement between employers' and workers' organizations.

(c) Those depending only on a workers' or on an employers' organization and recognized by the other party either by an agreement or only in fact.

(d) Those founded by charitable or other institutions.

All four types of employment exchanges must be carried on in accordance with the rules of a license obtained from the Ministry of Labour. Except the offices managed by workers' or employers' organizations, all must be operated by joint Committees representing employers and workers. The Committees are elected by the organizations concerned under a chairman agreed upon by both parties.

4. *Other Foreign Countries.*—In a number of other countries employment offices, national, state, or municipal, were established at public

[1] Goverment Action in Dealing with Unemployment in Italy. International Labor Office. Geneva, 1920.

expense before the Great War. Post war conditions have demanded their expansion and additional machinery to meet the growth of unemployment.

EMPLOYMENT EXCHANGES IN FOREIGN COUNTRIES

	Date Established
Argentina	1913
Brazil	
Canada	1918
Cuba	
Denmark	1913
France	1911
Germany	1914
Great Britain	1909
Hungary	1916
Italy	1919
Netherlands	1916
New Zealand	1891
Norway	1906
Sweden	1906
Switzerland	
Union of South Africa	1910

V. PUBLIC WORKS

One of the oldest and most regularly recurring proposals for unemployment relief is to carry on public works. These are of two types: emergency work created to absorb the surplus labor, and necessary public work distributed over a year or a period of years so as to coincide with slack seasons in private industry.

Emergency Public Work.—In this country over 100 cities carried on emergency public work [1] in 1914–1915 and employed thousands of men in sewer, street and road making, quarrying, forestry, drainage, waterworks, building and painting. Usually these men were remunerated at current wages for the occupation and worked in from two-day to two-week shifts.

In New York City 22 workrooms were operated [2] in the period from January to April, 1915, by the Mayor's Committee on Unemployment, giving work to about 5,000 persons daily. The work was recognized as merely enabling the unemployed to accept relief without loss of self-respect. Those who could not be placed in regular employment worked 5 days a week from 10 A. M. to 3 P. M., the hours being fixed so that they

[1] Commons, John R. and John B. Andrews. Principles of Labor Legislation. New York, 1916.

[2] New York City. Mayor's Committee on Unemployment. Report. New York, 1916.

could seek private employment at morning and night. Men received 50 cents a day and a noon meal, women 60 cents a day. A great variety of work was done, such as preparing bandages, making garments, mending shoes, repairing chairs, etc. No goods were sold in the competitive market but they were utilized for war work, for the unemployed themselves or in city departments. In the four months of their operation these workshops gave a total of 215,429 days' work.

In the winter of 1913–1914 considerable difficulties [1] were encountered regarding wages for public work in San Francisco performed by the unemployed. At first the current wages were paid, but it was soon found that the funds were rapidly being used up and that men were being attracted from other cities. Then it was proposed that a nominal wage of 20 cents an hour be paid merely to tide over the men out of work. This was opposed by the trade unions, on the ground that it would tend to lower the standard of wages. Where public agencies open workshops the same opposition is bound to come from employers if goods manufactured at unusually low labor costs are offered below the standard price in a market already depressed.

In actual practice the administration of emergency public work is frequently complicated by political factors which lower its efficiency. If relief to the unemployed is to be supplied from the public funds in any case, its conjunction with some employment probably prevents a certain amount of fraud and saves the self-respect of bona fide workers. It should not be confused, however, with genuine constructive measures which remove the causes of unemployment.

Prearranged Public Work.—With public work prearranged for slack periods the case is somewhat different. Proposals of this kind are allied to the attempts at regularization of private industry.

Among the types of government undertakings which have been utilized for taking up the slack in employment are government shipbuilding, afforestization, land reclamation, construction of public buildings, road building and the like. For instance, assistance [2] to the British unemployed is at present being rendered through a special fund under the Ministry of Transport which provides for work on arterial roads and on sewerage schemes in connection with housing projects. About 70 local authorities also have roadbuilding schemes in operation, or under consideration. In the United States approximately $78,000,000 were to be expended [3] on roads last spring under the Federal Roads Act. It is reported that the amount of federal funds under contract April 1, roughly totals $39,000,000, and every state availing itself of federal aid must match the funds dollar for dollar. The execution of such work, whether by federal,

[1] United States. Report of Commission on Industrial Relations. Vol. V.

[2] Great Britain. Labour Gazette. January, 1921.

[3] Industrial Information Service, Boston. February 17, 1921.

state or municipal governments, necessitates farseeing plans for the financial as well as the industrial details. If money must be secured at the time when a depression occurs, it is as difficult for the state as for private industry to obtain funds. The program must be ready for several years in advance and permanent provisions for an employment fund must be made. The state of Pennsylvania [1] has actually set up such a fund.

Practical difficulties are liable to develop even when the public work is carefully laid out. There is danger that such undertakings become the object of political manipulations, and that they be continued after the real need for them is past. More opportunities are available in some occupations than in others. Moreover, the slack season unfavorable to private industry is often equally inopportune for public work. Weather conditions are frequently unsuitable for highway and building work in the winter season, and the attempt to carry out contracts in the dull season is likely greatly to increase the cost of public works.

Nevertheless the method of combating unemployment by planning public work in advance has been tried in some European countries, and the principle has been endorsed by various students of the subject.

VI. UNEMPLOYMENT INSURANCE

Unemployment insurance is not a remedy for unemployment, nor is it strictly a palliative. It is a plan by which a portion of the burden of supporting those who are not in a position to produce is shifted from the state to industry. It is in the main humanitarian in its purpose rather than calculatingly designed for economic efficiency.

There is, however, a definite economic waste which a proper insurance system might alleviate. That is the permanent evil effect upon the unemployed who must depend upon the charity of the state for subsistence. The acceptance of insurance does not entail the undermining of character and ambition which may accompany acceptance of charity.

Unemployment insurance may be effected through several different agencies; namely, the state, industries, the trade unions, and the individual concerns or plants. Although development of state unemployment insurance has been made abroad, notably in central Europe and England, few attempts in this direction have been made in this country. Nor has much been done by individual plants to provide direct unemployment benefits, although protection against unemployment is afforded by part time work systems, savings plans and profit sharing schemes.

Trades Union Benefits.—Although a few national labor organizations in the United States have established systems for unemployment insurance, the greater part of the out-of-work benefits are voted from the ordinary union assessments to meet emergency conditions.

The Cigar Makers' union was the first to adopt the policy of unemploy-

[1] Pennsylvania Laws, 1917, No. 411.

ment insurance. It was begun locally in New York in 1875 and in 1885 was adopted by the national body. Later the Deutsch-Amerikanische Typographia and the diamond workers established regular unemployment benefits.

At present the Molders' union pays out the greatest amount of out-of-work relief. In 1918 a total of $36,729 was paid; and in 1919, $34,356. The Molders' union has a stamp system similar to that in Great Britain. These stamps are given out according to the following conditions.[1]

"The extension of out-of-work relief to unemployed members, of which all of our unions were duly notified, must not be construed as applying to any members excepting those who are suffering from enforced idleness. Members who have not been initiated or reinstated for 6 months are not entitled to out-of-work stamps but, if idle, are entitled to honorary cards. The extended relief does NOT apply to members who have received 13 weeks' sick benefits and then 13 out-of-work stamps, unless they have recovered and are able to work but cannot secure the same. The extended relief does not apply and must not be given to any member excepting he is totally unemployed. The fact he works only one, two or three days a week does not entitle him to out-of-work stamps and every financial secretary must govern himself accordingly in the granting of the extended out-of-work relief. A member entitled to receive out-of-work stamps, when out of employment, can have such a stamp in his book week after week without limit, until official notice is given that the extended benefits have been discontinued."

The amount of unemployment benefits paid by organizations affiliated with the American Federation of Labor from 1903 to 1919, inclusive, is reported as follows:

1903	$79,538.37
1904	78,073.25
1905	85,050.72
1906	79,582.70
1907	46,481.79
1908	205,254.31
1909	484,028.49
1910	197,808.00
1911	218,742.71
1912	215,398.60
1913	69,445.70
1914	99,024.88
1915	256,002.29
1916	120,770.60
1917	57,751.63
1918	49,060.00
1919	65,026.42
Total	$2,407,040.46
Average Annual Cost	$141,590.61

[1] International Molders' Journal, Cincinnati, February, 1921.

Many unions afford indirect unemployment relief by remission of the dues of those out of work. About 20 national unions follow this practice.

Local unions frequently vote portions of their funds to unemployed members who are in want. This custom, however, cannot be classed as insurance as the members have no claim on the union and are dependent on the good will of the local membership.

State Unemployment Compensation.—At present there is no provision for definite unemployment insurance made either by federal or state governments in the United States. Organized labor has long advocated definite out-of-work schemes, controlled and supported in part by the state. Attempts also have been made to throw the whole burden upon the employers; the plans proposed being similar to workmen's compensation laws applied to injuries.

A typical proposal of this kind has recently been advocated by the Wisconsin State Federation of Labor.

VII. SPREADING OUT THE JOB

Under this heading may be included a number of measures which different industrial groups have initiated as remedies or at least as palliatives for unemployment. Chief among them is the shortening of the workday, which organized labor has always urged very largely on the ground that it will force the employment of a larger number of workers. On this point the records [1] of the American Federation of Labor are explicit.

The annual convention in 1887, in discussing unemployment resulting from the introduction of machinery, went on record as stating:

"This evil can be met only be reducing the hours of labor and this answer is suggested to be given to all opponents of the shorter workday: That as long as there is one man who seeks employment and cannot obtain it, the hours are too long."

Ten years later the convention stated that through the reduction of hours,

"the evil of long hours of labor on the one hand and a lack of employment on the other may both be remedied at one and the same time. We realize the hardships and poverty of the wage class, but we believe there is no safer or more practical plan to deal with the great question of the unemployed than in such a distribution of labor as shall work to the advantage of those at work and out of work."

At the 1899 convention the American Federation so far emphasized this aspect as to disclaim interest in the efficiency of the 8-hour day, a position which two years later was repudiated. The 1899 dictum was:

"We deprecate the assertion sometimes made that workmen will produce as much in 8 hours as in 9, for if this were true the 8-hour day would be shorn of half its beneficial results, and the very purpose for which we strive would be defeated.

[1] American Federation of Labor. History, Encyclopedia, Reference Book, Washington, 1919. Pp. 215–223.

For one of the first duties of labor organizations is to bring about such a condition as to enable all who wish to work to find remunerative employment."

Again in 1907, the Federation declared:

"We regard the reduction of hours of labor as paramount to all other considerations, even to an increase in wages, except in such occupations where the earnings are so meager as to make it difficult to maintain a fair standard of living. But in those trades in which the development of machinery is making such wonderful strides it is absolutely necessary that the hours of work be shortened in order that the opportunity for employment be shared by all members."

During the war when unemployment ceased to be an issue, more emphasis was placed upon the social value of the shorter workday, but with the present industrial depression trade unionists return to the plea that employment should be spread among a larger number through decreasing the working hours.

This theory of the trade unionists that shorter hours will supply more men with employment has generally been regarded as fallacious by the economists. Unless an equal amount of output is produced by the same men in the reduced working day, production costs will rise proportionally to the additional number of men it is necessary to employ and the increased price of the product will diminish sales.

Nevertheless, in times of industrial depression employers resort to shortening hours as a means of supplying employment to more men. For instance, at the end of last year the executive of the Canadian Employment Service Council adopted a resolution [1] that private employers and government departments, municipal, provincial and federal, be requested to spread available employment among the normal staff by short time rather than by releasing employees, and by the elimination of all overtime. In Great Britain the Minister of Labour issued [2] a circular to joint industrial councils, reconstruction committees, and trade boards calling attention to the advantages of short-time working, in preference to the dismissal of a portion of the staffs, as a means of spreading out the amount of employment available when it is impossible to keep the whole work force employed. The British Federation of Master Cotton Spinners Association put [3] into operation a short-time work plan which was obligatory on all its members. The extent to which American manufacturers have resorted to short-time in the past months is well known.

The spreading out of employment by short-time is not the result of purely humanitarian motives. The importance of maintaining the organization in skilled trades and the lower costs of production under the piece-rate system are incentives to spreading out employment by

[1] Canada. Labour Gazette, January 1921.

[2] Great Britain. Labour Gazette, January, 1921.

[3] Industrial Information Service, January, 27, 1921.

means of short-time. During the depression of 1908 in Great Britain a contraction of output of 13.3% in the cotton trade was met by 5% dismissal and 8.7% short-time; in the glass trade a contraction of 11.8% by 11% dismissal and 1% short time.

A variation of the short-time method of spreading employment is the alternation of workers practiced in some American factories. This enables the employer to maintian his force by giving all the men half a week's work in alternate shifts, and secures to the employees at least a nominal wage.

Finally, another method of spreading out the job is restriction of production. Both organized and unorganized workers try to make the job last, especially in seasons of unemployment. The economic fallacy of the practice is apparent, although workers believe it to be both in their own and their fellow-workers' interests.

VIII. IMMIGRATION AND UNEMPLOYMENT

Whenever there is a considerable amount of unemployment in the United States, immigration automatically falls off, but by many it is not regarded as a sufficient check. Organized labor in this country consistently favors a restrictive policy in regard to immigration at all times, while employers in some industries which are in constant need particularly of unskilled labor, advocate the "open door." Besides, there are sentimental and other reasons leading many to advocate unrestricted immigration.

A large proportion of immigrants to this country are unskilled laborers or persons without a definite occupation. The following table classifies the arrivals to this country, by occupation, for the year 1920 with comparative figures for 1910–1914.

Number and Occupations of Immigrant Aliens

Occupations	Number 1920	Per cent of Total	
		1920	1910–1914
Professional	12,442	2.9	1.2
Skilled	69,967	16.3	14.5
Farm laborers	15,257	3.5	24.3
Farmers	12,192	2.8	1.1
Laborers	81,732	19.0	18.4
Servants	37,197	8.7	11.7
Other Occupations	28,081	6.4	2.7
No occupation (including women and children)	173,133	40.3	26.2
Total	430,001	100.0	100.0

There are two major reasons why the influx of large numbers of unskilled workers, and to some extent of the skilled, inevitably tends to increase the unemployment situation: (1) the new arrivals largely concentrate in the large industrial centers where the employment situation is most acute; (2) unskilled immigrant labor, as a class, is, for obvious reasons, more subject than the native to the hazard of unemployment or irregular employment.

Recent measures for restricting immigration, such as the Dillingham bill, provide that immigrants of any nationality shall be limited to a certain per cent of the number of aliens of that nationality reported to be in this country at the census of 1910. Some exceptions are provided for. The tendency of present day legislation is to prevent undesirable aliens from entering the country without stopping the flow of immigration of the desirable kind.

It is one question to restrict immigration and another to afford the immigrants the best possible chance to enter useful fields of employment. In past years the distribution of incoming aliens has largely been in the hands of private agencies, which naturally find the industrial centers, where a labor surplus may be desirable, the most fruitful fields for their activities. Little concerted effort has been made to direct these immigrants from the peasant class to the land. This lack of adequate means of distribution tends to swell the ranks of the unemployed and increase the already large class of casuals who are out of work during a considerable portion of the year.

The European point of view in regard to immigration to this country has undergone profound changes since the Great War.[1] The exodus to the United States is no longer regarded with complacency. The countries exhausted by war wish to retain their manpower to build up the impaired economic structure. Then, too, it is realized that the addition of millions of alien workers to our population will give the United States a potential strength which is disturbing to European minds for economic as well as for political reasons. In order to give the new immigration, which cannot be prevented, a different trend, European nations are attempting by various devices to retain a hold on their nationals after they leave the home land. Formerly, with one or two noteworthy exceptions, the emigrant was set adrift when he left the native heath. Now he is taught to be mindful of the call of the home country and to respond to its needs.

The number of immigrants and emigrants for a 10-year period is shown in the following table:

[1] Immigration and the Future. Frances Kellar. New York, 1920.

TOTAL ALIEN IMMIGRATION AND EMIGRATION, FISCAL YEARS 1910 TO 1920

Year	*Immigrant*	*Emigrant*
1910	1,041,570	202,436
1911	878,587	295,666
1912	838,172	333,262
1913	1,197,892	308,190
1914	1,218,480	303,338
1915	326,700	204,074
1916	298,826	129,765
1917	295,403	66,277
1918	110,618	94,585
1919	141,132	123,522
1920	430,001	288,315

Recent figures, beginning July 1, 1920, indicate a large increase of immigration even over the pre-war period. To meet this influx, the Bureau of Information, which had been discontinued during the war, has been revived within the Immigration Service. The renewal of the Bureau has been welcomed by many industrial concerns, employment bureaus, public officials and professional men, as a step in advance toward the assimilation of the foreigner.

An overwhelming number of immigrants locate in the northeastern section of the country. There has been a slight falling off since the pre-war period in New York, New Jersey and Pennsylvania, and an increase in the number attracted to New England. A loss of new aliens is also indicated for the industrial and farming territories of Ohio, Indiana, Michigan, and Wisconsin. The percentage for the central and southern regions, which never attract many aliens, is about constant. The gain in the southwest is due to the Mexicans who flock into Texas. There is also to be noted a pronounced gain in the Pacific states.

New York still holds the lead for actual numbers. Of the 430,000 coming to America during the fiscal year ending June 30, 1920, no less than 106,000 located in New York State, the greater part in New York City.

The future of immigration to this country no man can safely predict. Whatever measures of restriction are adopted by Congress and European Governments, it is likely that at most times enough immigrants will reach our shores to affect the question of employment. The outstanding lack at the present time is competent distributing agencies which will place the newcomers to the best advantage for employment, and particularly to help them to agricultural pursuits so that they may not swell the labor surplus at industrial centers.

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CHAPTER XII

STRIKES AND LOCKOUTS IN THE UNITED STATES

By C. W. Doten

Definition of Strike and Lockout.—Many attempts have been made to define the terms "strike" and "lockout," and some writers have undertaken to formulate detailed classifications of these stoppages of work; but for the purposes of this study the following definitions seem as satisfactory as any. Moreover, most of the statistics contained herein have been gathered and compiled on the basis of this classification.

> "A strike is a concerted withdrawal from work by a part or all of the employees of an establishment, or several establishments, to enforce a demand on the part of employees."[1]
>
> "A lockout is a refusal on the part of an employer or several employers to permit a part or all of the employees to continue at work, such refusal being made to enforce a demand on the part of employers."[1]

It is extremely difficult in many cases to distinguish between strikes and lockouts. The industrial effects are practically the same, and even though statistics have been gathered separately for the two forms of dispute between employer and employee, it has seemed best in this study, which must of necessity cover a large field in a somewhat general manner, to deal only with strikes. To do otherwise would entail a duplication of all tables or else the added labor of combining tables. If this were done, it would only increase the totals slightly, as the number of lockouts is small in comparison with the number of strikes, and it would render it difficult to check the accuracy of the figures by reference to the original sources.

Lack of Statistical Information.—It is unfortunate that during the past sixteen years there should have been no adequate statistical investigation of strikes in the United States. The record of strikes for the twenty-five year period from 1881 to 1905, inclusive, is complete and

[1] Twenty-first Annual Report of the (U. S.) Commissioner of Labor, 1906, page **11**.

detailed by reason of four exhaustive reports[1] published by the United States Bureau of Labor. These reports were based upon investigations in the field by expert agents of the Bureau.

During the past seven years the Bureau[2] has gathered statistics of strikes and lockouts from various sources such as daily papers, labor journals, and the reports of state boards of conciliation and arbitration, and has published them in the *Monthly Labor Review.* The Bureau does not regard these statistics as comparable with those contained in the earlier reports either in completeness or in accuracy, for it has not undertaken any special field investigations, and it has no authority "to require reports relative to strikes from anyone."

Number of Strikes.—It is not safe to assume that even the number of strikes is complete in these recent reports, though this is the simplest information to be obtained. In the following table the recent figures are included with those taken from the earlier reports. The reports for 1916–1919 do not give the number of establishments or the number of employees affected in such a way as to make it possible to include them in this table.

It is apparent from an examination of Table I that strikes increased in number during the twenty-five years from 1881 to 1905. The number of strikes and the number of establishments involved in these disturbances have increased at a more rapid rate than the growth of population or the numbers of wage earners.

It is apparent from Table I that the number of strikers and the number of employees thrown out of work by strikes have not increased as fast as the number of strikes.

Causes of Strikes.—In the earlier reports of the United States Bureau of Labor, strikes were classified according to causes or objects, and the practice is still continued by the Bureau, though the list of causes now used is much shorter. A strike usually has more than one cause or object, and it frequently happens that the cause announced by the strikers may not be the most fundamental one. It is therefore difficult to secure information on this point, and all classifications of this sort must be regarded as merely an approximation of the truth.

It is probable, however, that the degree of error is not very great in the case of such causes as are included in Table II.

Wages and hours have always been the chief cause of strikes and

[1] These reports were as follows:

1. Third Annual Report covering the period from Jan. 1, 1881, to Dec. 31, 1886.
2. Tenth Annual Report, Jan. 1, 1887, to June 30, 1894.
3. Sixteenth Annual Report, July 1, 1894, to Dec. 31, 1900.
4. Twenty-first Annual Report, Jan. 1, 1901, to Dec. 31, 1905.

[2] Now the Bureau of Labor Statistics.

TABLE I

STRIKES, ESTABLISHMENTS INVOLVED, STRIKERS, AND EMPLOYEES THROWN OUT OF WORK, BY YEARS, 1881 TO 1919

Year	Strikes	Establishments		Strikers		Employees Thrown Out of Work	
		Number	Average per Strike	Number	Average per Strike	Number	Average per Strike
1881	471	2,928	6.2	101,070	215	129,521	275
1882	454	2,105	4.6	120,860	266	154,671	341
1883	478	2,759	5.8	122,198	256	149,763	313
1884	443	2,367	5.3	117,313	265	147,054	332
1885	645	2,284	3.5	158,584	246	242,705	376
1886	1432	10,053	7.0	407,152	284	508,044	355
1887	1436	6,589	4.6	272,776	190	379,676	264
1888	906	3,506	3.9	103,218	114	147,704	163
1889	1075	3,786	3.5	205,068	191	249,559	232
1890	1833	9,424	5.1	285,900	156	351,944	192
1891	1717	8,116	4.7	245,042	143	298,939	174
1892	1298	5,540	4.3	163,499	126	206,671	159
1893	1305	4,555	3.5	195,008	149	265,914	204
1894	1349	8,196	6.1	505,049	374	660,425	490
1895	1215	6,973	5.7	285,742	235	392,403	323
1896	1026	5,462	5.3	183,813	179	241,170	235
1897	1078	8,492	7.9	332,570	309	408,391	379
1898	1056	3,809	3.6	182,067	172	*a*249,002	*a*236
1899	1797	11,317	6.3	308,267	172	417,072	232
1900	1779	9,248	5.2	399,656	225	505,066	284
1901	2924	10,908	3.7	396,280	136	543,386	186
1902	3162	14,248	4.5	553,143	175	659,792	209
1903	3494	20,248	5.8	531,682	152	656,055	188
1904	2307	10,202	4.4	375,754	163	517,211	224
1905	2077	8,292	4.0	176,337	85	221,686	107
1914	*b* 1204						
1915	*b* 1246						
1916	3681						
1917	4324						
1918	3232						
1919	3253						

a Not including 2 strikes involving 33 establishments not reported.
b Figures not comparable with those in following years, though best available

will probably continue to be in the future, though they do not now have the preponderance that they had in the earlier years. It should be

TABLE II

STRIKES DUE WHOLLY OR PARTIALLY TO CERTAIN CAUSES

Years	Wages and Hours		Recognition of the Union		Sympathy	
	Number	Per Cent of all Strikes	Number	Per Cent of all Strikes	Number	Per Cent of all Strikes
1881	397	84.3	32	6.8	4	0.8
1882	349	76.9	31	6.8	4	0.9
1883	370	77.4	46	9.6	3	0.6
1884	333	75.2	42	9.6	9	2.0
1885	479	74.3	54	8.4	20	3.1
1886	1123	78.4	165	11.5	41	2.9
1887	896	62.4	265	18.5	67	4.7
1888	560	61.8	143	15.8	34	3.8
1889	686	63.8	161	15.0	65	6.1
1890	1129	61.6	286	15.6	181	9.9
1891	958	55.2	298	17.4	198	11.5
1892	744	57.3	238	18.3	116	8.9
1893	810	62.1	219	16.8	59	4.5
1894	878	65.1	190	14.1	118	8.8
1895	864	71.1	200	16.5	7	0.6
1896	609	59.4	278	27.1	6	0.6
1897	741	68.7	175	16.2	8	0.7
1898	713	67.5	214	20.3	8	0.8
1899	1205	67.1	448	24.9	26	1.5
1900	1231	69.2	376	21.1	27	1.5
1901	1679	57.4	967	32.1	69	2.4
1902	1967	62.2	1014	32.1	83	2.6
1903	2255	64.5	1106	31.7	83	2.4
1904	1140	49.4	898	38.9	85	3.7
1905	1076	51.8	738	35.5	56	2.7
1914	389	52.7	89	12.0	25	3.4
1915	673	64.3	79	7.6	9	0.9
1916	1929	62.6	556	18.0	32	1.0
1917	2124	59.8	507	14.3	70	1.9
1918	1779	63.6	367	13.1	34	1.2
1919	1656	54.3	690	22.6	100	3.3

remembered that more than one-half of the strikes in 1881–1882 and nearly one-half in 1883, 1884, 1885, and 1886, were by unorganized labor and consequently no question of recognition of the union could have been involved in these disputes. Even if these six years are left out of account, there was a very large increase in the number and proportion of strikes due to this cause, especially after 1897. It will be surprising to many, however, to see that there has been a marked falling-off in the relative number of strikes for this cause in recent years as compared with 1898 to 1905.

Surprise may also be aroused by the figures for sympathetic strikes. Thirty years ago such strikes were very common; but during the depression of the 90's they almost completely disappeared as they did again in the hard times of 1915, and for the past quarter of a century they have been relatively unimportant, so far as can be seen from the data now available.

Strikes against reductions in wages increase in a period of depression, especially in the earlier stages of the downward swing of production and prices, while strikes for an increase in wages move in the opposite direction. At the present time many such defense strikes are occurring. It is significant that even strikes ostensibly for an increase of wages are really for the purpose of preventing a reduction and are undertaken in some cases at least in the hope that through arbitration or compromise a somewhat smaller reduction will be suffered.

Jurisdictional Disputes.—One other class of strikes should be mentioned because of the very great popular misconception in regard to their frequency. These are jurisdictional disputes, that is, strikes by the members of one trade against the performance of work which they regard as belonging to their craft by members of some other craft or trade. According to the Bureau's report, there were in 1916, 19 such strikes; in 1917, 21; in 1918, 16; and in 1919, 15. Reduced to percentages, they constitute about 0.5% of all strikes in these years and are one of the least important classes of disputes deemed worthy of separate consideration. In the period 1881 to 1905, there were 315 strikes of this sort out of 36,757, or a little over 0.8%. The percentage of establishments was 0.3%, and out of a total of 6,728,048 strikers only 4,220, or 0.06%, struck for this reason.

Table III shows the relative numbers of strikes ordered by labor organizations and those which have taken place among unorganized laborers during the period from 1881 to 1905. It is significant that strikes of the latter type were more numerous than union strikes in 1881 and 1882, and that they remained nearly equal until after 1886. It is also noteworthy that non-union labor does not use the same judgment in timing its strikes to conform with favorable business conditions. This is particularly noticeable during the period of depression in the 90's. The number of union strikes decreased much more than the fall in commodity prices in this period and rose much more rapidly than the index of prices when conditions improved after 1898, while non-union strikes show no such conformity to business conditions.

TABLE III

A COMPARISON OF THE STRIKES OF ORGANIZED AND UNORGANIZED LABOR

Year *	Ordered by Labor Organizations		Not Ordered by Labor Organizations	
	Number	Per Cent	Number	Per Cent
1881	223	47.4	248	52.6
1882	220	48.5	234	51.5
1883	271	56.7	207	43.3
1884	240	54.2	203	45.8
1885	357	55.3	288	44.7
1886	763	53.3	669	46.7
1887	952	66.3	483	33.7
1888	616	68.1	288	31.9
1889	724	67.3	351	32.7
1890	1306	71.3	525	28.7
1891	1284	74.8	432	25.2
1892	918	70.7	380	29.3
1893	906	69.4	399	30.6
1894	847	62.8	501	37.2
1895	658	54.2	555	45.8
1896	662	64.6	363	35.4
1897	596	55.3	482	44.7
1898	638	60.4	418	39.6
1899	1115	62.1	682	37.9
1900	1164	65.4	615	34.6
1901	2218	75.9	706	24.1
1902	2474	78.2	688	21.8
1903	2754	78.8	740	21.2
1904	1895	82.1	412	17.9
1905	1552	74.7	525	25.3

* No comparable figures are available in the reports of the Bureau of Labor Statistics for the years 1914–1919.

Table IV classifies strikes by industries. It is taken from a much larger table in the Report [1] of the Bureau of Labor. Certain very marked differences among the industries are to be noted in this table. In Boots and Shoes, Textiles, Glass, and Railroad Transportation strikes are usually confined to one plant or establishment, while in the Building Trades,

[1] Twenty-first Annual Report of the Commissioner of Labor, pp. 16–17.

Clothing, and some others a considerable number of establishments are usually involved.

TABLE IV

STRIKES, ESTABLISHMENTS INVOLVED, STRIKERS, AND EMPLOYEES THROWN OUT OF WORK, BY INDUSTRIES, IN WHICH THE GREATEST NUMBER OF STRIKES OCCURRED, 1881 TO 1905

Industry	Strikes	Establishments		Strikes		Employees Thrown Out of Work	
		Number	Average per strike	Number	Average per strike	Number	Average per strike
Boots and Shoes	1,101	1,555	1.4	88,553	80	160,059	145
Building Trades	9,564	69,899	7.3	917,905	96	1,083,669	113
Clothing, Men's	1,147	15,996	13.9	372,214	325	459,059	400
Clothing, Women's	640	4,918	7.7	215,595	337	232,154	363
Coal and Coke	3,336	17,025	5.1	2,006,353	601	2,460,743	738
Textiles	1,251	1,878	1.5	250,352	201	434,354	347
Cotton and woolen goods	111	440	4.0	38,308	345	64,928	585
Cotton goods	665	832	1.3	166,357	250	277,470	417
Wooden goods	79	187	2.4	12,631	160	14,016	177
Woolen goods	396	419	1.1	33,056	83	77,940	197
Foundry and Machine Shop	1,668	4,722	2.8	208,352	125	282,706	169
Freight handling and Teaming	916	5,665	6.2	249,545	272	275,483	301
Glass	548	1,020	1.9	63,641	116	135,431	247
Iron and Steel	835	1,219	1.5	250,125	300	436,647	523
Printing and Publishing	1,001	2,999	3.0	44,424	44	58,471	58
Railroad transportation	506	680	1.3	123,413	244	218,303	431
Stone quarrying and cutting	1,057	4,450	4.2	122,671	116	142,451	135
Tobacco: Cigars and Cigarettes	1,780	7,381	4.1	231,988	130	281,890	158
Total	25,350	139,407	5.5	5,145,131	203	6,661,420	263
Total all Industries	36,757	181,407	4.9	6,728,048	183	8,703,824	237

It can be seen that two industries, the Building Trades and Coal and Coke, are the ones in which the strike evil is most prevalent. These two industries are responsible for more than one-half of all the strikes covered by this table and more than one-third of all the strikes in the country. They have a still greater preponderance over other lines of industry as measured by the number of strikers and the number of employees thrown out of employment as a result of strikes. It will be noted later on in this report that there is a very clear correlation between the number of strikes and the seasonal or irregular character of employment. Is it too much to hope that strikes could be greatly reduced in these industries if the employees in them could be assured of more regular and constant employment?

Losses in Wages and Production.—In its sixteenth annual report, the United States Bureau of Labor undertook to ascertain the wage loss to employees and the loss suffered by employers by reason of strikes during the twenty-year period from 1881 to 1900. The following table gives these losses by years:

In commenting on these figures, the bureau calls attention to the fact that many of these losses were made up later by speeding up the work, by more regular employment, etc., so that they must not be regarded as net losses in the case of either the employees or the employers. It should be noted also that many of the strikes were for higher wages and were successful. In such cases it is probable that the wage loss to employees was soon recovered through larger earnings.

Even taking the figures as they stand, they are not particularly impressive as evidence of great loss. The total loss to employees in twenty years was only $267,863,478 or a yearly average of $12,893,174. The loss to employers averages $6,136,556 a year.

The loss to employees, if it had been borne equally by all those gainfully employed, according to the Census classification, would have imposed an average burden of only 55 cents a year upon each person. The *per capita* burden in 1881 would have been 19 cents, in 1890, 43 cents, and in 1900, 63 cents.

But all those gainfully employed are not laborers or wage earners, therefore it may be worth while to make another estimate. W. I. King in his "Wealth and Income," p. 168, gives a table which is perhaps as accurate as anything yet published on the number and earnings of wage earners in the United States. Making use of his figures as the basis of computation indicates that the average annual loss per wage earner during the twenty-year period was 77 cents, while in 1881 it was 29 cents, in 1890, 85 cents, and in 1900, 90 cents. King estimates the average wages in 1900 to have been $417. Thus the loss due to strikes in that year would have amounted to a little over 0.2% of each working man's wages, or in other words about $\frac{3}{5}$ of a day's time, while the yearly average for the whole period would have been about $\frac{2}{5}$ of a day per capita. In any case it is less of a loss than an added national holiday such as Armistice Day would entail. Moreover it is worthy of note that illness occasions a loss each year at least twelve times as great, and that the fire loss in the country (1881–1900) was nearly ten times the wage loss due to strikes.

TABLE V

Wage Loss of Employees, Assistance to Employees, and Loss of Employers, January 1, 1881 to December 31, 1900

Year	To date when strikers were re-employed or employed elsewhere		Loss to Employers
	Wage loss of employees	Assistance to employees by labor organizations	
1881	$3,372,578	$287,999	$1,919,483
1882	9,864,228	734,339	4,269,094
1883	6,274,480	461,233	4,696,027
1884	7,666,717	407,871	3,393,073
1885	10,663,248	465,827	4,388,893
1886	14,992,453	1,122,130	12,357,808
1887	16,560,534	1,121,554	6,698,495
1888	6,377,749	1,752,668	6,509,017
1889	10,409,686	592,017	2,936,752
1890	13,875,338	910,285	5,135,404
1891	14,801,505	1.132,557	6,176,688
1892	10,772,622	833,374	5,145,691
1893	9,938,048	563,183	3,406,195
1894	37,145,532	931,052	18,982,129
1895	13,044,830	559,165	5,072,282
1896	11,098,207	462,165	5,304,235
1897	17,468,904	721,164	4,868,687
1898	10,037,284	585,228	4,596,462
1899	15,157,965	1,096,030	7,443,407
1900	18,341,570	1,434,452	9,431,299
Total.	$257,863,478	$16,174,793	$122,731,121

But the above reckoning has been based upon the assumption that the loss set forth in Table V is an actual loss. As has already been noted there are numerous ways in which this loss may be compensated for or offset. Perhaps the most important of these is that the time lost in strikes is really taken out of the time that employees would have been idle in any case rather than out of production time. This is particularly true of seasonal and irregular occupations and industries like the building trades, clothing manufactures, boot and shoe manufactures, glass making, quarrying, and coal mining.

Strikes in Seasonal Occupations.—It is significant that more than one-half of all the strikes that occurred between 1881 and 1905 and much more than one-half of the employees thrown out of work were in occupations or industries that are highly irregular or distinctly seasonal in character. Among these coal and coke is the most conspicuous, because 9% of the strikes and over 28% of all the employees thrown out of work through strikes were in this industry. It is possible to trace the effects of strikes in this industry both upon the employee's working time and upon production. This is done in the following table:

TABLE VI

STRIKES AND PRODUCTION IN COAL MINES, ANTHRACITE AND BITUMINOUS, IN THE UNITED STATES, 1910 TO 1916 *

Year	Men employed. Thousands	Men on Strike. Thousands	Working days lost by reason of strikes		Days worked per year	Average tonnage		Tons of coal produced. Millions
			Per man employed	Per man on strike		Per man per year	Per man per day	
1910	725	218	26.5	88.0	220	618	2.8	447
1911	722	41	1.3	24.0	220	615	2.8	443
1912	723	311	17.3	40.0	226	663	2.9	478
1913	748	135	4.1	22.5	238	681	2.9	509
1914	763	162	14.5	68.0	210	602	2.9	459
1915	734	67	3.4	37.0	209	645	3.1	475
1916	721	171	4.6	19.5	236	732	3.1	527

* Geological Survey figures in the Statistical Abstract of the United States, 1917, pp. 259, 537.

Table VI indicates very little correlation between strikes and either the yearly output of coal or the extent of employment. Taken by themselves the figures representing the number of men on strike and working days lost per man would seem to indicate a tremendous waste in productive capacity and a great loss in wages; but it is apparent that these losses were almost entirely wiped out before the end of the year.

It is noteworthy that there was more coal produced in 1910 than in 1911, even though the former year witnessed many protracted strikes involving large numbers of employees. Moreover, there was no real loss of employment by reason of these strikes. Again 1912, with 43% of the entire labor force out on strike and with an average loss per man of 40 days, shows large total production, increased output per man per day and per year, and six days more employment per man than the previous year which was relatively strikeless.

Low production in 1914 and 1915 was due to general business depression caused by the Great War rather than to strikes.

It is probable that much the same results would be shown if statistics could be obtained in other seasonal and irregular employments. It is true also that all employments are subject to more or less irregularity, especially when individual establishments are taken into account.

These statistics therefore confirm to some extent the general feeling among wage earners that strikes do not in the long run mean much real loss of time to the men and that such loss as does occur is in the end more than compensated for by the purposes attained by means of the strike. It is probably futile, therefore, to attempt to convince workingmen by the citation of statistics that striking is inexpedient.

STATE REPORTS ON STRIKES AND LOCKOUTS

Many states have bureaus or departments of labor or conciliation, mediation, and arbitration boards which are concerned with industrial disputes. Most of these states publish annual or biennial reports on these matters, though few of these reports are really statistical in character. Some of them describe in detail the most serious or important cases handled, and give an alphabetical list, by names of concerns, of other cases in which the board or department has been interested. In such reports the lists are never a complete record of all the strikes in the state, and they cannot be used for statistical purposes.

In a few states, notably Massachusetts and New York, the departments of labor or boards of arbitration publish detailed statistics of strikes each year. These are not always comparable with the statistics of the United States Bureau of Labor Statistics, however, as the fiscal year is used in some cases instead of the calendar year, or they may lump strikes and lockouts together and use a very different classification of industries. A brief discussion of the statistics of one of these states will indicate what can be obtained from the best of these state reports.

New York.[1]—The third deputy commissioner in charge of the Bureau of Mediation and Arbitration reports the following record of "disputes" for the fiscal year ending June 30, 1918, and for the three preceding years:

[1] State of New York, Annual Report of the Industrial Commission, 1918. New York State Department of Labor. 1919.

COMPARISON OF DISPUTES, 1915–1918

	1915	1916	1917	1918
Number of strikes and lockouts	104	328	234	265
Employees involved directly	53,855	222,325	144,951	83,650
Employees involved indirectly	2,407	31,629	18,376	6,355
Aggregate days of working time lost	868,838	9,581,163	2,600,335	1,519,884

It is interesting to note that, according to the United States Bureau of Labor Statistics, there were the following number of disputes (strikes and lockouts) in New York State: 1916, 592; 1917, 711; 1918, 683. These figures are for the calendar year and are therefore not directly comparable; but it is perfectly apparent that the state report falls far short of covering all disputes, though it may include the most important ones.

This report also contains a detailed analysis of the figures for 1917 and 1918, "trades affected," "principal cause or object of disputes," "results of disputes," and "methods of settlement." It is interesting to note that there were no sympathetic strikes in either of these years, which is further evidence of the relative insignificance of this class of strikes.

The most significant thing about this record of disputes is the seriousness of the disputes in 1916 as indicated by aggregate lost time. This table indicates also a small increase in the number of strikes in 1918 (July 1, 1917 to June 30, 1918) which nearly coincides with the first year that this country was in the War; but it is apparent that these disputes were not serious ones and were of short duration, because the number of persons involved and the days of lost time were relatively small.

The deputy commissioner lays great stress upon the serious loss to the men and to the community as indicated by the days of working time lost, particularly in 1916. Indeed there were serious losses; but they represent only one day *per capita* for the entire population of the state, and about two days each for those classed by the United States Census as gainfully employed in that state. The average per wage earner in the state may be estimated for that year at about 2.6 days, while the average loss per person on strike or thrown out of work by reason of disputes was 32.7 days. These were indeed heavy losses, particularly to those involved in the disputes, if they came out of the time when these people would otherwise have been employed; but it should be noted that at this time, July 1, 1915, to June 30, 1916, industry had not fully recovered from the serious depression which followed the outbreak of the war in Europe and which caused an unusual amount of unemployment during the winter of 1914–1915.

How much of this lost time was in seasonal and irregular trades cannot be determined from the 1918 report; but it may be approximately estimated on the basis of the detailed figures for 1917 which are given in this report. According to these figures, 32% of the lost time was in the building trades and the clothing industry.

CONCLUSION

It is clear that there are no statistics available for the past fifteen years that cover a sufficient period of time or a wide enough range to render detailed comparisons with the period 1881 to 1905 safe or even possible in many particulars.

Such comparisons as can be made, however, indicate that a very large proportion of strikes in recent years have occurred in seasonal and irregular occupations, such as the clothing industry, coal mining, and the building trades, in which employees do not ordinarily work much more than two-thirds of the time.

It may be questioned whether such detailed studies as were made by the United States Bureau of Labor down to 1906 should be undertaken again at government expense. It is certain that no private organization could afford to bear the cost of such investigations.

Statistics, when properly interpreted, do not support the popular belief that strikes are responsible for great losses in earnings to wage earners or in the output of industry.

The strikes that have seriously affected or threatened the public welfare and the ongoing of industry are such strikes as those in the steel and coal industries in 1919, or such as have been imminent at times on the railroads of the country. England has been menaced by strikes of this sort several times since the close of the War. No statistical study of strikes in the past would be of any use as a means of showing the effects of such strikes as these, and none would be necessary in any case, for it is perfectly clear that they would lead to disastrous consequences to industry and to the general welfare which would be out of all proportion to the losses in wages and profits of those directly concerned in them. Such strikes must be prevented if it is possible to stop them.

Statistics show that strikes are most frequent and most prolonged in the seasonal and irregular occupations. Attention has been called to the probability that this may be in part due to the fact that the ordinary penalty for striking, namely, loss of earnings, is not effective in industries where workmen are normally idle about one-third of the time. Strikes in such occupations are probably due also to the difficulty of getting and keeping wage rates sufficiently above the rates in more regular trades and industries to enable the laborers to maintain a decent standard of living throughout the year. Whatever the reason or the cause, the remedy is to stabilize or regularize the employment.

Finally, strikes are merely symptoms of more fundamental maladjustments, injustices, and economic disturbances which produce unrest, discontent, and bitterness among the ever-increasing number of industrial workers. Treating symptoms rarely reaches the roots of the disease. Suppressing strikes will not cure social unrest; but will probably increase it. Strikes are always regrettable; but not always reprehensible. Until the social millennium is attained, they will continue to occur and will be sometimes necessary both as a direct defense against injustice and oppression and as the only way of compelling the public to give its attention to hidden evils in industrial relations.

C. W. Doten.

CHAPTER XIII

THE LEGAL MACHINERY FOR ADJUSTING LABOR DISPUTES IN THE UNITED STATES

By John Koren

Variety.—American legislation for the settlement of labor disputes presents almost as many varieties as there are states. The nomenclature of the bodies created to deal with controversies between employer and employee may in many cases be the same, but their duties, manner of appointment, etc., vary in a confusing manner. About the only consolation to be drawn from this legislation is the fact that the need for it is recognized. The following tabular exhibits justify this generalization.

Table I shows by type the American statutes relating to industrial arbitration. Seven of the states have laws for local arbitration, but no permanent agency to execute them. Two states legalize permanent district or county boards established by private parties. Eight states (Alaska and the Philippines are not included) provide for arbitration or conciliation by the State Commissioner of Labor or other state officials. In twenty-seven states there are laws creating a special State Board or Commission for the settlement of labor disputes. In the case of Kansas a Court of Industrial Relations has been established, with very broad powers, which is without a counterpart in this country. Seventeen states (Porto Rico is not included) make provision for local boards as well as for bodies with state-wide powers.

Adequacy.—Table II shows that the state legislation creating machinery for the adjustment of industrial disputes is active in eleven states, that is, functions with more or less success; that it is inactive in five states; and dormant in eighteen, not counting Alaska, the Philippine Islands and Porto Rico. (In eleven states, without counting the District of Columbia and Hawaii, no legislation worthy of the name exists.) The figures carry their own comment. It is a fair statement that for the country as a whole the bodies for the adjustment of industrial disputes are not functioning. It will also be noted that several highly important manufacturing states are included in the lists of states with inactive or dormant legislation.

A study of how the legislation works in states in which it is reported to be active would require a long and intimate investigation quite beyond the limitations set for the inquiry into industrial waste. But it is not hazardous to remark that in no state has the existing machinery shown itself capable of meeting a great crisis. The experience in Kansas is too new to be included in this comment.

TABLE I

American Statutes Relating to Industrial Arbitration: by type, as follows:

I. Laws providing for local arbitration with no permanent agency therefor.
II. Laws providing for permanent district or county boards established by private parties.
III. Laws providing for arbitration or conciliation through the agency of State Commissioners of Labor (or other State officials).
IV. Laws providing for a special State Board or Commission for the settlement of industrial disputes.
V. Laws providing for local boards, as well as statewide bodies.

I	II	III	IV	V
Alaska	Iowa	Alaska	Alabama	Alabama
Indiana	Kansas	Arkansas	California	California
Iowa		Colorado *	Colorado	Colorado
Nevada		Georgia	Connecticut	Kansas
New Jersey		Maryland *	Idaho	Maine
Texas		Missouri *	Illinois	Maryland
Washington		Nevada	Kansas	Massachusetts
		Philippine Islands	Louisiana	Michigan
		South Dakota	Maine	Minnesota
		Washington	Maryland	Montana
			Massachusetts	Nebraska
			Michigan	New York
			Minnesota	Ohio
			Missouri	Oregon
			Montana	Pennsylvania
			Nebraska	Porto Rico
			New Hamsphire	Rhode Island
			New York	South Carolina
			Ohio	
			Oklahoma	
			Oregon	
			Pennsylvania	
			Porto Rico	
			Rhode Island	
			South Carolina	
			Utah	
			Vermont	
			Wisconsin	

* Old law, now in disuse, but still on statute books. Not included in other tables.

(In Colorado, Idaho, Illinois, Maryland, Massachusetts, New York, Ohio, Pennsylvania, Philippine Islands, Rhode Island, and Utah, mediation and arbitration is carried on as a part of the central department of labor, under various names.)

Whether adequate bodies can be created for the purpose in hand is another question. The need of properly constituted labor courts, or agencies called by some other name, is generally agreed upon, but how they should be constituted, the jurisdiction that should be given them, etc., remain to be determined. Meanwhile, in view of the obvious industrial waste resulting from labor disputes, it is certainly not an over-statement to say that one of the urgent measures for its elimination is to acquire the wisdom to create and operate successfully agencies endowed with sufficient power and wisdom to stop the thousands of destructive and needless controversies over labor questions.

The remaining tables show numerous details of legislation in regard to the various bodies intended to function in labor disputes. They help to illustrate the helter-skelter character of existing laws, which in large part seems to result from accident, for there is little evidence that these laws are based upon a knowledge of requirements and the best experience. No extended analysis of these tables is in order here; they are capital evidence of the ineptitude of our legislation and point to conditions that spell constant waste and grave dangers likely to arise at any moment.[1]

TABLE II

American State Legislation for the Adjustment of Industrial Disputes

Classified according to activity of the body created for this purpose.

Active	Inactive	Dormant	No Legislation
Colorado	Iowa	Alabama	Arizona
Illinois	Maine	Alaska	Delaware
Kansas	Nebraska	Arkansas	District of Columbia
Maryland	Porto Rico	California	Florida
Massachusetts	Washington	Connecticut	Hawaii
Minnesota	Wisconsin	Georgia	Kentucky
New York		Idaho	Mississippi
Ohio		Indiana	New Mexico
Oregon		Louisiana	North Carolina
Pennsylvania		Michigan	North Dakota
Utah		Missouri	Tennessee
		Montana	Virginia
		Nevada	West Virginia
		New Hampshire	
		New Jersey	
		Oklahoma	
		Philippine Islands	
		South Carolina	
		Texas	
		Vermont	

(Wyoming possesses a Constitutional provision commanding the State Legislature to create an agency for the adjustment of industrial disputes, but no statute has ever been passed to carry out such provision.)

(The provisions of Rhode Island and South Dakota are too recent to admit of classification here.)

[1] The tables have been prepared by Mr. Carl I. Wheat.

TABLE III

Nomenclature of State Agencies for Industrial Conciliation in the United States and the Comparative Activity of the Same. Together with the Dates of Legislation in the Various States upon the Subject of Industrial Conciliation

State or Other Governmental Unit	Name of Body Created	Comparative Activity	Dates of Legislation on this Subject	
			First Legislation on this Subject	Subsequent Legislation (Not including mere amendments)
Alabama	State Board of Mediation and Arbitration	Dormant	*1911*[4]	
Alaska	(No Permanent Board)	Dormant	*1912*[1, 2]	
Arkansas	(No Permanent Board)	Dormant	*1913*[2, 5]	
California	State Board of Arbitration and Conciliation	Dormant	*1891*[4]	
Colorado	The Industrial Commission of Colorado †	Active	1887[2]	1897[3] *1915*[4, 5]
Connecticut	State Board of Mediation and Arbitration	Dormant	*1895*[3]	
Georgia	(No Permanent Board)	Dormant	*1911*[2, 5]	
Idaho	State Labor Commission †	Dormant	1897[3, 5], §	*1899*[3, 5]
Illinois	The Industrial Commission †	Active	1895[3]	*1917*[3, 5]
Indiana	(No Permanent Board) *	Dormant	1897[3], §	1899[3], § *1915*[1]
Iowa	(No Permanent Board)	Inactive	*1886*[1]	
Kansas	Court of Industrial Relations	Active	*1886*[1]	*1920*[3]
Louisiana	Board of Arbitration and Conciliation	Dormant	*1894*[3]	
Maine	State Board of Arbitration and Conciliation	Inactive	*1909*[4]	
Maryland	State Board of Labor and Statistics †	Active	1878[1]	1904[2] *1916*[4, 5]
Massachusetts	State Board of Conciliation and Arbitration †	Active	1886[4]	1913 *1919*[4, 5]
Michigan	State Board of Mediation and Conciliation	Dormant	1889[3], §	*1915*[4]
Minnesota	State Board of Arbitration	Active	*1895*[4]	
Missouri	State Board of Mediation and Arbitration	Dormant	1889[2]	*1901*[3]
Montana	State Board of Arbitration and Conciliation	Dormant	*1887*[4]	
Nebraska	State Board of Mediation and Investigation	Inactive	*1913*[4]	
Nevada	(No Permanent Board)	Dormant	*1907*[1, 2, 5]	
New Hampshire	State Board of Conciliation and Arbitration	Dormant	*1911*[3]	
New Jersey	(No Permanent Board) *	Dormant	*1880*[1]	1886 § 1892 §
New York	State Board of Mediation and Arbitration †	Active	1886[4], §	*1907*[4, 5]
Ohio	The Industrial Commission of Ohio †	Active	1885[1], §	1893[4] *1913*[4, 5]

Oklahoma	State Board of Arbitration and Conciliation	Dormant	*1907*[3]	
Oregon	State Board of Conciliation	Active	*1919*[4]	
Pennsylvania	Bureau of Mediation and Arbitration †	Active	1883[1] §	1893[1] § *1913*[4, 5]
Philippine Islands	The Bureau of Labor †	Dormant	*1908*[2, 5]	
Porto Rico	The Mediation and Conciliation Commission	Inactive	*1919*[4]	
Rhode Island	State Board of Labor †	Comparatively inactive	*1919*[4, 5]	
South Carolina	State Board of Conciliation	Dormant	*1916*[4]	
South Dakota	(No Permanent Board)	? ‡	*1920*[2]	
Texas	(No Permanent Board)	Dormant	*1895*[1]	
Utah	The Industrial Commission of Utah †	Active	1896[3]	*1917*[3, 5]
Vermont	State Board of Conciliation and Arbitration	Dormant	*1912*[3]	
Washington	(No Permanent Board)	Inactive	*1903*[1, 2]	
Wisconsin	State Board of Conciliation	Inactive	1895[4] §	*1919*[3]
Wyoming	(Constitutional Provision only. No Board)			
United States (Federal Provision)	U. S. Board of Mediation and Conciliation, U. S. Labor Board (Act of 1920)	Active	*1913*[4]	*1920*[4]

* Former State Agencies for Industrial Conciliation in these States have been discontinued by repeal of the law creating them.

† In these States Industrial Conciliation either represents only a portion of the duties of the agency designated above, or this work is under or consolidated with other agencies of the State. (See Note 5.)

‡ This provision is so recent that no estimate of comparative activity is as yet possible.

[1] Local or temporary Boards provided for.

[2] Intervention by Labor Commissioner, Governor or other official provided for.

[3] Permanent Board of Commission created. (Statewide.)

[4] Both permanent (Statewide) and local Boards provided for.

[5] Formed by consolidation with general Labor or other State Department, or run in connection with such Department, with other powers in addition to those of industrial conciliation.

§ Repealed.

Italicized denotes that the body created as shown remains on the statute-books at the present time. (Those not italicized have either been repealed or merged in the subsequently created bodies.)

NOTE.—The State of North Dakota created in the year 1890 the duty of mediation in industrial disputes by the Commissioner of Agriculture. This law was repealed by the Revised Code of 1895, and no law relating to this subject is at present on the statute books of this State

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Index		1 Alabama	2 Alaska	3 Arkansas	4 California	5 Colorado	6 Connecticut	7 Georgia	8 Idaho	9 Illinois	10 Indiana	11 Iowa	12 Kansas	13 Louisiana	14 Maine
	GENERAL														
1	Permanent board or commission (state-wide)	x			x	x	x		x	x			x	x	x
2	Local or temporary boards	x	x		x	x					x	x	x		x
3	Governor or State Labor Commission given duty to intervene		x	x				x							
4	Constitutional provision for industrial arbitration								x						
	MAKE-UP OF PERMANENT BOARDS OR COMMISSIONS														
5	Number of members	3			3	3[3]	3		2[3]	2[3]			3	5	3
6	Appointed by governor by and with advice and consent of the Senate	x[5]			x[5]	x	x		x				x	x	x
7	Removable by governor	x													
8	Term of office—years	2			1	6	2		2				3		3
9	To contain a representative of employers				x	x			x	x				x[8]	x
10	To contain a representative of employees				x	x	x		x	x				x[8]	x
11	To contain a neutral member				x				x[10]					x	x
12	No more than two members to belong to the same political party					x	x[12]		x[13]						
13	Previous residence in the state required—years					2									
14	To be competent persons				x									x	x
15	Not to have occupation or business interfering with duties on the commission														
16	To devote entire time to duties on the commission					x									
17	Neutral member to be chairman				x				x						
18	Neutral member to be chosen by the other members													x	x
19	If no agreement within specified time, governor to appoint neutral member													x	x
20	State Labor Commissioner or other state official to be a member														
	MAKE-UP OF TEMPORARY OR LOCAL BOARDS														
21	Number of members	3	3		3						3		5		3
22	Mutually agreed on by the parties														
23	Appointed by governor or other official		x			x					x	x	x		
24	One or more selected by employer (or to be employer)	x	x		x							x	x[18]		x
25	One or more selected by employees (or to be employees)	x	x		x							x	x[18]		x
26	Unorganized employees to have opportunity in choice	x													
27	One or more neutral members	x	x		x							x			x
28	Neutral members to be selected by the "interested" parties	x	x		x							x			x
29	If no agreement on neutral member, State Board or other official to appoint same		[19]												
30	Neutral member to be chairman				x										x
	COMPENSATION														
	Permanent Boards														
31	Yearly salary					x							x		
32	Payment by number of days actually served	x			x				x					x	x
33	Expenses allowed	x			x	x			x				x	x	x
	Temporary or local boards														
34	Compensation provided	x	x			x					x	x	x		
35	Expenses allowed		x									x			
	Source of Compensation														
36	All expenses met by state	x			x	x			x		x	x	x	x	x
37	Partly by state and partly by local authorities												x		
38	All expenses to be met by the parties		x												
	MEDIATION OR CONCILIATION (STATE BOARDS)														
	Jurisdiction														
	Scope														
39	Any industrial dispute (numbers refer to number of persons who must be involved)	x	x[23]	x[24]	x	x	x	x[24]	50[25]	25				20	10
40	Disputes not subject to suit at law or in equity									x				x	
41	Where stoppage has begun or is imminent	x	x		x		x								x
		1	2	3	4	5	6	7	8	9	10	11	12	13	14

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for Adjusting Labor Disputes

15 Maryland	16 Massachusetts	17 Michigan	18 Minnesota	19 Missouri	20 Montana	21 Nebraska	22 Nevada	23 New Hampshire	24 New Jersey	25 New York	26 Ohio	27 Oklahoma	28 Oregon	29 Pennsylvania	30 Philippine Is.	31 Porto Rico	32 Rhode Island	33 South Carolina	34 South Dakota	35 Texas	36 Utah	37 Vermont	38 Washington	39 Wisconsin	40 Wyoming	41 United States	Index
x	x	x	x	x	x	x		x		x	x	x	x	x		x	x	x			x	x		x		x	1
x	x	x	x		x	x	x		x	x	x		x	x		x	x	x		x			x			x	2
							x								x				x				x				3
						x						x									x			x[2]			4
3[3]	3	2	3	3	3	3		3		3[3]	3[3]	7[4]	3	1	3[3]	5	5	3			3[3]	3		3		3	5
x[5]	x	x	x	x	x	x[5]		x			x[5]	x	x[6]			x[5]	x	x[5]			x	x[5]		x		x	6
x	x[7]		x		x	x					x		x								x					x	7
2	3		2	3	2	2		3			6		4			4	6	6			4	3		3		7	8
	x		x	x	x	x		x			x	x[8]	x[9]			x[8]	x[8]	x				x		x			9
	x		x	x	x	x		x			x	x[8]	x[9]			x[8]	x[8]	x				x		x			10
			x	x	x	x		x				x[11]	x			x	x[11]	x				x		x			11
											x										x						12
												x[14]				x[15]											13
				x																							14
											x										x						15
		x[16]																									16
																x	x										17
			x					x					x					x				x					18
			x					x					x					x				x					19
												x					x										20
3	3 or	4			3 or	3	3		5 or	3	3 or		3 or	3		3				5			3[17]			3 or 6	21
	x		x		x				x		x		x														22
																	x	x									23
x	x	x			x	x	x		x[18]	x	x		x	x		x				x[18]			x			x	24
x	x	x			x	x	x		x[18]	x	x		x	x		x				x[18]			x			x	25
		x				x														x							26
x	x	x[18]			x	x	x		x	x	x		x	x		x				x			x			x	27
x	x	x			x	x	x		x	x	x		x	x		x				x			x			x	28
x		x					x						x	x		x				x						x	29
x[20]	x				x	x			x	x	x		x	x[21]						x							30
x	x	x												x							x					x	31
		x[16]	x	x	x	x		x				x	x			x		x						x		x	32
x		x	x	x	x	x		x				x	x			x		x						x			33
x	x	x				x	x				x		x							x						x	34
		x					x																			x	35
x		x	x	x	x	x		x				x	x	x		x		x		x				x		x	36
	x										x		x[22]														37
						x[22]	x												x								38
10	25	x[26]	10	10	20	x	x	10		x	x		50	x		x[27]	x	x	x		10	10	x			x[28]	39
					x								x														40
x				x		x	x	x		x	x		x													x	41
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		Alabama	Alaska	Arkansas	California	Colorado	Connecticut	Georgia	Idaho	Illinois	Indiana	Iowa	Kansas	Louisiana	Maine
	How Obtained														
42	On application or "submission" by one or by both parties	x	x		x					x				x	
43	On advice or request of governor of the state	x													
44	On notice from any source								x	x					
45	On notice from specified sources (local or labor officials, etc.)									x[29]				x[29]	x[29]
46	On own motion									x					
47	Action mandatory whenever board learns of dispute					x	x								
	Procedure														
48	Body designated or agent, attempts mediation		x	x		x		x							x
49	Proceeds to locality of dispute	x			x		x		x	x				x	
50	Holds hearing				x					x				x	
51	Makes decision (Numbers refer to the number of days within which decision or report must be made)	10			21					x				x	
52	Advises parties what they should do									x					x
53	If mediation is unsuccessful, attempt made to procure submission to arbitration		x						x						x
54	If parties fail to keep promises, may cease action until agreement				x									x	
	INVESTIGATION (STATE BOARDS) *Jurisdiction* *Scope*														
55	Same as for mediation or conciliation	x													
56	Any industrial dispute (Numbers refer to number of persons who must be involved)				x	x	x		x				x[35]		10[36]
57	Where stoppage has begun or is imminent						x			x			x		
58	Where mediation has failed or arbitration is refused								x	x					
	How Obtained														
59	Same as for mediation	x													
60	On application by either party				x										x
61	On our information												x		
62	On certain information as specified													x	
63	On request by governor														x
64	Action discretionary				x		x			x			x		
	Procedure														
65	Body designated, or agent, investigates dispute				x[42]								x[42]		x
66	Proceeds to locality of dispute	x							x					x	
67	Fixes responsibility														
68	Makes decision (Numbers refer to the number of days within which decision or report must be made)	10			x	x			x					x	x
69	Report to be made public (usually with recommendation for fair settlement)				x				x[44]	x				x	
70	Miscellaneous powers of investigating body[46]	x[47]							x[48]						
71	Provision for court review of decision					x							x		
	ARBITRATION (STATE BOARDS) *Jurisdiction* *Scope*														
72	Any industrial dispute (Numbers refer to number of persons who must be involved)	x			x	x	x		25	25					10
73	Where stoppage has begun or is imminent	x								x					x
	How Obtained														
74	Where both parties join in "submission" of case to arbitration[55]	x			x	x	x		x	x					x
75	Submission to be in writing	x			x		x		x	x					
76	Signed by both parties								x						
77	Statement of facts of the dispute	x			x		x		x	x					
78	Agreement to remain in action without strike or lock-out until award (Numbers show number of days this promise runs)	x			x		10			21					
79	Agreement to abide by award	x				x			x						
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FOR ADJUSTING LABOR DISPUTES—*Continued*

15 Maryland	16 Massachusetts	17 Michigan	18 Minnesota	19 Missouri	20 Montana	21 Nebraska	22 Nevada	23 New Hampshire	24 New Jersey	25 New York	26 Ohio	27 Oklahoma	28 Oregon	29 Pennsylvania	30 Philippine Is.	31 Porto Rico	32 Rhode Island	33 South Carolina	34 South Dakota	35 Texas	36 Utah	37 Vermont	38 Washington	39 Wisconsin	40 Wyoming	41 United States	Index
	x	x	x		x	x	x	x								x						x	x			x	42
						x												x									43
x	x			x	x						x		x								x	x					44
	x				x			x			x[29]					x					x[29]	x[29]					45
x	x				x											x[30]	x	x	x							x	46
	x																										47
	x	x[31]					x				x		x			x	x	x		x	x					x	48
x			x	x	x	x		x[32]		x				x								x					49
			x[33]		x[33]																						50
			10		x			x																			51
								x															x				52
	x		x				x				x					x					x		x[34]			x	53
	x				x																						54
x		x			x	x		x		x			x									x					55
			x								x[37]					x[38]		x				x[36]		25[39]			56
			x	x[40]																						x[41]	57
x	x							x				x[36]	x						x							x	58
					x													x	x								59
	x							x			x		x											x		x	60
											x											x[36]				x	61
					x								x														62
	x																										63
			x			x				x	x											x				x	64
x	x[33]		x	x	x			x[32]				x						x	x			x		x		x	65
	x					x[43]				x	x		x														66
	x		x		x			x					x									x					67
	x		x	5	x			x			x	x	x					x	x			x		x		x	68
x	x		x	x[44]	x			x			x	x				x		x[45]	x					x			69
	x			x[49]						x[47]	x[50]								x[51]								70
																											71
	25	x[26]	10	x	20[52]	x		10		x	x	25						x			10[53]	10[52]					72
								x			x										x[54]						73
	x	x	x	x	x	x		x		x	x	x[56]						x			x	x					74
						x																					75
	x[57]		x		x						x[57]										x	x[57]					76
	x		x		x	x				x	x											x					77
	21				28	x				x	10											21					78
				x		x				x											x						79
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		Alabama	Alaska	Arkansas	California	Colorado	Connecticut	Georgia	Idaho	Illinois	Indiana	Iowa	Kansas	Louisiana	Maine
	Procedure														
80	Designated body examines or "arbitrates" dispute..														x
81	Proceeds to locality of dispute..................									x					x
82	Holds hearing[60]..								x[61]	x					x[62]
	Award														
83	Number of days within which award must be made after completion of arbitration..................	10													
84	May be made by a majority......................	x							x						
85	To state facts of case and findings relating thereto..	x													
86	Binding to extent of agreement only..............					x									
87	Binding on parties who join in submission.........								x	x					x
88	Number of months award will remain binding.......				6					6					6
89	May be abrogated by the parties by notice (Numbers show number of days' notice is required)..........				60[66]					60					60
90	To be made public............................									x					x
	Disposition of Copies of Award														
91	To be retained in record.........................								x						x
92	One to each party.............................	x													
93	To governor (or other state officials)..............	x							x						
94	To local officials (clerk of local court, mayor, etc.)...								x	x					
	General														
95	Résumé to be published in annual report...........									x					
96	Some methods of enforcement by courts provided...					x			x	x					
	STATUTORY PROVISIONS FOR LOCAL BOARDS														
	Powers[46]														
97	All powers of state body in the particular case before this local board.............................				x										x
98	Exclusive jurisdiction over this dispute, but may ask advice of State Board.........................														
	Jurisdiction														
	Scope														
99	Any industrial dispute (Numbers refer to number of persons who must be involved)..................	x				x[67]					50[68]	10[69]	x[70]		10
100	Where mediation has failed......................		x												
101	Where parties desire local rather than state action...				x										x
	How Obtained														
102	By "submission" by parties.....................		x		x						x		x		
	Submission to Contain														
103	In writing....................................	x									x				
104	Signed.......................................										x				
105	Statements of facts of case......................										x				
106	Agreement not to strike or lockout pending award...	x									x				
107	Agreement to abide by award....................	x													
108	Agreement that award shall be "final"............	x									x[77]				
109	Agreement *re* length of time award shall be in force..	x													
	Procedure														
110	Members take oath............................	x			x							x			
111	Members sign consent to act or "acknowledgment"..	x													
112	Governor calls meeting.........................		x												
113	Board holds hearing...........................		x									x[78]			
114	Gives notice of hearing........................														
115	May adopt own rules of procedure................				x						x		x		
116	Rules prescribed by state body...................					x[81]									
	Decisions														
117	Number of days within which decision must be made.												15[82]		10
118	May be made by a majority......................		x											x	
119	To be in writing...............................	x										x			
120	To be signed..................................	x													
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Maryland	Massachusetts	Michigan	Minnesota	Missouri	Montana	Nebraska	Nevada	New Hampshire	New Jersey	New York	Ohio	Oklahoma	Oregon	Pennsylvania	Philippine Is.	Porto Rico	Rhode Island	South Carolina	South Dakota	Texas	Utah	Vermont	Washington	Wisconsin	Wyoming	United States	Index
	x				x	x		x[58]		x											x						80
	x		x		x																	x[59]					81
	x		x		x						x[58–59–63]											x[62]					82
						5		·7[64]		10																	83
						x															x						84
						x				x																	85
																					x						86
	x			x	x[65]																x						87
	6		6		6			6														6					88
	60		60		60			60														60					89
	x				x	x															x	x					90
					x			x		x											x	x					91
						x				x																	92
						x																					93
	x				x																	x					94
	x				x																x	x					95
	x			x							x																96
	x		x		x						x		x														97
	x				x						x																98
10	25	x[71]	x		x[52]	x	x		x	x	x[72]		50	x		x	x	x		x			x			x[41]	99
x		x											x	x		x							x			x	100
	x	x								x	x		x	x													101
	x	x	x		x	x	x		x		x		x	x		x[73]		x		x				x		x[74]	102
		x	x				x				x			x						x						x	103
		x									x									x						x	104
													x													x	105
							x													x							106
		x	x[75]		x[75]		x[76]				x[75]		x	x						x[76]							107
		x[77]					x													x						x[77]	108
		x					x																			x	109
			x						x	x										x							110
		x				x	x			x										x							111
							x																				112
									x[79]								x			x[80]				x		x	113
									x	x										x							114
		x							x	x										x						x	115
																	x										116
3	10		10		10	10			5		10		10[63]	10													117
							x																				118
						x			x																		119
						x			x																		120
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	Decisions—continued														
121	To contain statement of facts and findings	x													
122	Must be confined to the dispute directly at issue										x			x	
123	To be made public										x	x[49]			
124	Number of months it will remain in force											12	12[85]		
	Copies to:														
125	One to each party	x									x				
126	One to local official (clerk of local court, mayor, etc.)	x									x				x
127	One to governor or state board or other official	x									x	x			x
	Enforcement														
128	Court review provided		x												
129	Courts to enforce decision on petition of injured party		x												
	Expenses (and Salary of Members of Board)														
130	Number of dollars per member per day of actual service	4				10					10	5	2		3
131	Necessary traveling and other expenses of board members to be paid										x	x			
132	To be paid by the parties	x[91]	x												
133	To be paid by the state				x						x	x			
134	To be paid by the local municipality or county												x		
	STATUTORY PROVISIONS AS TO WITNESSES, EXPERT ASSISTANTS, AND REPORTS														
	General Powers														
	State Boards														
	May Subpœna Witnesses														
135	In all cases					x				x					
136	In mediation						x						x	x	
137	In investigation	x					x		x					x	
138	In arbitration	x	x						x						
	May Compel Production of Books and Papers														
139	In all cases					x				x					
140	In mediation						x						x	x	
141	In investigation													x	
142	In arbitration		x												
	Local Boards														
143	May subpœna witnesses										x				
144	May compel production of books and papers										x				
145	Same powers as state body for the particular dispute before it	x			x										
146	Same powers as a court of first instance											x			
	State and Local Boards														
147	May invoke court aid in enforcing above powers[96]		x		x				x	x	x		x		
	Service of Process														
148	By sheriff or other regular official									x		x			
149	By appointee of board	x[98]													
	Subpœnas May Issue from														
150	Any member of the board	x	x				x[99]							x	x
151	Chairman of the board						x								
152	"The board," or not specified					x				x	x	x	x		
	Oaths May Be Administered by														
153	Any member		x			x					x[102]			x	x
154	Chairman								x	x		x			
	Witness Fees														
155	Same as for witnesses in a court of first instance of the state (superior, district, and similar courts)	x										x			x
156	Number of dollars per day attended								2						
157	Expenses of travel to be paid														
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For footnotes, see

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TABLE IV.—STATUTORY PROVISIONS

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160	Local municipality or county														
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161	May be employed on request by parties														
162	May be employed by the board on own motion												x		
163	Expenses paid by the state														
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164	Annual to governor						x						x		x
165	Annual to legislature														
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167	Of each case to legislature	x													
168	To include recommendations for legislation					x[111]	x							x	
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FOOTNOTES TO

[1] Body entitled "Court of Industrial Relations" (Statute of Jan., 1920).
[2] This provision was never complied with by legislation of any sort.
[3] Industrial conciliation only a part of the duties with which this body is charged. (Action charted refers only to this feature.)
[4] In addition to members shown above, the Board includes two farmers, to complete the total of seven members required.
[5] Advice and consent of the Senate not required.
[6] Applies to only two of the three members.
[7] Consent of Senate necessary for removal.
[8] To contain two representatives.
[9] Employer or employee members to be appointed from lists submitted for the purpose.
[10] A neutral member to be the Judge of the District Court, is provided only in cases of arbitration.
[11] The neutral member is to be the State Commissioner of Labor.
[12] One to be from party receiving highest number of votes at last election, one from next highest party, and one from a "bona fide labor organization."
[13] No more than one member to belong to the same political party.
[14] Members, except farmers, must have been engaged in industrial work in the state for at least three years preceding appointment.
[15] Citizenship of Porto Rico and of the United States is required.
[16] Only the "Commissioner of Mediation and Conciliation" gives full time to this work, the other member receiving pay per number of days actually served.
[17] In addition, the State Commissioner of Labor acts as Chairman or Moderator, without a vote.
[18] Two to be selected.
[19] If no agreement is reached, the submission to arbitration is recalled.
[20] No members to be directly connected with case, but some members to have knowledge of the industry in which dispute arises. State Board members or other officials to be members, and if appointment of third member becomes necessary, the Chief of Bureau deputizes some member of his staff for the purpose.
[21] Only true where no agreement is reached on neutral member, in which case the Chief of the Bureau of Mediation, etc., becomes such member and is Chairman.
[22] Applies to local board compensation.
[23] Only disputes regarding wages, hours, and conditions of employment.
[24] "Whenever practicable."
[25] If thought desirable, Board *may* act even though specified number is not involved.
[26] Only disputes in specified industries.
[27] Only disputes regarding conditions of labor.
[28] Only disputes regarding wages, hours, and conditions of employment on interstate carriers engaged in interstate commerce.
[29] Local governmental officials or labor officials given duty to notify Board of disputes within their territory.
[30] Mediation usually only on application, but may act on own motion *re* public service corporations in disputes with their employees.
[31] During mediation neither party to use time so gained for advantage over the other.
[32] Action to be by the State Commissioner of Labor.
[33] Public notice of hearing or not, at discretion of Board, where parties desire private hearing.
[34] If parties refuse to submit dispute to arbitration, State Labor Commissioner requests a sworn statement of the reasons for such refusal, making this public.
[35] In specified industries, or by agreement, in other industries.
[36] If governor thinks public welfare is threatened. (In Oklahoma, if *Board* thinks public is likely to suffer injury.)

FOR ADJUSTING LABOR DISPUTES—*Continued*

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STATUTORY PROVISIONS

37 Any dispute not subject to any action before a state court.

38 Where a submission to a local board of arbitration has been unsuccessful.

39 Only disputes regarding wages.

40 Where stoppage is imminent, parties given duty to submit to investigation.

41 Only disputes on interstate carriers engaged in interstate commerce.

42 Notice of hearing specifically called for.

43 If governor and a majority of board deem an investigation advisable.

44 Report, but to governor instead of to public.

45 Findings of fact reported to governor unless majority of board deem this unwise.

46 See section under "Witnesses" for further powers of investigating bodies.

47 Same powers as a board of arbitration.

48 Board may have assistance of attorney-general or other officials.

49 Decision, binding on parties who join therein. (In Missouri, binding unless exceptions are filed within five days.)

50 Same powers as a court to enforce orders at hearings.

51 State Industrial Commissioner, if he so desires, or if requested by either party, may call in two disinterested citizens to assist in the investigation.

52 Where dispute is not suable in state courts.

53 Commission requests parties to forward applications for arbitration to it.

54 If work has ceased, Commission not to act until it is resumed.

55 The vagueness of many statutes makes accurate classification difficult. The arbitration section records nothing not specified in the statute, but this does not mean that points not specified are excluded. Thus, only six states in so many words require submission to be in writing, but it is submitted that in the other cases this is implicit in the statute, especially where submission is required to be signed.

56 On information of dispute, Board itself tries to get case submitted to it.

57 Names of employee signatories to be kept secret.

58 Pending award, parties to remain in statu quo.

59 If either party fails to perform promises, Board ceases operations until other party in writing agrees to a resumption.

60 Mandatory public notice of hearing. Discretionary when parties request no hearing.

61 Additional persons to be added to Board for this duty. No provision for non-public hearing. Meetings to be open to public. Record to be kept.

62 Inquiry may be carried beyond state lines.

63 May enforce orders at hearings with same powers as a Court of Common Pleas.

64 If dispute is *re* wages, decision reverts back to date on which employees presented written demand on employer.

65 Decision to be "final and binding."

66 May also be abrogated by agreement of parties, or otherwise, as provided in submission.

67 Whenever the State Industrial Commission considers it expedient.

68 Action by governor, on own motion, or on application, whenever an interruption of industry "would be to the detriment of the public interest." Board first offers mediation, then requests submission to arbitration, and, if unsuccessful in this, investigates. Secretary of State acts as secretary and keeps records.

69 Disputes *not* in interstate commerce which threaten public welfare, where the parties, or officials, petition governor to appoint a board.

70 The local board act applies chiefly to mechanical and mining industries.

71 In the industries specified in the statute.

72 Under the Consolidation Act of 1913, the State Industrial Commission may appoint local boards at a compensation of $5 per day. These may establish their own rules of procedure, hold hearings and publish reports. Deputies of the Commission may serve thereon, but without the extra compensation.

FOOTNOTES—*Continued*

[73] Submission to be "required" by the Commission in cases where disputes threaten an interruption of industry "with detriment to the public interests."

[74] "Railway Boards of Labor Adjustment" may also act on own motion, or on request of the National Railway Labor Board, as well as on application by the parties.

[75] Inferred, as decisions are to have such binding effect as had been agreed upon in the submission.

[76] Agreement that award may be specifically enforced in equity, and to remain in force for one year, no new arbitration to be asked on same dispute during said year, unless award be set aside by mode specified.

[77] To stipulate how future disputes arising out of this award may be settled. Board may be reconvened for this purpose.

[78] Evidence not restricted to technical, legal evidence. Board may enforce its writs the same as a District Court. May hold hearing outside of state with governor's permission.

[79] Attorneys or other agents of the parties may *not* appear before the Board.

[80] Hearing to be within ten days of appointment of board. Pending award there are to be no discharges save for certain stated causes, and no strikes, or advice leading toward strikes.

[81] Decision may become an order of State Industrial Commission when approved by it.

[82] Status quo to be kept for at least ten days by the parties pending award.

[83] Extension of ten more days may be granted by the State Board.

[84] If similar disputes are going on, the parties may submit them to this board for arbitration.

[85] Award of either Board or Umpire may be impeached for fraud, accident, or mistake. If award is for money, it may be made of record by filing with the District Court.

[86] Thirty days' notice of abrogation necessary.

[87] To the Board of Mediation and Conciliation.

[88] No more than ten days to be paid for in any one arbitration. In Oregon, twenty days.

[89] Fees and expenses "as fixed by the State Board." Probably paid by the state.

[90] As fixed by the Board of Mediation and Conciliation.

[91] If the dispute was voluntarily submitted, the expenses are to be paid by the parties, otherwise by the state.

[92] Members authorized to receive expenses, but no further compensation.

[93] Parties to give a bond conditioned upon the payment of all expenses connected with the arbitration.

[94] May summon any employee who keeps a record of wages.

[95] Board may summon any operative, or any person who keeps a record of wages in the department of the business in which the dispute arose.

[96] Although it is not stipulated in all states that court aid may be secured in enforcing the power of summoning witnesses, etc., it is submitted that the power carries with it the possibility of this being enforced.

[97] Fee the same as for similar services for courts of first instance to be paid by the local municipality or county in which the dispute exists.

[98] To receive the same fees as are provided for witnesses.

[99] Subpœnas issue from the Chairman or Clerk in cases of investigation, and from "the Board" in cases of arbitration.

[100] May issue from secretary.

[101] Any Justice of the Peace or clerk of a court of record will issue subpœnas for this board.

[102] All testimony to be on oath or affirmation.

[103] May be administered by clerk or deputy.

[104] Same, as in State Supreme Judicial Court.

[105] 25 cents for each hour in attendance in excess of two hours, and 5 cents per mile each way for necessary travel.

[106] 50 cents for attendance, and 25 cents for each hour above two, and 5 cents per mile traveling expenses each way (for witnesses before State Board only).

[107] Fees to be paid by the parties where the case was voluntarily submitted (otherwise by the State).

[108] An accountant may be employed to examine books and papers for Board. To be sworn.

[109] Not stated to whom, but inference is clear that it is to governor.

[110] Unless the Board deems it undesirable to make such report. Also reports on each case to governor.

[11] Reports on occasion only

CHAPTER XIV

INDUSTRIAL ACCIDENTS

By Sidney J. Williams

The Cost of Accidents.—Accidents contribute to industrial waste in three ways:

1. The loss of productive labor on the part of workmen who are killed or injured, together with the cost of medical and surgical attention and the overhead cost in connection with the payment of claims.

2. The indirect loss of production due to the stoppage or slowing up of work when an accident occurs. This applies not only to the operation at which the man is injured, but also to other operations dependent thereon. It applies also to "near-accidents" in which no personal injury occurs.

3. The injurious effect of frequent accidents on the morale of workers. Conversely, it may be noted, successful accident prevention work leads to improvement in labor relations.

Direct Cost of Accidents.—In 1919 there occurred, in all the industries of the United States, about 23,000 fatal accidents; about 575,000 non-fatal accidents causing four weeks or more disability; about 3,000,000 accidents in all causing at least one day's disability.[1] The figures for 1918 were about 13% higher.

The time lost as a result of these accidents may be computed as follows:

	Days
Actual time lost in 2,977,000 non-fatal accidents	50,000,000
Loss of future earning power as result of complete or partial permanent disability resulting from 115,000 accidents included in above, equivalent to	108,000,000
Loss of earning power resulting from 23,000 fatal accidents equivalent to [2].	138,000,000
Total	296,000,000

[1] Estimate of F. S. Crum, Assistant Statistician, Prudential Life Insurance Company, based on all available statistics.

[2] The equivalents here used are those agreed upon by the statisticians of the Federal and State Labor Departments and Industrial Commissions. The equivalent for death or permanent total disability is 6,000 days, based on a twenty-year expectancy of working life for the average workman accidentally killed or injured. Smaller equivalents are used for the loss of an arm, hand, finger, etc.

If we may assume an average wage of $4 per calendar day ($28 per week) the above time lost represents a wage loss of $1,184,000,000. From this we may subtract the actual cost of subsistence of the men killed,[1] which may be placed at approximately 60% of their wages, or about $331,000,000. This leaves a net economic loss to the country of about $853,000,000 for the year 1919.

A part of this loss is borne by the employer in the form of payments under workmen's compensation laws, made either direct to the workman or in the form of insurance premiums. The remainder is borne by the workman himself, and his dependents.

In addition to compensation actually paid to the workman, the employer pays for medical and surgical aid and hospital bills, and also, except where he is self-insured, he bears the various administrative and overhead expenses of the insurance companies. In one state—Wisconsin—these costs other than compensation amounted to 86% of the actual compensation paid to workmen; while the actual compensation amounted to about 22% of the total actual and prospective wage loss. Such data as are available from other states, and from insurance companies operating nationally, indicate that the Wisconsin figures are approximately typical. If this is the case, then the total direct cost of industrial accidents in the United States in 1919, including medical aid and insurance overhead, was not less than $1,014,000,000, of which $349,000,000 was borne by employers and $665,000,000 by employees and their dependents. These approximate figures are still short of the mark because they do not include such items as medical expenses incurred by workmen and not paid by the employer or insurance company; overhead cost of personal accident insurance carried by workmen; cost of training new men to take the place of those injured; employment department and welfare department expense in keeping track of injured workmen and their families.

Experience indicates, and authorities agree, that 75% of this loss could be avoided. This would mean a saving of a quarter of a billion dollars yearly to employers, and a saving of half a billion dollars yearly to employees.

Results Accomplished in Accident Prevention.—The best measure of accident cost in and to an industrial concern is the "severity rate" or number of days lost per thousand hours worked, using for fatalities and permanent disabilities the equivalents already employed above. This is a more exact measure than the compensation cost, because the latter varies with changing rates of wages and changes in compensation laws. The records necessary to compute severity rates, however, are often not available, especially for earlier years, even in many companies which have done very successful and profitable safety work. The following

[1] For a period of twenty years, as above.

table shows the records of a few companies in reducing their "severity rate," typical of those for which exact figures are available.

PER CENT REDUCTION IN ACCIDENT

Company	Severity Rate (Days lost per 10000 hours worked)	Two Years Compared		Average Number Employees
Raritan Copper Works......	81%	1912	1920	900
E.I. du Pont de Nemours Co.	77%	1910	1919	17,000
T. H. Symington Company..	87%	1919	1920	500
The Federal Rubber Co.....	62%	1918	1920	1,700
Bethlehem Steel Company (Bethlehem Plant)........	65%	1919	1920	13,000
Halcomb Steel Co..........	77%	1916	1918	1,400
Four Wheel Drive Auto Co..	83%	1917	1918	1,300
Oliver Iron Mining Co......	73%	1919	1920	2,400

The above records are the more remarkable when it is considered that in several cases—for example, the Bethlehem Steel Company—considerable progress had been made in accident prevention before the period covered by the table. If accurate records for the years preceding the inauguration of safety work were available, the total reduction would frequently be found to exceed 90%.

Doubtless many other companies which have spent considerable money on safety work have secured less favorable results. Such companies are naturally less likely to publish their figures. In most, if not all of such instances, for one reason or another proper methods have not been used. Authorities agree that it is possible, by using the methods already worked out, to reduce deaths and serious accidents—and therefore to reduce accident cost—in American industry by at least 75%.

The cost of carrying on successful safety campaigns has been a small fraction of the saving made. Thus the United States Steel Corporation has stated that its safety work has yielded a net profit to the company of more than one billion dollars per year. Similarly, a coal mine employing about one hundred men reports a decrease of 68% in accident cost per ton of coal, even when the cost of the safety department is included with the actual compensation and medical expense during the later period.

The methods used in securing these results are similar in all industries. They represent a combination of two factors: on the one hand, mechanical and engineering improvements, ranging from a simple gear guard up to the complete redesign of processes and equipment; and on the other hand a definite system of education and supervision not only of workmen but of foremen and superintendents. Experience has shown, not only that the combination of these two factors is necessary for complete success, but further that each increases the value of the other. Improvements in equipment and methods have made it possible to obtain a readier response to educational efforts among workmen and foremen; while the educational and supervisory work has led to the invention of safer and better equipment and methods, and the more willing use of the improved equipment which had been provided. An outline of the principal essentials of organized accident prevention work is given elsewhere in this chapter.

Indirect Cost of Accidents—Benefits from Prevention.—The total economic cost of accidents is not limited to the direct cost already discussed. A description of two typical instances will illustrate what is meant and will pave the way for a general analysis.

In a plant manufacturing aluminum canteens for the War Department, each half of the canteen was formed on a stamping press. Several operators lost one or more fingers at this work. A state inspector, calling to investigate, found that these accidents occurred when the operator reached in to free a piece which had stuck in the die. As a remedy he suggested a foot-operated kick-out. The War Department representative protested against this change on the ground that the canteens were urgently needed and their production must not be interrupted. Finally the press was shut down and the kick-out installed. To the surprise of every one, within a couple of days the output of canteens had caught up with production schedule and thereafter the daily production was approximately doubled as a result of installing the kick-out.

Another company, manufacturing metal beds, had a bad accident record in its punch press department. A safety engineer was employed. He found that the accidents occurred because the operators had to put their hands under the die, in placing and removing material. To remedy this he introduced a variety of semi-automatic feeds, most of them simple home-made affairs, with which the operator fed the material into a trough instead of placing it directly in the press. These changes immediately brought about, not only a practical elimination of serious accidents, but also an increase in production, ranging from 10 to more than 100%.

What caused these large increases in output? The accidents occurred because the operator placed his hand in the press, either in the normal operation of placing or removing material or in the supposedly exceptional instances where the material stuck and had to be pried loose. In a very small fraction of these cases, either the operator inadvertently tripped the press or something went wrong in the clutch; the plunger descended and injured his hand. While personal injury occurred in only a few instances, *every* time the operator put his hand into the press, time was lost—sometimes a fraction of a second, sometimes more. When the operation was changed so that the man had no need to put his hand in the press, these time losses were saved—a larger economic gain than the elimination of the few personal injuries.

Another factor in the increase of output was doubtless the elimination of fear or nervousness. An operator who knows that a false move may cost him a finger—especially if he has seen another man injured at the same operation—is likely to be cautious and slow in his movements. If he has to reach into the press, he may take his foot off the treadle in order to avoid the possibility of tripping. In various ways he may lose more time than is required by the additional motion of reaching into the press. Again, consider a truck load of material being pushed through a shop by a workman. A piece of material falls off the truck and injures the workman's foot. We call this an accident and we know that it results in an economic loss. But there are many other times—perhaps a hundred or more—when a piece falls off the truck but does not happen to fall on the workman's foot. Every time this happens, there is more or less damage to the material, its container, or the floor; the workman must stop and pick up the piece—perhaps he must call some one else to come and help him; other truckers behind him are forced to wait; the machine operator who is to use the material may also be delayed. The foreman or safety inspector who investigates the occasional personal injury may find that it was caused by a hole in the floor, by too restricted a passageway, by poor lighting, by an improperly designed truck, or any of several other causes. When this defect is remedied it saves not only the occasional injury but the much more frequent loss of time. From the economic standpoint, the injury is chiefly important not because of its own direct cost but because it attracts attention to a condition of inefficiency which in the aggregate is even more costly.

Accident Prevention as Stimulus to Efficiency.—These instances lead to a general analysis. What is an accident? One dictionary definition is "anything occurring unexpectedly." In this broad sense, the material sticking in the punch press, the belt breaking, the casting falling off the truck, the railroad train jumping the track, is an accident, whether any person happens to be injured or not. Against this idea, place the idea which is the spirit and aim of all large scale production—to determine the "one best way" of doing things, and always to do each thing in that one way. Obviously, these two ideas are in direct opposition. All accidents in the broad sense—all things occurring unexpectedly—are hindrances to efficiency, whether any one happens to be injured or not. The occasional accident in which some one is injured therefore has a significance beyond its own cost—it serves as a symptom of many other "accidents" in which no one was injured but through which time was lost and production curtailed.

If accidents hinder efficiency, it is equally true that efficiency hinders accidents. In a perfectly efficient plant, nothing would ever happen unexpectedly and there could be no accidental injuries. The fact is, however, that few if any plants are perfectly efficient. The two punch press departments mentioned above were in factories whose general management and whose profits were well above the average. Particular attention had been given to increasing production efficiency. Nevertheless, the constant loss of time due to the lack of a kick-out in the one case and of chute feeds in the other case passed unnoticed until attention was attracted by the injury of operators, and a remedy was suggested by a safety inspector or engineer. As long as executives and engineers, like other men, are imperfect, any new impetus to higher production efficiency—any new assistance in securing the higher efficiency—is a good thing. Therefore accident prevention work is economically desirable as an aid to efficiency as well as for its direct saving of money.

This is particularly true because safety work has a human as well as a production appeal. Most executives as well as most workmen are instinctively more sympathetic to a suggestion designed to prevent human injury than to those designed merely to improve mechanical efficiency. Perhaps this explains why in the instances above quoted, as in many others, changes have been made to prevent accidents and have incidentally increased production, where no one had thought of making the same changes for production purposes only.

It is impossible to make even an approximate estimate of the amount of money which has been saved or may be saved by increasing production through accident prevention work. In the specific instances noted, punch press production was increased 10 to 100%. In general, the limit of this saving is nothing less than the total saving which might be made through the elimination of all stoppages or interruptions in production. Whatever this possible saving may be—and we know that it is tremendous—organized accident prevention work will be of material assistance in bringing it about.

Accident Prevention and Better Industrial Relations.—Industrial waste arises, not only from imperfect physical equipment and methods, but also from imperfect relations between management and men. In improving the latter, as well as the former, safety work plays an important part.

Accidents have a certain effect on labor turnover. When a man is injured, another must be put in his place. This, however, is not the only way in which accidents affect labor turnover. Frequent accidents affect the worker's feeling toward the management; they make him less productive in his work and more ready to quit on slight provocation. On the other hand, in a shop or other place of employment where attention is given to accident prevention, the feeling of the workman is very different—partly because he appreciates having a safe place in which to work, but still more because of the co-operative methods used in making the place safe.

The recognized basis of safety work as successfully practiced in this country to-day is co-operation between management and men. We have already pointed out that successful safety work is a combination of engineering and education. To get results from any educational work requires the good-will and preferably the co-operation of those to be educated.

Very few accidents are due to mechanical causes alone. In most instances the human element enters, often to a controlling degree. In the average plant, the fullest possible provision of mechanical guards—for gears, belts, circular saws, and the like—will not prevent more than 5 to 10% of the accidents. Attention to some of the less obvious engineering factors—lighting, internal transportation system, and the redesign of equipment and processes which are inherently hazardous—will prevent many more accidents. There will still remain, however, a large percentage which can be prevented only by greater caution on the part of the workmen and of the supervisory force. This can be secured only by organization and education which lead the workman to realize that in this matter his interests and the interests of the employer are identical, that the only way they can prevent accidents is by working together, and that the result of their joint efforts will be of benefit to both.

Here arises the great contribution of safety to the betterment of industrial relations. When workmen find that it is both possible and profitable to co-operate with the management in preventing accidents, they begin to see that it may be possible and profitable to co-operate in other respects as well. Many industrial executives testify that this is the case. One of them said two years ago, "I believe that accident prevention during the past ten years has offered the first common ground on which employer and employee can meet with mutual understanding of each other's motives, and with profit to both." The workmen's safety committees later described in this report, and first organized a dozen years ago, were forerunners of the general shop committees and the employee representation plans now in use. Good-will and co-operation with respect to safety —which is a non-controversial subject as between employer and employee —lead to good-will and co-operation in other more delicate problems of shop management, such as hours of work and wages.

Conversely, improved industrial relations tend to reduce accidents. Records show that green men are about five times as likely to be hurt as experienced men; therefore any reduction in labor turnover is an aid to safety. The same is true of any industrial relations or betterment work which improves the worker's state of mind or his health, because mental and physical disturbances have been found to be large contributory factors in producing accidents. As with mechanical efficiency, so with employee relations—improvement in both of these goes hand in hand with improvement in safety, each influence reacting beneficially upon the other.

Essentials of Successful Safety Work.—1. *The Management.*—An efficient safety organization starts at the top. First, the manager must do his part, and his part is to "put safety on the map." He must make it a necessary part of the process of production, get back of it so actively that every foreman and workman will know just what the company proposes to do to help make the plant safe. He must convince his men by visible signs, in the form of mechanical guards, good lighting, etc., that he is doing his full part, before he can expect his men to take safety seriously or give any genuine co-operation. He must bring his superintendents and foremen to believe in safety and to give it their whole-hearted and intelligent co-operation.

2. *The Safety Engineer.*—One man should be made responsible for the safety work in every plant, regardless of its size. His duties and qualifications will determine whether he should be called the safety engineer, safety director, safety inspector, or by some other equally significant title. For brevity he is here referred to as the safety engineer. In small plants he need not devote his entire time to accident prevention, but under no circumstances should this responsibility be given as a sideline to an already overworked individual.

The safety engineer should be given opportuntites to acquaint himself, by reading and by personal contact, with the methods employed by other safety engineers who have done effective accident prevention work. The following will suggest a few of the duties of a safety engineer:

1. Check up unsafe practices, insanitary conditions, the use and need of safeguards, etc.
2. Keep in touch with foremen and secure their co-operation by serving them.
3. Recommend methods of safeguarding and follow up installations.
4. Check all specifications and drawings for new equipment or repairs to see that provision is made for safety.
5. Supervise bulletin board service.
6. Supervise safety educational activities.
7. Arrange programs for safety meetings.
8. Investigate all serious accidents and near-accidents.

3. *Central Safety Committee.*—In large plants the safety organization should be headed by a central safety committee to which all important matters should be referred for decision. In some cases the plant "staff," if it meets regularly, may make unnecessary the formation of a central

safety committee. The central safety committee should include the superintendent as chairman, the safety engineer as secretary, and four or five other men occupying responsible positions, such as chief engineer, master mechanic, employment manager, purchasing agent, and department superintendents.

An effective central safety committee will relieve the manager of many details, and, by making thorough investigations of all important problems, will enable the manager to make quick decisions in promoting safety work. This committee should have authority to:

1. Pass on controversial matters.
2. Establish standards for safeguards.
3. Review reports and recommendations of safety engineer, foremen, and workmen.
4. Formulate safety rules.
5. Outline educational methods and direct safety campaigns.
6. Study accident experience tabulated by safety engineer.

4. *Foremen and Sub-Foremen.*—The attitude of the workman toward safety depends to a great extent upon the attitude of the foreman. Discipline has a place in safety work, but in the long run a foreman must lead his men into safe habits, not drive them. Foremen should:

1. Instruct their men, especially new men.
2. Enforce safety rules with wise discipline.
3. See that tools and machines are kept in proper repair and adjustment.
4. Inspect their departments and render weekly reports.
5. Investigate accidents and near-accidents and recommend methods of prevention.
6. Keep closely in touch with and encourage the workmen's safety committees.

5. *Foremen's Safety Meetings.*—In small plants where there are only one or two foremen, these men are often considered part of the plant staff, and thus participate in the meetings of the central safety committee. In larger plants, where the central safety committee does not include all of the foremen, special safety meetings for foremen and sub-foremen should be held at least once each month, to consider reports of inspection committees, new recommendations, progress on approved recommendations, accident experience, etc.

6. *Foremen's Inspection Committee.*—In plants having more than 500 employees it is advisable for the purpose of standardizing safety work to appoint a foremen's inspection committee, consisting of at least five foremen selected from different departments. The membership should be changed at regular intervals. This committee should make one general inspection of the plant at least every three months—once a month is preferable. Each report of this committee should be submitted at the foremen's meeting.

7. *Safety Mass Meeting for all Employees.*—As soon as possible after the first foremen's safety meeting, the manager should call a general meeting of all employees for the purpose of explaining to them the entire plan and securing their co-operation.

8. *Workmen's Safety Committee.*—Give a workman some active part in safety work, some recognition, some responsibility—and you will secure his interest. This has been the experience of all companies which have properly organized workmen's safety committees. The one indispensable thing is that the foremen shall believe in the committee idea and constantly encourage the men in their work. When the workmen are given full opportunity to ascertain just how men are being injured in their departments, they find out for themselves what a small percentage of the accidents can be prevented by mechanical guards and what a large percentage are due to unsafe practices. The duties of the workmen's safety committees are:

1. To make regular inspections for unsafe conditions and practices, and submit to the foreman a written report of findings.
2. To instruct and warn fellow workmen regarding dangerous practices.
3. To investigate all serious accidents and near-accidents and submit reports and recommendations.

9. *Safety Bulletin Boards.*—Bulletins giving pictures and stories which drive home what the workman can do to protect himself, have come to be recognized as one of the most effective means of reaching the men. Bulletin boards should be placed at convenient points in each department.

The secret of a live bulletin board is constant change—always something new, something striking. In addition to the National Safety Council safety bulletins, home-made bulletins should be used covering accidents or near-accidents which have actually occurred in the plant, together with interesting exhibits, such as goggles which prevent eye injuries.

The foregoing outline of the essentials of successful accident prevention work is recommended by the National Safety Council of Chicago, based on the experience of its 4,000 member companies, including the companies whose accomplishments in accident reduction have been previously noted.

Relations of Safety Department to Other Departments.—Preceding sections have indicated that to be successful, accident prevention work must be closely tied in with the production and engineering departments on the one hand and with the personnel or industrial relations department on the other. In the latter are included the employment department and the medical or health department. Co-operation with the medical department is necessary in the treatment of injuries and in the return of injured men to work at the proper time and under proper conditions;

also with respect to the physical examination of new employees. Inspections for safety and for sanitation are also closely allied and in many plants are carried out by the same men.

Between the employment department and the safety department the most important point of contact is the instruction of new men. As new men are especially susceptible to injury, an important feature of every safety program is the instruction of the new man in the safe way of doing his work. This should be carried out in connection with any general instruction that is given to new employees.

The teaching of English to workmen is also closely associated with safety. Non-English-speaking workmen are particularly liable to injury because often they do not really understand how to do their work and do not understand the instructions of their foremen. Teaching these men to speak English reduces the accident rate. On the other hand, written or oral lessons on how to avoid injury are often used as material in teaching English.

While some companies place safety work directly under the production department, the majority make it one of the division of the personnel department. The safety department then acts in an advisory or consulting capacity toward the production and engineering departments. This arrangement is desirable because it has been found that in order to prevent accidents, responsibility must be placed squarely upon the production executives, from the manager down to the foreman, for these are the only men who can really bring about the proper maintenance of physical conditions in the plant and proper supervision of employees.

SIDNEY J. WILLIAMS.

CHAPTER XV

HEALTH OF INDUSTRIAL WORKERS

By Eugene Lyman Fisk, M.D., Assisted by C. T. Sharpe, M.D.[1]

FOREWORD

"It is becoming realized more and more that health rather than material wealth is a people's greatest asset, as upon its health, its sanity, and its vigour depend its progress, its prosperity, and its destiny. Indeed, health and not wealth is the basis of a people's ambitions, aspirations, and achievements." [2]

This investigation was undertaken for the purpose of ascertaining the degree of waste arising in industry from ill health and physical insufficiencies. It soon became apparent that to restrict the investigation or the discussion of this problem to a particular class of workers would be an unwise limitation of the investigation and would not lead to a sufficiently broad treatment of the fundamental problems involved.

The word "industry" is used throughout industrial literature in a rather vague and indeterminate sense. For some it connotes mechanical factory labor; for others, all gainful occupations.

A continual restriction of the term "industrial worker" to mechanical factory labor operates in our judgment to erect an unnecessary and formal barrier between capital and labor. It lends support to the notion that fundamentally different types of human beings are engaged in these subdivisions of human activity. It is desirable to recognize that from the President of the United States to the laborer in the factory or on the farm, all citizens not physically incapacitated are, or should be, workers. The fundamental needs and responsibilities of all citizens as to the maintenance or upbuilding of health are similar, and we cannot properly solve the health problems of the factory worker unless we consider him as one of the great army of the gainfully employed rather than a specialized unit in a division of that army. An investigation of this type should include in its scope an inquiry into the root causes of human insufficiency, of human failure and unhappiness. Any progress made in the solution of these supreme human problems will likewise solve the problems of the factory worker.

[1] Research Assistants, Mabel Webster Brown, Jane Olcott Walters, Nellie Dunn MacKenzie.

[2] Armstrong-Jones, Robert. A Review of Dementia Praecox Studies. Science Progress, London, July, 1920, v. 15, pp. 155–59.

Perhaps the thought we have in mind may be more clearly conveyed by considering actual conditions in a large automobile factory. Under the roof of such an establishment, which is certainly regarded as being included in industry, we find under modern conditions engineers, chemists, physicians, lawyers, even literary men—publicity men—technical experts of various kinds, mechanics and ordinary laborers. There is no sharp line of demarcation here between the industrial worker in the restricted sense, the commercial worker and the executive. We believe it will lead to a solution of all these problems, whether of health, organization, productivity or social progress, if these discussions of human needs include the entire group, rather than sharply differentiating one group from another. The health of the chief executive and his aids may have a profound influence on the situation of the entire group.

In considering this problem, however, it is well to have before us a picture of the working population. This we may readily derive from a consideration of the following analysis of gainfully employed individuals in the United States, based upon census records and an assumed increase in population for 1921, which brings the total for these classes up to 42,000,000 grouped as follows:

Farm laborers	7,762,000
Farmers	6,846,000
Proprietors and officials	3,150,000
Professional	2,268,000
Lower salaried	2,646,000
Servants	1,722,000
Industrial wage earners	16,044,000
Unclassified	2,520,000

It should be borne in mind, therefore, that throughout this report on health where the terms "working classes," "those gainfully employed," "industrial workers," "wage-earning population," or similar expressions are used in the discussion of health in industry, reference is made to all gainfully employed persons, unless otherwise specified.

APPROACH TO THE PROBLEM

Direction of Evolution in Man.—No satisfactory solution of the problems relating to the influence of impaired health conditions on the productivity and adjustment to labor of the industrial workers may be expected until there is first attained a good working knowledge of the type of organism that is under consideration, i. e., civilized man. What is man's physical equipment as a machine and how near to perfection, or rather how far from perfection, is he on the average? Is he naturally tending toward physical perfection by a process of evolution and can he be left gradually to move toward that goal, or must he employ his intelligence not only for individual protection and advancement but for the improvement of his race?

Leading biologists assure us that there is no evidence that the physical type of existing races has improved during the historical period of about one hundred centuries and there is considerable evidence to show that man has so eased his struggle for existence as to halt the progress of natural evolution.[1]

The actual physical records would in fact suggest that the present favorable general death rate (12.9 per 1,000 in 1919, United States Registration Area) is due rather to a mitigation of the struggle for existence and a protection of the community from communicable disease than an actual upbuilding of the physique and underlying resistance of the people. There is real danger in drawing a too sweeping conclusion from the evidence supplied by general death rates as to the physical advancement of the race.

Partial pre-war studies,[2] such as have been made by the Life Exten-

[1] Conklin, Edwin Grant. The Direction of Human Evolution. New York; Scribner, 1921.

Osborn, Henry Fairfield. Men of the Old Stone Age. New York; Scribner, 1915.

Grant, Madison. The Passing of the Great Race. New York; Scribner, 1916.

Tyler, John M. The New Stone Age of Northern Europe. New York; Scribner, 1920.

Metchnikoff, Elie. The Nature of Man. New York; Putnam 1910.

—— The Prolongation of Life. New York; Putnam, 1910.

[2] Fisk, Eugene Lyman. The Possible Functions of the Life Insurance Company in the Conservation of Health. Address delivered before the Section on Social and Economic Science, American Association for the Advancement of Science, Cleveland, O., January 3, 1913.

—— Some Results of Periodic Health Examinations. Address delivered before the American Association for the Advancement of Science, December, 1914. Popular Science Monthly, v. 86, pp. 324–330.

—— Periodic Physical Examination of Employees: Its Economic and Social Value. Address delivered before the National Association of Manufacturers, New York City, May 26, 1915..

—— Findings of the Life Extension Institute in Physical Examinations of Industrial Workers. Address delivered before the Annual Meeting of the American Public Health Association, Rochester, N. Y., September 8, 1915.

—— Increasing Mortality in the United States from Diseases of the Heart, Blood Vessels and Kidneys. Address before the Philadelphia Pathological Society, October 14, 1915. New York Medical Journal, January 15, 1916, v. 103, No. 3, pp. 97–106.

—— Influence of the War on our Health Ideals. Address before the Eastern Association School, Silver Bay on Lake George, 1917. Physical Training, October, 1917, v. XIV, No. 10, October, 1917, pp. 443–454.

Schereschewsky, J. W. Studies in Vocational Diseases—The Health of Garment Workers, United States Public Health Bulletin No. 71. Washington; Government Printing Office, 1915.

sion Institute, by Schereschewsky, Mock, Clark, Britton, Farnum and others in the physical examination of workers in all walks of life, and also life insurance records, revealed the probability of what was actually found by the warring nations in the physical sifting of their populations. Man is far below a reasonable standard of animal excellence.[1] His period of full vigor and physical freedom is brief compared to his life cycle and to what might easily be attained by better breeding, better physical training, more intelligent care of his body and more rational adjustment to his work. The following chart [2] illustrates this thesis:

Clark, W. I. Medical Supervision of Factory Employees. Journal of the American Medical Association, February 15, 1913, v. LX, No. 7, pp. 508–510.

Mock, H. E. An Efficient System of Medical Examination of Employees. Address at the Tenth Annual Meeting of the National Association for the Study and Prevention of Tuberculosis, Washington, D. C., May 7–8, 1914. Transactions, pp. 39–46.

Britton, J. A. The Relation of Medical Examinations of Employees to the Hygiene of the Working Place and the Efficiency of the Working Force. Address at the Tenth Annual Meeting of the National Association for the Study and Prevention of Tuberculosis, Washington, D. C., May 7–8, 1914. Transactions, pp. 47–50.

Rector, F. L. Physical Examination of Industrial Workers. Journal of the American Medical Association, December 18, 1920, v. 75, pp. 1739–1741. Reprint, p. 2.

Schereschewsky, J. W. Medical Examination of Employees as a part of Industrial Insurance. Address at the Tenth Annual Meeting of the National Association for the Study and Prevention of Tuberculosis, Washington, D. C., May 7–8, 1914. Transactions, pp. 51–54.

Sachs, T. B. The Campaign in Chicago for Medical Examinations of Employees. Address at the Tenth Annual Meeting of the National Association for the Study and Prevention of Tuberculosis, Washington, D. C., May 7–8, 1914. Transactions, pp. 35–38.

Farnum, C. G. The Scope of Medical and Surgical Supervision. Read at a meeting of the American Association of Industrial Physicians and Surgeons, Detroit Michigan, June 12, 1916, Proceedings. pp. 19–23.

—— The Relationship of Impaired Physical Condition to Accidents. Read before the Section on Industrial Hygiene of the American Public Health Association, 43d Annual Meeting, Rochester, N. Y., September 9, 1915.

Harris, L. I. and L. I. Dublin. The Health of Food Handlers. A co-operative Study by the Department of Health, the Metropolitan Life Insurance Company and the American Museum of Safety. Monograph Series No. 17 of the Department of Health of the City of New York, August, 1917.

[1] Great. Britain—Inter-Departmental Committee. Report on Physical Deterioration, 1904.

Great Britain.—Physical Training Commission. Report on Scotland, 1904.

Great Britain.—Ministry of National Service. Report v. 1, 1917–1919, upon the Physical Examination of Men of Military Age by National Service Medical Boards from November 1, 1917–October 31, 1918. London; His Majesty's Stationery Office, 1920, p. 6–23, 66, 75, 85.

[2] U. S.—Bureau of the Census. United States Life Tables, 1910. Washington; Government Printing Office, 1916. p. 18-19.

American Experience Table of Mortality.

The length of the period or "spans" of mature life—after adolescence—varies greatly according to the aspect from which it is viewed. The four following "spans" have been generally distinguished:

The Health Span, or period of physical freedom and full vigor after maturity; ages 18 to 31.
The Work Span, or period when men can compete in industry on a fair basis of equality; ages 20 to 42.
The Military Span, or ages at which men are eligible for active military service; ages 18 to 42.
(Britain raised the age to 50 late in the war but accepted very few at that age.)
The Biblical or Traditional Life Span, extending to age 70.

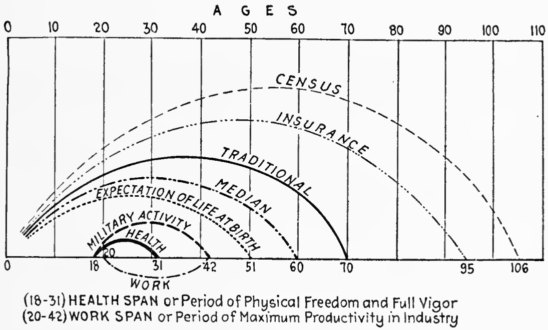

FIG. 1.

The median age at death is 60, according to the United States Life Table, 1910. (This is the age at which one-half of a group of even age will be dead.) The most appalling feature of this evidence is the brief duration of the Health Span and Work Span compared to the Life Span. Insurance tables end at 95—Census Life Table at 106.

During the period of active, vigorous industrial life, ages 20 to 40, the death rate rises in the United States 166%.[1]

This explains why 42 was fixed as the extreme limit for active military service in Great Britain until over-age men were taken, and has often been fixed as the limit for acceptance for active industrial service. (The formal military age limits are 18 to 45, but no country calls men above 40 for active service if it can avoid it.)

[1] U. S.—Bureau of the Census. United States Life Tables, 1910. Washington: Government Printing Office, 1916.
Fisk, Eugene Lyman. Diseases of Mature Life. Read at the Annual Conference of Sanitary Officers, New York State Department of Health, Saratoga Springs, June 25, 1919

The significance of these movements in mortality is made clear in the military records of this and other countries.

The rise of the rejection rate for military service is consistent with the rise in the death rate as age advances. For example, in Great Britain an analysis of a representative group of 10,000 men examined for service showed the following ratios:[1]

Ages	18	23	40
Rejection rate	22%	48%	69%
Increase over age 18	....	+118%	+213%
[2] Death rate per 1000 England and Wales 1911–1912	3	3.8	8.1
Increase over age 18	....	+26%	+170%

The rising death rate after age 18 (actually it commences at 12) reflects the cumulative effect of various factors in the environment acting upon the organism. Its resistance depends upon inherited constitution and the nurture, training and protection that has been afforded and maintained from childhood onward. This increase in the death rate and the ratio of physical defects is not the result of a fixed biological law but of ignorance and neglect.[3]

In this country, a study of ages 21 to 30 showed an increase of 30% in the rejection rate over that for age 21 for military service,[4] which is entirely consistent with British figures.

The rejection rate for active military service (Group A), ages 21 to 31, for the whole number in the United States draft is not known, but has been estimated by the Surgeon General's office as approximately 28%,[5] although there is reason to believe it was higher. It was 33% in the first draft.[6]

[1] Comrie, John D. An Analysis of Physical Defects Among the General Male Population, Based upon 10,000 Recruit Examinations. Lancet (London), November 29, 1919. p. 957–960.

[2] Great Britain.—Life Table No. 8.

[3] Loeb, Jacques. The Organism as a Whole. New York; Putnam, 1916.

—— The Mechanistic Conception of Life. Chicago; University of Chicago Press, 1912.

Schaefer, E. A. Life; Its Nature, Origin and Maintenance. London, Longmans, Green & Co., 1912.

[4] U. S.—Provost Marshal General. Second Report to the Secretary of War on the Operations of the Selective-Service System to December 20, 1918. Washington; Government Printing Office, 1919, p. 161, Table 55.

[5] Love, Albert G. and Charles B. Davenport. Defects Found in Drafted Men Statistical Information Compiled from the Draft Records Showing the Physical Condition of the Men Registered and Examined in Pursuance of the Requirements of the Selective-Service Act. Under Direction of Surgeon General M. W. Ireland, U. S. War Department, Washington; Government Printing Office, 1920, Table 3, p. 46 and Table 1, p. 417.

Davenport, Charles B. Personal Communication.

[6] U. S.—Provost Marshal General. Second Report to the Secretary of War on the

In Great Britain the rejection rate for ages 18–42 was 64%. Only 36% were accepted in Grade 1 as eligible for full active military service, 22% in Grade 2; 31% in Grade 3; 10% in Grade 4. (This report covers the examination of 2,425,184 men of military age—18–42.)[1]

The British Committee, commenting on these figures, has this to say:[2]

"These four inferences may be summarized by saying that medical examinations showed that, of every nine men of military age in Great Britain, on the average three were perfectly fit and healthy; two were upon a definitely infirm plane of health and strength, whether from some disability or failure in development; three were incapable of undergoing more than a very moderate degree of physical exertion and could almost (in view of their age) be described with justice as physical wrecks, and the remaining man as a chronic invalid, with a precarious hold upon life."

Is Man Physically Deteriorating? The problem as to whether the physical state of civilized man is deteriorating is obscured by many complex factors. It is apparently negatived by the increased expectation of life in all civilized countries and the progressive fall in the general death rate.

For example, in the United States registration area, the general death rate has fallen from 17.6 per thousand in 1900 to 12.9 per thousand in 1919.[3]

In Great Britain[4] and Sweden[5] and other European countries there has been similar improvement in the death rate at practically all ages of life, but chiefly at the younger ages.

It is notable that the death rate from organic diseases is greater in this country than in England and Wales and that death in the middle age of life is now likewise greater, although not formerly so.[6]

Operations of the Selective-Service System to December 20, 1918. Washington; Government Printing Office, 1919, p. 162, Table 57.

[1] Great Britain.—Ministry of National Service. Report v. 1, 1917–1919, upon the Physical Examination of Men of Military Age by National Service Medical Boards from November 1, 1917–October 31, 1918. London; His Majesty's Stationery Office, 1920, p. 4.

[2] Ibid.

[3] U. S.—Bureau of the Census. Mortality Statistics, 1919, Washington; Government Printing Office, 1921, p. 9.

[4] Great Britain.—Registrar General. 79th Annual Report, 1916, p. 8–9.

Fisher, Irving and Eugene Lyman Fisk. How to Live. New York; Funk & Wagnalls, 1921, p. 384.

[5] Sweden.—Report Royal Central Bureau of Statistics, Stockholm; 1916. Mortality Extension Tables, 1916.

Fisher, Irving and Eugene Lyman Fisk. How to Live. New York; Funk & Wagnalls, 1921, p. 389.

[6] Fisher, Irving and Eugene Lyman Fisk. How to Live. New York; Funk & Wagnalls, 1921, p. 378–380.

Hoffman, Frederick L. Recent Statistics of Heart Disease. Journal of the American Medical Association, May 15, 1920, v. 74, p. 1364.

ANALYSIS OF SEVEN LOCAL BOARDS IN DETROIT, BROOKLYN AND NEW YORK (SUBURBAN AND CITY).[1]

	Number	Percentage of Those Examined
Number of men called	8,875	....
Number of men examined	7,611	....
Number of men discharged for physical reasons	2,232	29
Prominent Causes of Rejection:		
Defective eyes	462	6
Defective teeth	366	4.8
Underweight	350	4.6
Hernia	223	2.9
Heart defects	184	2.4
Defective feet	180	2.3
Injured or amputated limbs	169	2.2
Ear defects	88	1.2
Tuberculosis of lungs	77	1
Tuberculosis of joints	2	....
Undersize	53	.7
Genito-urinary, bladder, etc	37	.5
Varicose veins	35	.4
Overweight	32	.4
Syphilis	32	.4
Varicocele	28	.3
Deformity of trunk	38	.5
Asthma, bronchitis, etc	21	.3
Mental and insane	14	.2
Debility and poor physique	16	.2
Miscellaneous injuries	15	.2
Hemorrhoids and fistula	18	.24
Kidney disease	10	.1
Rheumatism	8	.1
Epilepsy	7	.1
Miscellaneous defects	7	.1

[1] Fisher, Irving and Eugene Lyman Fisk. How to Live. New York; Funk & Wagnalls, 1921, p. 400–401.

Fisk, Eugene Lyman. Some Lessons from the Recent Draft Examinations. Address before Section 1, American Association for the Advancement of Science, December 31, 1917. Journal American Medical Association, February 2, 1918, v. 70, No. 5, p. 300-303.

Organic Heart Disease and Acute Nephritis and Bright's Disease Death Rate per 1000 Population by Age Groups in the Registration Area 1910 Males Only. Compared with England and Wales. 1911.[1]

	U. S.	England and Wales	Per Cent Excess of United States Over England and Wales
All Ages	2.548	1.629	36.06
2–4	0.240	0.115	52.08
5–14	0.247	0.167	32.38
15–24	0.367	0.278	24.25
25–44	1.080	0.715	33.79
45–64	5.303	3.939	25.72
65 and over	26.23	14.83	43.46

Death Rate per 1,000 Population by Age in the Registration Area 1910. England and Wales. 1911.[2]

	U. S.	England and Wales	Per Cent Excess of United States Over England and Wales
All ages	15.96	15.58	2.38
2–4	9.34	9.96	−6.63
5–14	3.12	2.77	11.25
15–24	5.09	3.42	32.80
25–44	8.79	6.39	27.30
45–64	21.42	20.54	4.10
65 and over	85.13	85.65	−.06

In the United States, the improvement is limited to the early ages; after age 50 there is little evidence of improvement and some evidence of an increasing mortality is exhibited in a number of studies.[3]

There is evident need to combat the chronic organic maladies that limit the Working Span and are not now systematically attacked as are typhoid, tuberculosis and venereal diseases[4] and cancer.

[1] U. S.—Bureau of the Census. Mortality Statistics, 1918, Washington; Government Printing Office, 1920, p. 17.

[2] Ibid.

[3] Fisher, Irving and Eugene Lyman Fisk How to Live. New York; Funk & Wagnalls, 1921, p. 378–380.

[4] Hoffman, Frederick L. Recent Statistics of Heart Disease. Journal of the American Medical Association, May 15, 1920, v. 74, p. 1364.

The recent organization of the Association for the Prevention and Relief of Heart Disease and the organization of cardiac clinics, show a growing recognition of this need.[1]

Morbidity Rates.—From the death rate we turn to the sick rates for further light on the condition of the population.

In the report on National Vitality prepared by Professor Irving Fisher for the National Conservation Commission appointed by President Roosevelt in 1909, it was estimated that there were about 3,000,000 persons seriously ill at all times in the United States and that 42% of this illness was preventable with a resulting extension of life of over 15 years.[2]

Even in the short period of time since that report was issued a measure of this reduction has been noted. The estimate of 13 days annual loss from illness must now be reduced to approximately 7. The duration of life has actually been extended probably a period of five years. The Life Tables for 1910 for the original registration states were the first reliable life tables issued based upon the mortality in the registration states and can be compared only with separate life tables such as those of Massachusetts, where the expectation of life in the first year of life has increased among males from 44 years (1893–7) to 49 years (1910) and among women from 46 years (1893–7) to 53 years [3] (1910).

While it is not now, and never has been possible to collect complete and mathematically accurate morbidity statistics for the entire country, nevertheless critical studies of special groups in the population enable us to approximate the morbidity rate in the general population and in industry. Changes that have taken place in the death rates from some of the principal diseases that contributed to the morbidity rate when the report on National Vitality was issued, furnish consistent and confirmatory evidence of the fact suggested by the morbidity surveys herein quoted, that there is now less disability and sickness present than there was even fifteen years ago.

Investigations of the United States Commission on Industrial Relations in 1913–15 which cover a survey of the sickness prevalent among approximately a million workers of representative occupations, revealed an average loss to more than 30,000,000 American wage-earners of about nine days per year.[4]

[1] Association for the Prevention and Relief of Heart Disease. First Report, covering the period from its incorporation, December 18, 1915 to January 1, 1921. (Office of the Association, 325 East 75th Street, New York City.)

[2] Fisher, Irving. Report on National Vitality, Its Wastes and Conservation. Washington; Government Printing Office, 1909, p. 12.

[3] Massachusetts.—Report State Board of Health, 1898, p. 822–825 (figures for 1893–1897); Life Tables State of Massachusetts, U. S. Census, 1910, p. 50–53 (figures for 1910.)

[4] U. S.—Commission on Industrial Relations. Final Report, 1913–1915, v. 1, p. 124.

The Social Insurance Commission of California, reporting in 1917, estimated an average annual loss to wage-earners on account of sickness of six days.[1]

The Dallas Wage Commission in 1919 estimated an average loss of 6.8 days.[2]

The Metropolitan Life Insurance Company, through a sickness census of policyholders and others, people of small means in industrial life, 637,038 white and colored persons, reported loss during the working year as follows: males 6.8 days; females 6.9 days.[3]

These rates, of course, varied with the age of the individual and just as consistently as does the death rate or the rejection rate for military service.

The following chart exhibits this curve and should be compared with the charts herein produced showing the curve of the death rate and the curve of military rejections.[4]

It will be noted that the sick rate at age 35 to 44 is nearly double the rate for 15 to 24, a difference closely approximating that found in the mortality tables and in the tables exhibiting the rejection rate or the actual physical status of individuals at those ages.

Sydenstricker is of the opinion that between 8 and 9 days annual loss from sickness is a justifiable estimate based on the United States public health investigations (unpublished data).[5]

Official commissions investigating sickness conditions in Ohio and Illinois in 1919, found that the loss of time by wage-earners will average between 8 and 9 days per year for each wage-earner in the entire group.[6] Quinby at the Hood Rubber Company found a sick rate of 6.6 days.[7]

The fall in the general death rate in the registration area from 1907 to 1917 is 2.3 per thousand, indicating a saving of 240,000 lives in 1917.[8] On the basis of 2 people ill for every death, there would be a saving of about 500,000 cases of illness. The sickness rates actually determined in recent studies show that $2\frac{1}{4}\%$ of wage-earners are constantly ill to an

[1] California.—Report Social Insurance Commission, 1917, p. 15.

[2] Texas.—Report Dallas Wage Commission, 1919.

[3] Stecker, Margaret Loomis. Some Recent Morbidity Data: A Summary of Seven Community Sickness Surveys made among Policyholders of the Metropolitan Life Insurance Company, 1915 to 1917. New York; Metropolitan Life Insurance Company, 1919, p. 28, tab.

[4] Ibid.

[5] U. S.—Public Health Service. Unpublished data.

[6] Ohio.—Report Health and Old Age Insurance Commission, 1919, p. 56.

Illinois.—Report Health Insurance Commission, 1919, p. 11.

[7] Quinby, R. S. A Study of Industrial Absenteeism. Read at Annual Meeting of Industrial Physicians and Surgeons, Boston, June 7, 1921.

[8] U. S.—Bureau of the Census. Mortality Statistics 1918. Washington; Government Printing Office, 1920, p. 9.

extent to be incapacitated. This would justify an estimate of approximately 2,400,000 people continually ill instead of 3,000,000.

Possibility of Further Improvement.—These fluctuations in mortality and in the morbidity rate from certain types of disease lend consistent support to the principle derived from clinical observation, laboratory

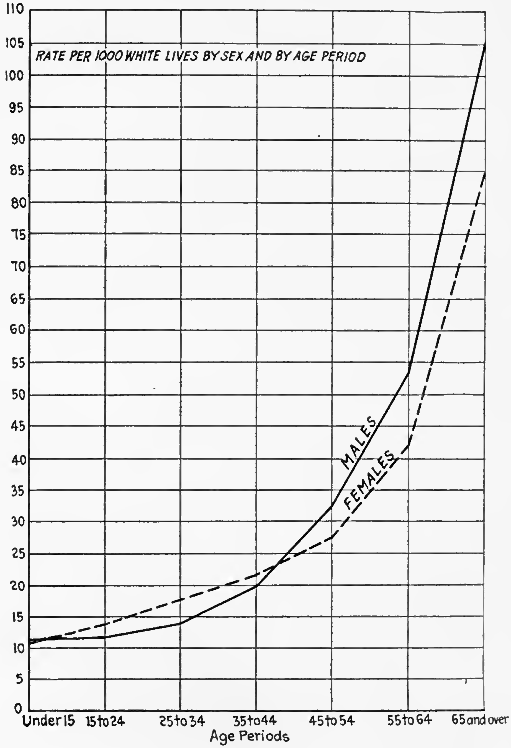

FIG. 2.

observation and biological research that the life cycle of man and the subdivisions we have designated the Health Span and Work Span are not fixed.

While it is wholly beyond the bounds of possibility to extend the human life cycle to the same degree that it has been extended in the lower organisms, the factors that shorten the human life cycle are practically identical with those which have been successfully combated in dealing with the lower organisms.[1]

These factors may be grouped under the following categories and will be found to cover every type of influence that tends not only to shorten human life but to produce physical impairment and lower the working capacity.

Heredity;	Hormone Excess;
Infection;	Physical Trauma or Strain;
Poison;	Psychic Trauma or Strain;
Food Deficiency;	Physical Apathy;
Food Excess;	Psychic Apathy.
Hormone Deficiency;	

Can the possible economic and human savings from the practical application of these principles be given quantitative expression?

The following exhibit attempts to answer this question conservatively.

DEMONSTRATION OF POSSIBLE SAVINGS FROM HEALTH SUPERVISION AND PERIODIC PHYSICAL EXAMINATION [2]

Expected mortality per 1,000 in population examined; conservative figure for average population at work..........................	10 lives	
Probable number of substandard or physically impaired lives per 1,000 in population examined..	300 "	
Expected mortality *without examination* per 300 substandard lives...	6 "	
Probable mortality *with examination* per 300 substandard lives......	3 "	
Gain in mortality (lives per annum) in substandard group...........	3 "	
Add at least one life saved in standard group......................	1 life	
Economic value of average life..................................		$5,000

[1] Loeb, Jacques. Natural Death and the Duration of Life. Scientific Monthly, December, 1919, v. 9, No. 6, p. 578.

Carrel, Alexis. Present Condition of a Strain of Connective Tissue Twenty-eight Months Old. Journal of Experimental Medicine, July 1, 1914, v. XX, No. 1, p. 1.

Fisk, Eugene Lyman. Prolonging Human Life. Yale Review, July, 1920, v. 9, pp. 699–713.

—— On Prolonging Human Life. North American Review, July, 1920, v. 212, No. 1, pp. 51–62.

[2] Dublin, Louis I. Personal communication.

Jackson, C. W. The Influence of Medical Re-Examination on Insured Lives: Health Conservation. Paper read before the Actuarial Society of America, Boston, Mass., October 16, 1913. Transactions, pp. 321–325.

Fisk, Eugene Lyman. The Possible Function of the Life Insurance Company in the Conservation of Health. Address before the Section on Social and Economic Science, American Association for the Advancement of Science, Cleveland, Ohio, January 3, 1913. Reprint, Postal Life Insurance Company, New York.

(Formula of Dublin and Whitney based on exact computation of basic factors, increment of wealth, etc. Value of 1 year of life $100×50 (average lifetime) [1] ($5,000, economic value of average life).	
Mortality gain to State for each 1,000 examined (4 lives×$5000) [2]...	$20,000
Assuming 2 people constantly ill for each death occurring in group, the saving of 4 lives means the elimination of 8 cases of chronic illness from the group, or a reduction of 8×365, or 2,920 days of illness. At a medical, nursing and extra diet cost for illness of $3 per day, the saving equals about..............................	$9,000
Profit to State and community per 1,000 of population.............	$29,000
Applying this factor to a population of 105,000,000 which would exclude the extremely aged and infirm who would not come under the operation of these formulae, we have the following exhibit:	
105,000,000×$29 equals about..............................	$3,045,000,000
What would be the cost of applying a system of periodic examination to the entire population?	
If there were thorough organization of such work the cost would not exceed $5 per individual—a total of...........................	$525,000,000
leaving an economic balance of...............................	$2,520,000,000
Assuming that one-third of the substandard cases revealed by these examinations or about 10,000,000 required medical, surgical or dental treatment at a cost of $100 per case, the cost of this repair work would aggregate..	$1,000,000,000
leaving a net margin of economic gain of........................	$1,520,000,000

also excess dividends in:

Health;
Happiness;
Satisfaction in Living;
Prevention of Pain;
Prevention of Sorrow;
Prevention of Discontentment; and
Industrial Unrest.

It should be remembered that these formulae are derived from actual experience in carefully studied groups and are not based upon mere estimates by authorities. They agree, however, in many particulars with the expert opinion grouped in the Report on National Vitality where a probable economic loss of $1,500,000,000 from preventable disease

[1] Dublin, Louis I. and Jessamine Whitney. On the Cost of Tuberculosis. American Statistical Association Quarterly, December, 1920, v. 17, p. 441–50.

Glover, James W. Monetary Loss in the United States due to Tuberculosis. Proceedings of the Sixth International Congress on Tuberculosis, Section 6, 1908, pp. 55–87.

[2] Fisher, Irving. Report on National Vitality, Its Wastes and Conservation. Washington; Government Printing Office, 1909, p. 34.

and death was estimated, based on the concensus of opinion of leading medical authorities.[1]

It was then stated that this estimate was very conservative and might well be exceeded by the cost from tuberculosis alone which had been figured at $1,000,000,000. A recent analysis of the question by Dublin and Whitney gives the annual loss from the tuberculosis death-rate alone of more than $500,000,000, exclusive of such items as sickness costs.[2] The annual loss from typhoid fever is $135,000,000.[3]

The figures herein presented relate to savings that have been effected in representative groups solely by the operation of a system of periodic examination, general instruction and guidance in hygiene and information as to needed medical treatment. The saving from other causes such as public health administration is, of course, not included.

To these possible savings from overhauling the human machine and instructing it in self-government must be added the possible savings from community hygiene, from state and federal organization for protection of the mass of citizens from epidemic infection, from endemic infection, from impure food; the organization of industry to improve the environment of the worker, safety provision and safety education. The influence herein dealt with has been chiefly that of personal hygiene and guidance.

With better organized facilities in the medical profession to follow up and co-operate with the agencies, whether private, state or national, that provide these periodic examinations, a much greater saving could be accomplished.

The experiential sources of information on which these statements are based are as follows:

1. The degree of impairment or substandard physical condition in the population is known through:
   (*a*) Physical examination of 175,000 by the Life Extension Institute.[4]
   (*b*) Examination for employment in industry.[5]

[1] Fisher, Irving. Report on National Vitality, Its Wastes and Conservation. Committee of One Hundred on National Health. Bulletin No. 30. Washington; Government Printing Office, 1909, p. 1 and 104–106.

[2] Dublin, Louis I. and Jessamine Whitney. On the Cost of Tuberculosis. American Statistical Association Quarterly, December, 1920, v. 17, pp. 441–450.

[3] Gay, Frederick P. Typhoid Fever Considered as a Problem of Scientific Medicine. New York; Macmillan, 1918, p. 23.

[4] Fisk, Eugene Lyman. Conservation of Man Power. Address before the Trust Company Section American Bankers Association, Twenty-third Annual Meeting, Chicago, Ill., September 23–24, 1918. Proceedings, 1918, pp. 397–404.

[5] Schereschewsky, J. W. Studies in Vocational Diseases—The Health of Garment Workers, United States Public Health Bulletin No. 71, Washington; Government Printing Office, 1915.

—— Medical Examination of Employees as a Part of Industrial Insurance. Address at the Tenth Annual Meeting of the National Association for the Study

(*c*) Draft and military records.[1]
(*d*) Framingham Community Health Demonstration.[2]

2. The expected mortality on most of these substandard classes is known from the experience of life insurance companies that extend back a quarter of a century on many thousands of lives insured at rated up premiums.[3]
3. The extent to which the death rate can be reduced in these classes both standard and substandard by a system of periodic examination or instructions alone without special provision for treatment, is known through the experience on a group of policyholders in one company that followed such an experiment for a period of seven years and showed more than 50% reduction in mortality among those examined and found impaired.[4]

The welfare work, nursing service, health education, etc., carried on by another company has been estimated as saving 38,000 lives in

and Prevention of Tuberculosis, Washington, D. C., May 7–8, 1914. Transactions pp. 51–54.

Mock, H. E. An Efficient System of Medical Examination of Employees. Address at the Tenth Annual Meeting of the National Association for the Study and Prevention of Tuberculosis, Washington, D. C., May 7–8, 1914. Transactions, pp. 39–46.

Clark, W. I. Medical Supervision of Factory Employees. Journal of the American Medical Association, February 15, 1913, v. LX, No. 7, pp. 508–510.

[1] Love, Albert G. and Charles B. Davenport. Defects Found in Drafted Men. Statistical Information Compiled from the Draft Records, Showing the Physical Condition of the Men Registered and Examined in Pursuance of the Requirements of the selective Service Act. Under Direction of Surgeon General M. W. Ireland, U. S. War Department. Washington; Government Printing Office, 1920, pp. 28–55.

U. S.—Provost Marshal General. Second Report to the Secretary of War on the Operations of the Selective Service System to December 20, 1918. Washington; Government Printing Office, 1919, p. 161, table 55.

Great Britain.—Ministry of National Service. Report Upon the Physical Examination of Men of Military Age by National Service Medical Boards from November 1, 1917 to October 31, 1918, v. 1, 1917–1919. London, His Majesty's Stationery Office, 1920, p. 4.

[2] Armstrong, Donald B. Framingham Monographs No. 2 (June, 1918), No. 4 (November, 1918) and No. 5 (March, 1919). National Tuberculosis Association.

[3] Hunter, Arthur. Can Insurance Experiences be Applied to Lengthen Life? Address delivered at the Eighth Annual Meeting of the Association of Life Insurance Presidents, New York, December 10, 1914. Proceedings, 1914, pp. 27–37.

—— and Oscar H. Rogers. Influence of Occupations upon Mortality. Transactions of the Actuarial Society of America, May, 1920

Rogers, Oscar H. Heart Murmurs—Their Influence on Mortality. Transactions of the Actuarial Society of America, May, 1919.

[4] Jackson, C. W. The Influence of Medical Re-Examination on Insured Lives: Health Conservation. Paper read before the Actuarial Society of America, Boston, Mass., October 16, 1913. Transactions, pp. 321–325.

Knight, Augustus S., M.D. President's Address, Assn. Life Ins. Med. Dirs., Oct. 20, 1921. Reprint, Metropolitan Life Ins. Co.

Fisk, Eugene Lyman. Proceedings American Association for the Advancement of Science, January 3, 1913. Reprint Postal Life Insurance Company, New York.

1920.[1] The economic value[2] of these lives is at least $190,000,000.

The savings postulated under this system of periodic examination (4 lives per 1,000 living) if attained would alone bring the death rate in the registration area down to about 11 per thousand (a not unreasonable expectation when it is considered that the death rate has already been reduced since 1900 by approximately that same number of lives—4.7 per thousand—chiefly through public health measures and the reduction of mortality from communicable disease).

In 1900 the death rate in the registration area was 17.6, in 1919 it was 12.9—a gain of four lives per thousand living. A further gain of four lives would bring our death rate somewhat below that of New Zealand and Australia and less than one-half that of Spain. These wide differences in death rates of various countries, even when corrected for age distribution, evidence the non-fixity of the life cycle, and the opportunity that exists not only for extending it but adding to human power and capacity for living and for enjoying life.

II. HEALTH CONDITIONS IN INDUSTRY

The general death rate among those employed at ages 15 to 65, as estimated on the basis of the industrial insurance mortality experience for the year 1920, was 11.46 per 1,000 living. An estimate of 42,000,000 persons gainfully employed in 1920 is considered conservative.[3] The application of this death rate to such a group would give a total loss for the year 1920 of 483,000 lives and a probable loss in the year 1921 of 500,000 lives. As showing possible margin of improvement, this death rate of 11.46 per 1,000 living in industry may be contrasted with that in the preferred occupations, such as teachers and graduates of women's colleges.

An investigation of mortality among the graduates of Smith College, Wellesley and Vassar, showed a death rate of only 3.24[4] or approximately one-third of the death rate for industry.

[1] Lengthening Life through Insurance Health Work: A Study of the Trends of Mortality Among Policyholders in the Metropolitan Life Insurance Company and in United States Registration Area, 1911 to 1919. Metropolitan Life Insurance Company, New York, 1921. Pamphlet.

[2] Dublin, Louis I. and Jessamine Whitney. On the Cost of Tuberculosis. American Statistical Association Quarterly, December, 1920, v. 17, pp. 441–450.

[3] Dublin, Louis I. Personal communication from Dr. Dublin, Statistician, Metropolitan Life Insurance Company, to Dr. Fisk, 1921.

[4] Hulst, Myra M. Mortality Rates of College Women, American Statistical Association Quarterly. March, 1921, pp. 602–604.

From industrial insurance records we find the principal diseases in the order of frequency with which they figure in death claims.[1] These individuals, although generally drawn from the industrial working population, were to some extent a selected class with a somewhat lower mortality than in the general working population and this must be given due allowance.

Causes of Death	Rate per 100,000 lives exposed
	Year 1920
Total—all causes	968.4
Tuberculosis	135.0
Organic diseases of the heart	114.6
Pneumonia (all forms)	103.9
Bright's disease	69.4
Cancer	68.3
Cerebral hemorrhage	60.1
Influenza	52.3
Puerperal state	22.5
Diphtheria	21.6
Respiratory diseases (other than those listed)	17.8
Diarrhea and enteritis	15.5
Measles	8.3
Typhoid fever	6.5
Whooping cough	6.5
Suicides	6.0
Scarlet fever	5.9
Homicides	5.7
Meningitis (all forms)	5.1
Other external causes (excluding suicides and homicides)	58 1
Traumatism by automobile	10.9
All other causes	185.3

Deaths from organic diseases of the heart, blood vessels and kidney exceed the death rate from tuberculosis. This class of diseases is chiefly due to infection of various types, epidemic infections being mainly responsible in the earlier years of life, but later focal infections.

Sydenstricker and Brundage report a sickness rate in a large rubber company employing 18,000 people, of 9.3 working days for males and 13.8 days for females.[2]

[1] Metropolitan Life Insurance Company. Statistical Bulletin, March, 1921, v. II, No. 3, p. 11.

[2] Sydenstricker, Edgar and Dean K. Brundage. Industrial Establishments Disability Records as a Source of Morbidity Statistics. American Statistical Association Quarterly, March, 1921, p. 584.

Compare this with the sickness surveys of the Metropolitan Life Insurance Company.[1]

NUMBER OF PERSONS SICK AND UNABLE TO WORK, AND RATES PER 100,000 EXPOSED

Disease or condition	All Surveys (571,757 Persons)	
	No. of cases	Rates per 100,000 exposed
All diseases and conditions	10,828	1,893.8
Typhoid fever	72	12.6
Malaria	67	11.7
Smallpox	4	.7
Measles	232	40.6
Scarlet fever	44	7.7
Whooping cough	211	36.9
Diphtheria and croup	56	9.8
Influenza	769	134.5
Pellagra	24	4.2
Tuberculosis of the lungs	424	74.6
Other forms of tuberculosis	73	12.8
Cancer—all forms	86	15.0
Rheumatism	940	164.4
Cerebral hemorrhage, apoplexy, paralysis	376	65.8
Mental alienation (insanity)	141	24.5
Other diseases of the nervous system	836	146.1
Diseases of the eyes and ears	191	33.3
Organic diseases of the heart	358	62.6
Other diseases of the circulatory system	103	18.0
Colds, coryza and rhinitis	290	50.7
Pneumonia—all forms	493	86.2
Other diseases of the respiratory system	665	116.2
Tonsilitis and other diseases of the pharynx	173	30.2
Diseases of the stomach (cancer excepted)	387	67.7
Appendicitis	215	37.8
Other diseases of the digestive system	345	60.3
Diseases of the kidneys and annexa	219	38.3
Other diseases of the genito-urinary system	152	26.6
Pregnancy	7	1.2
Normal childbirth	270	47.2
Other puerperal diseases and conditions	18	3.1
External violence	1,020	178.4
All other diseases and conditions	1,567	274.0

[1] Stecker, Margaret Loomis. Some Recent Morbidity Data, A Summary of 7 Community Sickness Surveys—Metropolitan Life Insurance Company, 1915–1917. New York, Metropolitan Life Insurance Company, 1919, p. 14.

It is notable that rheumatism, a vague term it is true, is the outstanding complaint. This type of trouble is frequently associated with focal infection and the organic diseases which loom so largely in the death record on industrial lives.

Experience of the Workmen's Sick and Death Benefit of the United States of America, 1912–1916—44,188 Members [1]

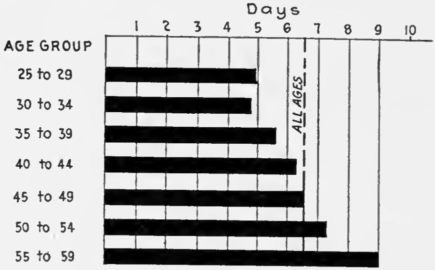

CHART A - Average annual number of disability days per member (all occupations) in certain age groups

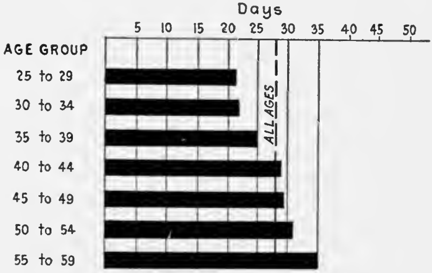

CHART B - Average annual number of disability days per disabled person (all occupations) in certain age groups

Fig. 3.

We here note the influence of advancing age on the sick rate comparable to that already observed in the other morbidity and mortality tables although these were selected and medically examined. The average annual loss in this selected group was close to that in other population studies, 6.6 days.

[1] Emmett, Boris. Disability Among Wage Earners, U. S. Bureau Labor Statistics, Monthly Labor Review, November, 1919, V. IX, No. 5, p. 27.

In addition to conditions that actually impair health and working capacity, there are many that constitute potential impairment.

In more than 100 plants where physical examinations of supposedly well employees were made by the Life Extension Institute wholly for the purpose of detecting physical impairments and offering counsel as to their correction, the following degrees of physical impairment were found in representative groups of more than 10,000 supposedly healthy people actively engaged at work:[1]

We here stress the following phases of the subject.

INFECTION

Epidemic and Communicable Diseases.—Tuberculosis is the most important of epidemic and communicable diseases, 2 to 3 deaths per 1,000 occurring annually at the working ages. Ten years ago the rate was nearly double that figure.[2] It is estimated that 3% of the industrial population, or about 1,250,000 lives are affected.[3]

Pneumonia, influenza and typhoid fever are the most important acute communicable diseases among adults. Typhoid fills more than 150,000 sick beds annually and takes about 15,000 lives, mostly in the working ages.[4] Influenza and pneumonia in non-epidemic years take about 35,000 lives in the working ages and thus account for at least 350,000 cases of illness.[5]

Hookworm infection is present in a large industrial area to the extent of at least 5% among the laboring population.[6] Intensive studies show 30% of students in a southern university infected.[7]

[1] Fisk, Eugene Lyman. Conservation of Man Power. Address before the Trust Company Section, American Bankers' Association, Twenty-third Annual Meeting, Chicago, Ill., September 23–24, 1918. Proceedings, 1918, pp. 397–404.

[2] Metropolitan Life Insurance Company. Statistical Bulletin, March, 1921, V. II, No. 3, pp. 1–4.

[3] Love, Albert G. and Charles B. Davenport. Defects Found in Drafted Men—Statistical Information compiled from the Draft Records showing the Physical Condition of the Men Registered and Examined in Pursuance of the Requirements of the Selected-Service Act. Under Direction of Surgeon-General M. W. Ireland, U. S. War Department. Washington, Government Printing Office, 1920, p. 30.

[4] Gay, Frederick P. Typhoid Fever, Considered as a Problem of Scientific Medicine. New York, Macmillan Company, 1918, p. 14.

[5] U. S. Bureau of the Census. Mortality Statistics, 1918, Washington, Government Printing Office, 1920, pp. 30–34.

[6] Brownlee, C. H. Price paid by the South to the Hookworm Disease. Address before the Southern Sociological Congress, Houston, Tex., May 8–10, 1915. Proceedings, 1915, pp. 50–54.

[7] Dowling, Oscar. Sociological Aspect of Hookworm Disease. American Journal of Public Health, July, 1920, pp. 595–598.

Malaria is so seldom a direct cause of death, causing only 2,500 cases annually in the registration area, that it is difficult to estimate its extent and influence. It is responsible for much sub-standard health and probably affects 1,500,000 people annually, covering 27,000,000 days' absence.[1]

The epidemic diseases of childhood are also reflected in chronic organic diseases among adults.

Focal Infection.—This type of infection arises chiefly in the head cavities, such as the tonsils, tooth sockets, middle ear, and accessory nasal sinuses, but may arise elsewhere as in the gall-bladder, appendix and seminal vesicles. It has been identified as a possible causative factor in the following conditions:[2]

1. Neurasthenia
2. Neuritis; reflex or remote result
3. Neuralgia
4. Myalgia
5. Myositis
6. Arthritis, acute, sub-acute or chronic
7. Oseitis
8. Periostitis
9. Gout
10. Basedow's disease
11. Furunculosis
12. Sepsis
13. Endocarditis
14. Pericarditis
15. Myocarditis
16. Chorea
17. Arteriosclerosis
18. Meningitis
19. Pleuritis
20. Bronchitis
21. Asthma
22. Pneumonia
23. Nephritis
24. Pyelitis
25. Cystitis
26. Gastric neurosis
27. Peptic ulcer
28. Appendicitis
29. Colitis
30. Cholecystitis
31. Herpes zoster
32. Many chronic skin diseases

More than 60% of workers show definite focal infection of some degree. This has been confirmed by X-ray examinations of more than 5,000 people by the Life Extension Institute.

There are more than 130,000 deaths annually in the working age (20–60) from the organic conditions largely due to focal infection and

[1] U. S. Bureau of the Census. Mortality Statistics, 1919. Washington, Government Printing Office, 1921, p. 9.

[2] Billings, Frank. Focal Infection, New York and London. Appleton, 1916.

King, James Joseph. Focal Infections of the Head as Sources of Systemic Diseases. Address before the Joint Session of the American Academy of Ophthalmology and Otolaryngology, 24th Annual Meeting, Cleveland, October 17, 1919. New York, William Wood & Co., pp. 1–10.

Mayo, C. H. Mouth Infection as a Source of Systemic Disease. Journal of the American Medical Association, December 5, 1914, p. 2,025.

Potter, N. B. The Vicious Circle in Oral Sepsis. New York Medical Journal, February 10, 1917, p. 243.

Rosenow, E. C. Mouth Infection as a Source of Systemic Disease. Journal of the American Medical Association, December 5, 1914, p. 2,026.

there are not less than 14,000,000 people in industry showing signs of organic impairment in some degree.[1]

Venereal Infection.—It is, of course, impossible to give definite figures for the prevalence of venereal infection. Drawing conclusions from the draft figures, 5.6% would be an outside estimate for ages 21 to 31 in the general mixed population, white and colored, for all venereal infections.[2] It has been estimated that about 60% of the infection occurs in this age period.[3] It may be roughly estimated that 1,500,000 workers are affected with venereal infection. The Life Extension Institute found less than 1% of syphilis in industry and about 3% in a mixed population.[4] The Mayo Clinic found 4.6% of syphilis in mixed classes and 10% among railway men.[5]

PSYCHIC AND PHYSICAL TRAUMA

Fatigue.—Fatigue may arise in:

1. The central nervous system.
2. The muscular system.
3. In both combined.

Fatigue may be subjective as experienced by the worker or objective as noted in his actions and output. In industry fatigue arises chiefly in the central nervous system.[6]

Unfortunately in most discussions of industrial fatigue a falling work curve or diminished output among employees who have not reported ill is accepted as a complete uncomplicated reflection of fatigue. This sweeping assumption is wholly unjustified.

From a thorough consideration of the literature it is quite evident that a vast amount of emphasis has been laid upon the mechanical or extrinsic factors influencing the working capacity while the multiplicity

[1] Fisk, Eugene Lyman. Addresses, Annual Banquet Life Extension Institute, New York, December 3, 1919. Reprint, Life Extension Institute, pp. 14–17.

[2] Davenport, C. B. and Albert G. Love. Defects found in Drafted Men. The Scientific Monthly, January, 1920, p. 13.

[3] King, Mary L. and Edgar Sydenstricker. Venereal Disease, Incidence and Different Ages, Tabulation of 8,413 cases. Case Report for Indiana. U. S. Public Health Service Report, December 24, 1920.

[4] Fisk, Eugene Lyman. Address, Annual Banquet Life Extension Institute, New York, December 3, 1919. Reprint, Life Extension Institute, pp. 17–18.

[5] Stokes, J. H. and Helen E. Brehmer. Syphilis in Railroad Employees. Journal Industrial Hygiene, January, 1920, pp. 419–427.

[6] Hayhurst, Emery R. Points in the Detection of Industrial Fatigue and Measures for its Possible Complete Elimination. Journal of Industrial Hygiene, November, 1920, pp. 256–258.

of original physical and mental states that may limit the working capacity have been almost wholly neglected.[1]

Emphasis has been laid on fatigue toxins although it is doubtful whether any specific fatigue toxin exists or whether metabolites in the blood resulting from muscular work can really *cause* fatigue in ordinary factory labor except under conditionsof unusually prolonged, severe or violent muscular work. In fact, skilled labor is much more liable to cause fatigue because of the demand it makes on the central nervous system.

[1] Lee, Frederic S. The Human Machine and Industrial Efficiency, New York, Longmans, Green & Co., 1918.

—— Effects of Temperature and Humidity on Fatigue. Address before Section 4 International Congress on Hygiene and Demography. Washington. Transactions, 1912, v. 3. pp. 504–512.

—— Is the Eight-Hour Day Rational? Science, November 24, 1916, pp. 727–735.

Goldmark, Josephine. Fatigue and Efficiency. New York. Russell Sage Foundation, 1912.

—— and Mary D. Hopkins, Philip Sargent Florence, Frederic S. Lee. Comparison of an Eight-Hour Plant and a Ten-Hour Plant. Public Health Bulletin No. 106. Washington, Government Printing Office, 1920.

Frankfurter, Felix and Josephine Goldmark. The Case for the Shorter Working Day. Franklin O. Bunting, plaintiff in error, vs. The State of Oregon, defendant in error. Brief for defendant in error. Supreme Court of the United States, October term, 1915. Reprint. New York, National Consumer's League, 1915, v. I and II.

Great Britain—Ministry of Munitions. Health of Munition Workers' Committee Interim Reports. Industrial Efficiency and Fatigue. London. His Majesty's Stationery Office, 1915–1916–1917 and 1918.

Florence, Philip Sargent. Use of Factory Statistics in the Investigation of Industrial Fatigue. Studies in History, Economics and Public Law. New York. Columbia University, v. LXXXI, No. 3, 1918.

National Industrial Conference Board. Analysis of British Wartime reports on hours of work as related to output and fatigue. Boston, National Industrial Conference Board, 1917. Research report No. 2.

—— Hours of work as related to output and health of workers. Cotton manufacturing. Boston, March, 1918. Report No. 4.

—— Hours of work as related to output and health of workers. Boot and shoe industry. Boston, 1918. Report No. 7.

—— Hours of work as related to output and health of workers. Wool manufacturing. Boston, 1918. Report No. 12.

—— Rest periods for Industrial Workers. Boston, 1919. Report No. 13.

—— Hours of work as related to output and health of workers. Silk manufacturing. Boston, 1919. Report No. 16.

—— Unwarranted conclusions Regarding the Eight-Hour and Ten-Hour Work Day. A Critical Review of U. S. Public Health Bulletin No. 106. Boston, 1920. Special Report No. 14.

Drinker, C. K. An Abstract and Criticism of a comparison of an Eight-Hour Plant and a Ten-Hour Plant. Journal of Industrial Hygiene, October, 1920, pp. 109–115.

Bainbridge reviews the evidence and says:[1]

"There appears, therefore, to be no secure foundation for the belief that products of muscular activity take any share in bringing about fatigue of the nervous system . . . . The conclusion that fatigue as observed among industrial workers is essentially of nervous origin is of considerable practical value."

After discussing various factors apart from work such as fear, emotion, anxiety, worries and the preventives of fatigue, financial gain, emulation and other stimulating influences, he mentions the general health as reacting on working power but does not develop this phase of the question. He lists the following table from Vernon:

27 Men Sizing Fuse Bodies (Heavy Labor)

	Average Hours of Work per Week	Average (relative) Output per Hour	Output per Week. Hours×Output per Hour
(1) Period of 6 weeks....	61.5	100	6150
(2) " " 6 "	51.1	109	5570
(3) " " 8 "	55.4	122	6759
(4) " " 3 "	56.2	124	6969

He comments as follows:

"The results shown in this table point to the conclusion that, at least in this particular occupation the maximal working week, consistent with the avoidance of cumulative fatigue, is fifty-six hours. For lighter forms of work, Vernon found that longer hours could be worked without loss, or even with improvement, of output. It is evident, therefore, that the establishment of a uniform length of working day for all classes of manual workers would lead in many cases to inefficiency."

While in an immediate sense these conclusions are justified the workers themselves must be studied as to all the factors, apart from work, that have influenced their output. We have little hesitation in saying that the most important factors relate to the original fundamental condition of physical and mental health of the workers before the tests were applied. Cumulative fatigue is stressed by most writers but the obvious influence of impaired health in determining as cumulative fatigue, what would otherwise be physiological and rhythmic, is ignored; that is, infection may

[1] Bainbridge, F. A. Physiology of Muscular Exercise. London, Longmans, Green & Co., 1919, pp. 180–183.

Vernon, H. M. Output in Relation to Hours of work. Interim Report, London. His Majesty's Stationery Office, 1917, pp. 17–25.

so depress an individual as to prevent him from rallying from ordinary physiological fatigue and thus carry him over into cumulative fatigue.

Gilbreth,[1] presenting the mechanical viewpoint, states that in a fatigue survey the most important data are those which have to do with lighting, glare and reflection, alternate sitting and standing, dark colored walls, types of chairs used and similar influences. To such influences he ventures to ascribe a loss in productivity of 20c. per worker for each and every working day. This would mean a loss of $60 per annum for each worker or about $2,500,000,000 per annum for the entire working population. Further proof is required to support such figures, but if 50% of such saving from the correction of mechanical environment defects is possible, what value shall we attach to a critical physical examination that reveals more than 50% of the working people with defective vision requiring correction?[2] How much fatigue can we prevent by such correction as compared to the comparatively trivial influence of environmental factors?

We would say that in a survey of fatigue it is first necessary to inquire:

Does the output fall because the worker is tired or because he is physically deficient?

Is the worker ill because he is tired or tired because he is ill?

Inasmuch as physical examinations have shown that more than 50% of any group of industrial workers show either disease conditions or substandard physical states that require medical attention,[3] this enormous factor which has been practically ignored in fatigue studies is entitled to first instead of last place. Comparisons of the productivity of 6, 8 and 10 hour plants do not give real testimony as to the optimal working day in any industry unless we know how many in the group are affected by preventable or curable conditions, such as:

Infected teeth, infected tonsils, constipation, faulty diet and mental poison such as home worries, suppressed or thwarted emotions or aspirations, conditions which may well have, and probably do have far more influence on working capacity than mechanical environmental influences—even hard work and long hours—unless carried to irrational extreme.

No one can question the desirability of avoiding a working day of such length that it excludes opportunity for proper relaxation and rest.

But it is more important that we rear a strong and virile race, capable

[1] Gilbreth, Frank B. and Lillian M. Unnecessary Fatigue a Multibillion Enemy to America. Journal Industrial Hygiene. March, 1920, pp. 542–545.

[2] Fisk, Eugene Lyman. Addresses, Annual Banquet, Life Extension Institute, New York, December 3, 1919. Reprint, Life Extention Institute, p. 18.

[3] Fisk, Eugene Lyman. Conservation of Man-Power. Address before the Trust Company Section, American Bankers' Association, Twenty-third Annual Meeting, Chicago, Ill., September 23–24, 1918. Proceedings, 1918, pp. 397–404.

of working beyond the average requirement rather than to adjust the environment and working requirement so that they shall conform to the necessities of a working population physically below par and encouraged by such measures to remain below par.

There is also need to combat the notion that work in itself is a curse and that the lighter the work the happier the nation.

Sir James Paget said:[1] "You will find fatigue has a larger share in the transmission of disease than any other single cause that you can name." The proposition may well be reversed. If a man is neither infected nor poisoned nor lowered in his resistance by faulty personal hygiene, it is questionable whether in an ordinary working day fatigue can really do anything but make rest a welcome luxury.

Prof. F. S. Lee,[2] in answering a query as to the possible influence of sub-standard health conditions in the causation of fatigue and the separation of this influence from other factors and its evaluation, put the matter squarely when he said "this is a great gap in these investigations yet to be filled."

Occupational Poisons and Disease.—At the Massachusetts General Hospital, only 9% of industrial workers treated suffered from conditions directly relative to the industry in which they were engaged.[3] This is an important cause of waste but cannot be treated in detail in this digest.

Economic Loss From Ill Health in Industry.—The value of an industrial life at age 31, the probable average age in industry, may conservatively be estimated as $8,000, using Farr's method and allowing for present wage scale.[4] (The figure $5,000 used elsewhere in the report, is the factor for the whole population regardless of age. The value varies with the age.)

Since we have found that there is an experiential basis for predicting a saving of 4 lives per 1,000 living per annum by the periodic physical examination and instruction of adults, we may present the following statement as exhibiting the saving from this method even apart from the organization of co-operative curative agencies:[5]

[1] Lee, F. S. The Human Machine. London. Longmans, Green & Co., 1918 p. 79.

[2] Industrial Fatigue. Annual Meeting American Public Health Association, New Orleans, October 27–30, 1919.

[3] Wright, Wade. An Industrial Clinic. U. S. Bureau of Labor Statistics Monthly Labor Review. December, 1917, v. 5, pp. 185–193.

[4] Fisher, Irving. Report on National Vitality Bulletin No. 30. Committee of One Hundred on National Health. Washington, Government Printing Office, 1909, p. 118.

[5] Jackson, C. W. The Influence of Medical Examination of Insured Lives: Health Conservation. Paper read before the Actuarial Society of America, Boston, Mass. October 16, 1913. Transactions, pp. 321–325.

Fisk, Eugene Lyman. The Possible Functions of the Life Insurance Company

Saving of 4 lives per 1,000 among 42,000,000 industrial workers.......	168,000 lives
168,000×\$8,000 (economic value of adult life)......................	\$1,344,000,000
Saving 2,920 days' illness per 1000 equals 122,640,000 days×\$3 (medical, nursing and other sickness costs)...........................	367,920,000
	\$1,711,920,000
Estimated cost of medical supervision [1] in industry at \$5 per capita...	210,000,000
	\$1,501,920,000
Cost of curative work (repair work, surgery, dental work and other curative measures cannot be closely figured but if intelligently organized it need not exceed \$500,000,000).....................	500,000,000
Net waste due to neglect to health supervision in industry (in round numbers)...	\$1,000,000,000

Economic Loss from Accidental Injury

Crum has estimated the total economic annual loss from public accidents in the general population as............................	\$2,229,156,000
based on the value of human life at various ages and the accident fatalities at those ages. This takes into account 45,000 fatal accidents in 1917 and an estimate of 5,625,000 non-fatal injuries by public accidents.[2]	
It has been estimated by the United States Department of Labor [3] that 875,000 people are annually disabled 4 weeks or more by industrial accidents. If we assume that the cost of turn over or replacement of these people is \$35,[4] that would mean a direct waste in turnover alone of 875,000×\$35.......................	\$30,625,000
Add for those killed (28,000×\$35)............................	980,000
Increased production cost due to industrial accidents................	\$31,605,000

At least 75% of the accident rate is preventable.[5] Even greater

in the Conservation of Health. Address before the Section on Social and Economic Science, American Association for the Advancement of Science, Cleveland, January 3, 1913. Reprint. Postal Life Insurance Company, New York.

[1] Drinker, C. K. and K. R. The Economic Aspects of Industrial Medicine. Journal of Industrial Hygiene, June, 1920, p. 60.

[2] Crum, Frederick S. Public Accidents and their Cost. Eighth Annual Safety Congress, 1919. Proceedings of the National Safety Council, pp. 1061–1064.

[3] Mock, Harry E. Reclamation of the Physically Handicapped. Journal American Medical Association, November 20, 1920, v. 75, No. 21, p. 1406.

Industrial Medicine and Surgery. Philadelphia and London, W. B. Sanders Co., 1919, p. 789.

[4] Drinker, C. K. and K. R. The Economic Aspects of Industrial Medicine. Journal Industrial Hygiene, June, 1920, p. 63.

[5] Bach, E. E. Labor Turnover and Its Relation to Mine Accidents. Eighth Annual Safety Congress, 1919. Proceedings of the National Safety Council, p. 849.

Price, C. W. (National Safety Council.) Some Outstanding Facts in the Safety Movement. American Labor Legislation Review, March, 1920, v. X, No. 1, pp. 25–26.

Williams, Sidney J. Communication to the Federated American Engineering Societies, May, 1921.

reduction has been made in some plants by safety measures and education. The economic value of these lives on the lowest basis of computation is $8,000 each and the saving of 20,000 of them (75%) would mean an economic gain in industry of............	$160,000,000
If we apply this rate to the general population on the basis figured by Crum, it would mean a saving of............................	$1,671,867,000

Special Items of Loss

Tuberculosis:	$500,000,000 annually from death alone;[1] $26,000,000,000 in this generation from diminished longevity.
Typhoid:	$135,000,000 annually.[2]
Hookworm:	Dowling[3] estimates loss from hookworm at least $250,000,000 annually: 33% increase in industrial efficiency has resulted from hookworm[4] prevention in certain sections.
Malaria:	$100,000,000 annually.[5]

These are all theoretically wholly preventable—at least 75% practically preventable.

To remedy the unfavorable health conditions discussed in this report, there is need to develop among the people at large a higher sense of responsibility for the care of their bodies; in other words, higher ideals of personal hygiene, as well as in citizenship generally. In order practically to apply these ideals, organization and certain governmental and social machinery is necessary. The possible lines of organization may be grouped as follows:

Federal;
State;
Community;
Industrial;
National, State and Local Extra-Governmental Health Agencies

Federal.—A Federal Department of Health, with a Cabinet Officer in charge of it, has been the ideal for which progressive health workers have striven for many years. If this is not attainable—it has been attained in Great Britain—an alternative is the concentration of federal health activities and related social activities in one department.

[1] Dublin, Louis I. and Jessamine Whitney. On the cost of Tuberculosis. American Statistical Association Quarterly, December, 1920, pp. 441–450.

[2] Gay, Frederick P. Typhoid Fever. Considered as a Problem of Scientific Medicine. New York, Macmillan Company, 1918, p. 23.

[3] Dowling, Oscar. Sociological Aspects of Hookworm Disease. American Journal of Medical Sciences. July, 1920, pp. 595–598.

[4] Farrell, John A. Hookworm Disease, its Ravages, Prevention and Cure. Columbia, South Carolina Board of Health, 1918.

[5] Hoffman, Frederick L. A Plea and a Plan for the Eradication of Malaria throughout the Western Hemisphere. An Address read in Abstract before the Southern Medical Association, 10th Annual Meeting, Atlanta, Ga., November 14, 1916. Reprint Newark Prudential Press, 1917, pp. 46–48.

Without considering in full the ramifications and subsidiary activities of such a department, we may list the following major functions that would come within its scope:

1. Disease control
2. Vital statistics
3. Child hygiene
4. Industrial hygiene
5. General sanitation
6. Laboratory
7. Health education
8. Medical and social service.
9. Housing.

State.—A State Board of Health would in many respects follow the lines of organization of the federal department. Special functions and activities may be emphasized as follows:

1. Divisional health officers
2. Inspectors
3. Health centers
4. Public health education
5. Maternity
6. Child Welfare
7. Hospitals
8. Sanatoria
9. Industrial medicine and hygiene
10. Foods
11. Drugs and poisons
12. Personal hygiene
13. Physical training for boys
14. Physical training for girls
15. Periodic physical examination
16. Housing.

Community.—The functions of a community Board of Health under the supervision of a Commissioner of Health or, in small localities, under the supervision of a full-time Health Officer, may be suggested as follows:

1. Health centers
2. Pre-natal work
3. Infant welfare work
4. Pre-school work
5. Public health nurse
6. Hospital and sanatorium
7. Day and night camp
8. Public health education
9. Factory inspection
10. School inspection
11. Personal hygiene
12. Periodic physical examination (private and public facilities for)
13. Dental prophylaxis
14. Community house
15. Parks
16. Playgrounds
17. Athletics
18. Baths and swimming
19. Housing.

Industrial.—The limitation of industrial responsibility for the health of the worker should be clearly understood. There are, however, certain opportunities and responsibilities which, within these limitations, may be grouped as follows:

1. Work
2. Industrial hygiene and sanitation
3. Medical supervision
4. Industrial nurse
5. Personal hygiene
6. Safety first and first aid
7. Mutual benefit and group insurance
8. Vocational guidance
9. Periodic physical examination
10. Physical examinations for new employees
11. Dental prophylaxis

Personal Relations

1. Education
2. Church
3. Social life
4. Play and recreation

Family Circle

Man—the primary unit in industry;
His Family—the secondary and controlling unit.

National, State and Local Extra-Governmental Agencies.—There is need for the prevention of overlapping and duplication of work in such agencies. This need has been partly met by the organization of the National Health Council, comprising the following organizations:

American Public Health Association;
American Red Cross;
American Social Hygiene Association;
Conference of State and Provincial Health Authorities of North America;
Council on Health and Public Instruction of the American Medical Association;
National Child Health Council;
  Affiliations: American Child Hygiene Association;
    Child Health Organization of America;
    National Child Labor Committee.
National Committee for Mental Hygiene;
National Organization for Public Health Nursing;
National Tuberculosis Association;
United States Public Health Service; (Conference Member).

Private Agencies.—Among private agencies, with enormous resources for improving the public health, we must number the life insurance companies. A number of these companies are now doing important public health work, giving to their policyholders the privilege of periodic health examinations either through the Life Extension Institute or through their own medical departments.

The National Industrial Conference Board in its Research Report Number 37 gives the following digest of important medical work in industry now being carried on:

Annual Work of Industrial Medical Departments by Size of Establishments. 207 Establishments

Size of Plant. Less Than	No. of Plants Reporting	No. of Workers	New Injuries	New Injuries Per Worker	Redressings	Redressings Per New Injury	Medical Cases	Medical Cases per Worker	Physical Examinations
1,000	52	31,846	106,776	3.35	119,977	1.12	79,578	2.50	13,793
1,000–2,000	54	76,964	114,986	1.49	178,900	1.55	211,204	2.74	45,692
2,000–5,000	59	179,193	236,978	1.32	439,697	1.86	340,887	1.89	97,784
5,000–10,000	23	149,947	211,381	1.40	461,529	2.19	194,092	1.29	94,795
Over 10,000	19	326,877	364,686	1.11	883,559	2.42	247,970	.75	273,754
Totals	207	764,827	1,034,807	1.35	2,083,662	2.01	1,073,731	1.40	525,818

A minimum medical organization and equipment has been suggested as follows:

For a factory population of 2,500: One full-time physician, two nurses, a dental hygienist for prophylactic work only, clinic and dental equipment.

For smaller plants a co-operative medical service can be utilized, either through existing organizations established for this purpose, or special organizations arranged in industrial centers where they are needed.

EUGENE LYMAN FISK.
C. T. SHARPE.

CHAPTER XVI

EYE CONSERVATION

By Dr. Earl B. Fowler

I. HAZARDS

Accident to Eyes—Industrial Loss.—There is still appreciable loss to industry through preventable accidents resulting in injury to the eye. The Industrial Commission of Pennsylvania reported that last year (1920) 18 persons lost both eyes in industrial accidents, the compensation totaling \$63,731; 652 workmen lost one eye, the compensation totaling \$826,674.[1]

In the United States the total number of industrial blind is approximately 15,000, or 13.5% of the total blind population; this type of injury being the leading causative factor of blindness. Some rather interesting estimates of the cost of maintaining these blind artisans have been compiled, but actual economic loss cannot possibly be estimated. Certainly the personal loss from blindness is far greater to the individual than from other kinds of defect. The eye was involved in 10.6% of all *permanently disabling accidents*.[2] Very complete tables indicating the causes of accidents to the eye are given by Harry Best in "The Blind."[3] Statistics as to number, severity and time-loss are, however, quite unsatisfactory owing to the irregularity in the reporting that still exists, in spite of uniform forms recommended and urged, but are complete enough to demonstrate that the continuing sacrifice is very large.

Effectiveness of Protective Methods.—Present protective methods as applied in large plants have effected a great reduction in injuries. The Commonwealth Steel Company of St. Louis, Missouri, reports:[4]

[1] Pennsylvania Department of Labor and Industry. Bureau of Workmen's Compensation. Report, 1920.

[2] Best, Harry. The Blind: Their Condition and the Work Being Done for Them in the United States. New York. Macmillan, 1919. (Average from state reports), p. 197.

[3] Ibid., pp. 173–209.

[4] Commonwealth Steel Company, St. Louis, Mo. (Works: Granite City, Ill.) Letter from Earl F. Varnum, Safety and Fellowship Department, to Guy A. Henry, New York City, February 5, 1921.

" We started accident prevention in 1912. Part of our work is very hazardous to the eye as it involves the chipping of steel castings by means of pneumatic hammers, consequently in this department there are a great many flying chips. Up until 1912 it was no unusual thing for us to have men injure their eyes and even have their eyes put out by these flying chips. When we started our Safety Work in 1912 we made it a rule that every man in this department should be provided with goggles and compelled to wear them, also in any other department in the plant where there was any chipping or grinding to be done. We have had wonderful results since that time, *not having an eye lost in our shop in any of these departments.*

" We had considerable trouble at first in getting the men to wear the goggles, even having to discharge a few men who refused to do so; but in showing the men the advantages they had in wearing the goggles the large majority were glad to have them and wear them. We have had hundreds of goggles broken from flying chips, and have had a good many cases where particles of glass flew into men's eyes, but these cases do not result in any serious condition, for the men come immediately to the dispensary and have the particles removed.

" We are now using laminated lenses which even does away with the particles of glass getting into the eyes, as the lenses are made in two parts with a strip of celluloid between them making them non-shatterable. We even go further than this and provide special lenses in goggles for men whose eyesight is not normal. We also have physical examination of our men, and when a man has only one eye or his eyesight is failing, we do not allow him to work in these departments where there is danger of having his eye put out by flying chips."

The National Safety Council reports as to the experience of the American Car & Foundry Company, as follows:[1]

" Will you please note that there is at least 75% to 80% reduction in eye accidents where goggles are in use in a plant? The per cent of reduction would, undoubtedly, be much higher if the men would wear the goggles more conscientiously.

" ' The American Car & Foundry Company has proven that the use of goggles has reduced accidents in their plant 75%. It is argued by some that the wearing of goggles in the event of accident only jeopardizes sight the more, on account of the liability of injury to the eyes from the broken glass of the goggles. As a matter of fact, however, this apparent danger is without foundation, as may be judged by the following evidence. There has not been a single case of injury to the eye from broken glass since goggles were introduced into the shops of the New York Central Railroad. The American Steel Foundries Company collected 94 pairs of goggles, all with lenses broken from flying chips of steel from their works during a period of three months, and in every case the eyes had escaped injury. Had the goggles not been worn, some of the eyes at least would have been lost. In another large steel foundry where spectacles had been worn since 1911, 48 pairs of goggles were collected in one month with lenses broken by flying pieces of steel;

[1] National Safety Council, Chicago. Letter from J. J. Lamb, Safety Engineer, to Wilson Goggles, Inc., Reading, Pa., March 1, 1921.

297 pairs were gathered among the several foundries covering a period of six months. During this entire period not one serious eye accident occurred.' "[1]

The Union Pacific Railroad Company reports on the use of goggles as follows:[2]

"Our employees are now all required to wear goggles on eye dangerous work. Once in a while some fellow takes the chance and leaves his goggles up on his cap and has an eye injury or loses his sight entirely, but these cases are so very rare they are hardly worth mentioning. I believe it would be safe to say we do not have over one-fourth of one per cent.

"We occasionally have a pair of goggles sent us wherein the lens is shattered but the man's vision was not impaired. There is absolutely no argument that can be put up against the universal use of wearing goggles in eye dangerous work.

"I am just forwarding to-day a photograph of one of our car repairers who was nailing siding on box cars, eyes absolutely protected and unimpaired.

"Hoping this information will be of some benefit to you in prosecuting the universal use of goggles in eye dangerous work, thereby doing a great service to humanity. . . . "

The Bethlehem Steel management is very rigid in demanding that protection be complete, supplying goggles according to a code it has formulated and printed.[3]

Striking reduction in eye accidents is shown by the following table from the American Locomotive Company:[4]

(Yearly Average)	Number Accidents Requiring Medical Attention	Number Eyes Lost	Average Number Full Time Men per Year Employed	Number of Injuries Per 1000 Full Time Men per Year
1910–1913	448	10.5	11,506	38.9
USE OF SAFETY GOGGLES ESTABLISHED				
1914	86	1	5,004	17.2
1915	52	2	3,311	15.7

[1] Posey, William Campbell. The Hygiene of the Eye, p. 268.

[2] Union Pacific System (The St. Joseph & Grand Island Railway Company) Omaha. Letter from H. H. Adams, Assistant to General Manager, to Wilson Goggles, Inc., Reading, Pa.

[3] Bethlehem Steel Company, Bethlehem, Pa. Bureau of Employment, Compensation and Welfare. Goggle Code. (Leaflet.)

[4] National Committee for the Prevention of Blindness, New York. Eye Hazards in Industrial Occupations. Publication No. 12, p. 113.

In the American Steel Foundries the proportion has been reduced 85%.[1]

Basing judgment on the experiences of the concerns making these and similar reports, it is evident that the continued loss is at least partially preventable and due to failure to apply protective measures rather than to any fault in the measures themselves as they have been developed.

Protective Devices—Code.—All industrial processes involving eye hazards demand protective measures, the protector either being applied to the machines or tools or worn by the worker. Definite codes have been formulated by some industries stipulating all occupations in which goggles must be worn and specifying the type of goggle required for a particular protection. Such codes have now been published by several of the states (including Pennsylvania) and by the Bureau of Standards at Washington.[2] The codes are very explicit as to the best-known designs and as to the manner of testing any protector in question. All concerns are thus given an adequate means of judging what protection is necessary.

Dangerous Operation.—Under the National Code the processes or operations in which protection to the eyes is necessary are divided into nine groups as follows: No attempt is made, however, to indicate their order of importance.

1. *Objects.*—Processes in which protection from relatively large flying objects is required, such as chipping, calking and riveting.

In this group, the danger of severe damage is relatively great as the penetrating wound, particularly when the foreign body remains or carries with it infectious material, generally destroys or greatly impairs the eye, and introduces the danger of inflammation in the other eye. The direction from which the foreign body comes is uncertain, as is the time element (compared with the stream from an abrasion wheel) and the danger from fellow workers is greater in this group. Strength of lens, tendency of fragments of glass to remain in place and not fly when a lens is broken, and strength of side screen, though making a goggle heavy, are imperative, and weight does not mean discomfort if adjustment of the frame is accurate.

2. *Dust and Small Particles.*—Processes where protection from dust and small flying particles is required.

The use of abrasion wheels gives rise to a large number of relatively less severe injuries. Lighter goggles are required, but their constant use is most necessary.

[1] Ophthalmology, 1916, v. XII, p. 61.

[2] United States Department of Commerce. Bureau of Standards National Safety Code for the Protection of the Heads and Eyes of Industrial Workers. Handbook Series No. 2, 1921.

There is a steady increase in the use of abrasion wheels; usually those made of alundum, carborundum, crystolon, or like products. The fine particles of the wheel or the metal are thrown at incredibly high speed and at temperature so high that they will fuse into the glass of a goggle surface. Damage to the cornea is less apt to be severe, if prompt careful treatment is administered, than from injuries in Group I, but the frequency of recurrence often produces several small opacities which definitely impair vision.

Glass plate shields attached to the machines are used in part. When a wheel is used for short periods by different workmen, the shield has an advantage, but may prove unsatisfactory because of rapid clouding from pitting, grease and dust.

3. *Dust and Wind.*—Operations where protection from dust and wind is required, e.g., automobile driving, locomotive driving and firing.

Locomotive engineers and firemen find great need for shielding their eyes and very definite discomfort and difficulty in wearing goggles. Firemen especially are at a disadvantage since they must turn frequently from the fire door to the cab window for observation. It is important that the fireman see clearly and quickly in looking ahead, yet his goggles coming suddenly into cooler air from the heat of the fire become covered with a film of steam, or sweat from the fireman's own exertion. "Penciling" the lenses (using some non-sweat compound) and wearing a "sweat band" across the forehead is of some help, but only by care on the part of the railroads in supplying the proper goggles and giving instructions as to their care will these objections gradually be overcome. Lenses must be white and very perfectly surfaced, with lens for visual correction when needed.

4. *Splashing Metal.*—Processes where protection from splashing metal is required, e.g., casting.

The goggles advised for this use have been found to resist breakage or penetration to a remarkable degree, saving many eyes in moisture explosions incident to "pouring" and similar work. The frames must be highly resistant to heat and so designed that molten metal cannot get through the ventilator holes.

5. *Gases, Fumes and Liquid.*—Processes where protection from gases, fumes and liquids are required, e.g., handling of acids and caustics, galvanizing tanks, and japanning.

6. *Excessive Dust and Small Particles.*—Processes where protection from an excessive amount of dust and small flying particles is required, e.g., sand-blasting. Very complete protective apparatus has been developed and is obtainable.

7. *Reflected Light or Glare.*—Operations where protection is required from reflected light or glare, e.g., sunlight from roofs, road-beds, water,

snow. Lighter tints in lenses but of a color that will filter out ultra-violet heat and excessive visible rays.

8. *Radiant Energy—Moderate Reduction Required.*—Processes where protection from injurious radiant energy with a moderate reduction in intensity of the visible radiation is required, e.g., oxy-acetylene welding and cutting, open-hearth, Bessemer furnace work.

9. *Radiant Energy—Large Reduction Required.*—Processes where protection from injurious radiant energy with a large reduction of the visible radiant energy is required, e.g., electric arc welding and cutting.

Goggles—Requirements and Standards.—The conclusion has been reached that no commercial illuminant radiates, for any working intensity of illumination, enough ultra-violet energy to be at all harmful, provided one exercises ordinary discretion in keeping unpleasantly bright visible light out of the eyes. Therefore, except for "trimming" or testing globes or similar constant subjection, filtering glasses are rarely necessary in ordinary occupations. The glass-enclosing globes of the lamps are sufficient to reduce any injurious radiation far below the danger point. Though discomfort may arise from intense lights in the range of vision, no permanent damage is likely to occur.[1]

In steel making, furnace work and welding, both oxy-acetylene and arc, the use of colored lenses is necessary. The ultra-violet rays even in this process, though apt to produce little more than a conjunctivitis, can reach the retina of an unprotected eye, and should be filtered out.[2] The infra-red waves are present in such sources but the greater part of the damage done by them to the tissues is due to their thermic action. The protection needed in welding is from the ultra-violet, intense light and heat.

Goggles for this use must meet these filtration requirements and still permit sufficient vision. The data published in Technologic Paper No. 93, U. S. Bureau of Standards, the work of W. W. Coblentz and W. B. Emerson, include tables covering practically all of the glass used in goggles at the present day with the power of filtration that they have been found to possess. From this it is possible to select the lens best suited for any one process. For arc welding and other intense sources they recommend black, green or yellowish green. Where more light must be permitted to pass, light bluish green or sage green is advised. The cobalt blue often used is *not* effective. Most of the glass sold under trade names has data readily accessible concerning its action. "The Bureau of Standards will test any glass submitted to them."[3]

[1] Bell. Proceedings of American Academy Arts and Sciences, v. 48, 1912, p. 1.

[2] Coblentz, William W. and W. B. Emerson. Glasses for Protecting the Eyes from Injurious Radiations. (United States Bureau of Standards, Technologic Paper No. 93.) 1919.

[3] King, W. G. Vice-president Julius King Optical Company. Safe Heads and

Very definite and severe tests are laid down by the National Code for determining the resistance of glass to breakage and the holding of the fragments in the frame after breakage. The specifications for frames are also given. Yet, in spite of this accessible information, the knowledge regarding the characteristics of adequate protection appears to be definitely limited to a few, mainly those responsible in the larger organizations. The distribution of such available information must be carried out as it is most important for smaller groups of workers to realize the necessity for safeguarding their eyes and to know the most certain means of accomplishing this. Much of the distribution will be the result of the activities of those commercially interested and there should be some check on the advertising. False statements or the sale of goggles under misrepresentation that they meet all of the specified requirements of the codes, introduces a grave menace.

Overcoming Objections to Goggles.—The matter of objections to wearing goggles has been gone into many times. These have been largely overcome through educational campaigns and many firms have developed additional measures for enforcing protection. In some of the states laws have been enacted regarding protection but in most instances these are not sufficiently explicit nor are they efficiently enforced. A reduction in compensation as penalty for failure to take advantage of all protective means has been suggested. Also that the reduction in insurance premium rates that accompanies improved practices be emphasized, for the educator must be made to realize that it is worth while to educate, reform and enforce. There is, however, much opportunity to improve the goggles now in use and the manufacturers are most active to this end. For example, the range of vision, with a glass sufficiently small to give the needed strength for severe hazards is such as to make them objectionable in certain of the structural work.[1] Also, up to the present time there has been a reduction in the strength incident to the surfacing of the glass to correct for visual defects. The careful, exact fitting of the frames to facial contour on which depends comfort and much of the value, is frequently difficult and certainly not universal.

Unavoidable Accidents—Treatment.—A certain number of accidents involving damage to the eye are still unavoidable. The presence or absence of permanently detrimental results is very likely to depend on the promptness and efficiency of the treatment that is instituted. Provision for first aid treatment must be close and the men must be taught to report without making any attempt to correct the condition themselves. In a number of the plants small foreign bodies that can be so removed

Good Eyes. (Lecture, Safety Fundamentals.) Safety Institute of America, New York. 1920. P. 78.

[1] Cross. Sun Ship Building Company, Chester, Pa.

are wiped off with a cotton swab moistened with a mild antiseptic solution. If anything further is necessary to dislodge them, or if injury has been done, a sterile dressing is applied, and the worker is sent to the surgeon at once. When special hazards exist, special measures should be most accessible, for it is often the first few seconds that count in the treatment. For instance, when acids or caustics are used a stream of water that may be turned into the eye and bottles of a neutralizing solution of the proper strength should be kept within easy reach.

With the improvement of motor transportation that has come in the last few years, efficient surgical care is readily accessible in most locations. Definite relations should be established with the surgeon to whom cases are to be sent and a program for first aids should be laid down by him to meet the individual requirement. Emphasis should be put on the importance of X-ray in all cases where there is even a remote possibility of the presence of an intra-ocular foreign body.

II. VISION

Correction of Sub-Standard Vision—Favorable Opinion.—That correction of sub-standard vision produces an increase in return that will pay for its cost—though no set of figures at hand will place this return on a dependable monetary basis—is the conclusion of the management in plants where several years of trial has provided a basis for judgment. As examples of this, we have the experiences of the Hood Rubber Company, Watertown, Massachusetts; the Cheney Silk Company, South Manchester, Connecticut, and Sears-Roebuck & Company, Chicago.

At the Hood Rubber Company[1] a specialist has been employed for three years on a part-time basis, giving three hours a morning almost entirely to eye examination and visual correction. The mechanical work is carried out by a manufacturing concern that sends a representative to take frame measurements and adjust delivered glasses, the company paying for the glasses at less than the usual retail rate and charging the employee the same, in weekly payments where necessary. The entire expense for the specialist, however, is carried by the firm. The employee in whom a condition of sub-standard vision is determined at the time of examination for employment or any subsequent examination, is advised to avail himself of this service, and most of them do, but there is no compulsion and no exclusion from employment because of sub-normal acuity. All employees reporting at the hospital complaining of symptoms that might be considered asthenopic in character are referred to the special-

[1] Quimby, R. S. Hood Rubber Company, Watertown, Mass. Personal Interview. April, 1921.

ist. The total number supplied with glasses was about 1,000 per year. The opinion as to results has been based on personal observation of foremen and personal comments of the employees themselves.

At the Cheney Silk Company [1] and at Sears-Roebuck & Company [2] the method is somewhat different, those falling below standard or complaining of symptoms being sent to one specialist whom they pay for the examination at a very reduced rate, so arranged because of the number and the fact that the companies assure payment. Glasses are supplied through the house at wholesale or reduced rates, on the installment plan where necessary. The time loss incident to the examination is at the companies' expense, but this has been shortened to a probable minimum. Here again the reports of foremen, department heads and industrial workers have been such as to lead to continuation of the service.

Measuring Degree and Permanence of Benefit.—Approximate valuation figures may be secured as further study gives more data, and as labor conditions become sufficiently stable that other factors may be held at a stationary level while quantity and quality variations in production before and after correction of vision may be observed. Figures may be secured either for numbers of individuals—Dr. Burlingame believes valuable data can be better obtained thus—or for groups in separate occupations. The unusual difficulty of maintaining the other factors at a stationary level is emphasized by Dr. Burlingame who found that the definite improvement noted in individual cases was quite temporary, the period over which it lasted being only six weeks to two months, and concluded that it was the result of the psychic stimulation incident to the examination, the supplying of glasses which were worn for the first time, and the feeling of being watched. Dr. Fisk feels that though it may not be possible to show that there is an improvement immediately following corrective measures, a drop in efficiency that would otherwise surely come later would be prevented.[3] This conclusion is necessarily reached by speculative means but the groundwork on which it is built is apparently sound.

Question of Correcting All Sub-Normal Vision.—It may be possible through study to decide as to the soundness of the theory that advises correction of all vision falling below a certain level, this level at a height varying with the acuity requirements of the different grades of work. Dr. Nelson M. Black states that " a person with one-fourth, one-third or

[1] Burlingame, C. C. Cheney Silk Company, South Manchester, Conn. Personal Interview. April, 1921.

[2] Mock, Harry E. Sears-Roebuck & Company, Chicago. Personal Interview. April, 1921.

[3] Fisk, Eugene Lyman. Life Extension Institute, New York City. Personal Interview. April, 1921.

even one-half standard visions cannot be considered as competent a workman as one with standard,"[1] but only much further observation is going to give facts as to the amount of time-labor lost by permitting continuation of work by those with this handicap. The normal or corrected eye loses less rapidly in speed of discrimination, speed of adjustment, and in the power to sustain clear-seeing, than the eye with even a slight visual defect.[2]

Eye work, the use of the eyes, produces fatigue, general and local, as does any prolonged physiological process, but with eyes approximating the normal under good working conditions, Professor C. E. Ferree has demonstrated this to be barely appreciable in four hours as measured by reduced sensitiveness.[3] But with defective visual apparatus requiring excessive corrective focusing effort or under sub-optimum lighting conditions, this fatigue develops rapidly so that in the same period of time the sensitiveness may be reduced to 43% normal. Any excess eye fatigue results in nerve trauma, which, repeated frequently, produces symptoms so often noted as to be beyond question—classed under the heading of asthenopia. When this condition has been reached there must be a time-labor loss from reduction in quantity and quality production. Where the symptoms are not noted the fatigue is produced to the same degree while the reserve of adaptation of the individual is such that it is not too far broken down, but Dr. Fisk feels that damage is sure to come later unless protected against.

In addition to this, actual loss, from failure to see sufficiently well to determine details of this process, or from mistakes, is frequent where sub-standards are not corrected. For example, at the Hood Rubber Company 20% of the inspectors were found to be unable to see sufficiently well to determine defects.[4]

Frequency of Sub-Standard Vision.—The percentage of employees with sub-normal vision has been determined in several carefully recorded series of investigations. For example, J. W. Schereschewsky found that in a total of 2,906 garment workers, only 743, or a little over 25% had bilateral normal vision; 17% having normal vision in one eye, with the other defective.[5] The highest percentage of defective vision was in the

[1] Black, Nelson M. Modern Illumination and its Relation to Ocular Comfort. Wisconsin Medical Journal, 1914–1915, v. 13, p. 316.

[2] Ferree, C. E. and G. Rand. Effects of Variations in Intensity of Illumination on Functions of Importance to the Working Eye. Transactions, Illuminating Engineering Society, 1920, v. 15, pp. 769–792.

[3] Ferree, C. E. Problem of Lighting in Its Relation to the Efficiency of the Eye. Science, July 17, 1914, pp. 84–91.

[4] Quimby, R. S. Hood Rubber Company, Watertown, Mass. Personal Interview. April, 1921.

[5] Schereschewsky, J. W. Studies in Vocational Diseases; The Health of Garment Workers. U. S. Public Health Bulletin No. 71, 1915, p. 75.

class of workers who made the greatest use of their eyes. The Life Extension Institute in its examination of more than 10,000 employees in factories and commercial houses found 53% with uncorrected faulty vision.[1] The Institute in its examination of 675 employees in the Underwood Typewriter Company, individuals engaged in close work, found 58% in need of correction by glasses.[2] Schereschewsky is of the opinion that "properly fitted glasses to correct even small defects is, for eye workers, an important part of the hygiene of the eye." Of the rejections in the National Army, 21.7% were because of eye trouble.[3] An examination of the vision of 3,000 employees of the Robert Gair Company, Brooklyn, N. Y., manufacturers of paper boxes, gave the following results; 22% normal, 38% astigmatic, 28% hyperopic, 7% myopic, and 5% color blind.[4]

In the Whiting-Davis Company, where a large amount of close fine work is done, all the employees' eyes were tested with the following results:

Glasses worn and satisfactory	8.3%
New glasses ordered for	83.3%
No glasses needed	8.4%

After being fitted with glasses 28% improved productivity was noted in comparing two months.[5] The only thing learned from further statistics is a confirmation of the fact that there are a large number in every group of workers who fall below the line. This is appreciably greater if the number with sub-normal vision in one eye are noted. The Bausch & Lomb Optical Company, Rochester, N. Y., have merely required visual correction without stipulating any individual to carry out the examination.[6] Those dissatisfied with their glasses have reported to one man (Mr. Max Poser) and he reports that more discomfort has resulted when there was a difference between the two eyes, even when one approached the normal, than with two equally defective eyes.

Standards Essential, and Proper Working Condition.—As in the correcting of other factors of occupational hygiene, standards have been set, so, after further study, visual acuity standards will have to be

[1] Life Extension Institute, New York City. Address at Banquet, December 3, 1919. (Pamphlet), p. 18.

[2] Life Extension Institute, New York City. How to Live. (A Monthly Journal of Health and Hygiene). July, 1919, p. 8.

[3] Survey, v. XL, 1918, p. 90.

[4] Brooks, C. H. Conserving Eyesight—For More Production, Textile World Journal, July 17, 1920, v. 58, p. 380.

[5] Factory, July 1, 1920, pp. 55–56.

[6] Poser, Max. Bausch & Lomb Optical Company, Rochester, N. Y. Personal Interview, April, 1921.

determined for each grade of workers and readjustments made, with alterations in our methods of testing acuity to suit conditions, until these standards give us the necessary minimum for each kind of work. As examinations are made at present, any set level would exclude workers shown by practical test to be very efficient producers.

Many sub-normal eyes will work well even for fairly trying work if conditions are good. Therefore it is first of all urgent to bring the working conditions up to the best, on the basis now understood. With relation to the eye, the first consideration is illumination; and on this subject much valuable data has resulted from the careful study given it.

III. ILLUMINATION

Improvement in Lighting Conditions Desirable.—Even the most superficial survey of lighting conditions reveals that in the majority of plants there is much improvement possible, in spite of the actual increase in production quantity and quality when poor illumination is corrected to standards now considered satisfactory.

The value of good illumination has been recognized for some time. It has been demonstrated to, and adopted by some industries; yet the following table, in agreement with the opinion almost universally expressed by illuminating engineers, demonstrates that it has not been sufficiently appreciated, on a monetary basis, to force its general adoption. The reason for this is certainly not clearly evident.

Condition of Lighting in 446 Plants Investigated.[1]

Excellent	8.7%
Good	32.0%
Fair	29.1%
Poor	18.8%
Very poor	3.5%
Partly good, partly poor	7.8%

There seems to be no question of loss due to faulty conditions. One observer estimates the loss in this country as above the entire cost of illumination.[2] (1918) Again it has been shown that improved lighting systems increased output 2% in steel plants and as much as 10% in shoe factories and textile mills where work is more exacting.[3] These are very definite figures determined under an accurate survey, given here only for the two extremes, but certainly convincing. "Experiments

[1] Eastman, R. O. Transactions of the Illuminating Engineering Society. February 10, 1920, v. XV, No. 1.

[2] Illuminating Engineering Society Transactions.

[3] Eshleman, C. L. Industrial Lighting. Proceedings, American Institute of Electrical Engineering, January, 1913, pp. 41–54.

by Mr. Durgin in industrial plants showed that the work was very materially speeded up by increasing the average lighting two or three times what was formerly considered good practice.[1]

Available Codes.—Codes prepared by state industrial commissions, by the Illuminating Engineering Society and by the large manufacturers of lighting equipment, make it possible to determine suitable installation even when an illuminating engineer is not employed, while new simplified apparatus makes the testing of results practical. There is at least one small, compact, reasonably accurate foot-candle meter on the market. Also much can be done in the smaller concerns by the common sense application of the rules laid down in these codes without undue expenditure.

Requirements for Efficient Lighting.—The simple requirements on which efficient illumination is based are:

1. Light enough to see by to do work—too little or too much producing discomfort.
2. Diffusion to avoid sharp contrasts and deep shadows.
3. Elimination of glare.

The quantity or intensity of illumination necessary to produce a brightness of surfaces such that the eye can perform its functions, covers an enormous range. All that is necessary for ordinary comfortable reading is 1.73 foot-candles, but this is below the best for most kinds of work. The standards required in the Massachusetts tentative code[2] are as follows, expressed in terms of foot-candles at the work: (*a*) roadways and yard thoroughfares, ordinary practice 0.05 to 0.25, minimum 0.02; (*b*) storage spaces, ordinary practice 0.05 to 1.00, minimum 0.25; (*c*) stairways, passageways, aisles, toilets, and washrooms, ordinary practice 0.75 to 1.59, minimum 0.50; (*d*) rough manufacturing, such as rough machining, rough assembling, rough bench work, ordinary practice 2.00 to 4.00, minimum 1.00; (*e*) rough manufacturing, involving closer discrimination of detail, ordinary practice 3.00 to 6.00, minimum 2.00; (*f*) fine manufacturing, such as fine lathe work, pattern and tool making, light-colored textiles; office work, such as accounting, typewriting, etc., ordinary practice 4.00 to 8.00, minimum 3.00; (*g*) special cases of fine work, such as watch making, engraving, drafting; close work on dark-colored textiles, ordinary practice 8.00 to 15.00, minimum 5.00.

[1] Ferree, C. E. and G. Rand. Effect of Variations in Intensity of Illumination on Functions of Importance to the Working Eye. Transactions, Illuminating Engineering Society, 1920, v. 15, pp. 769–792.

[2] Massachusetts State Board of Labor and Industries. Tentative Draft of Rules and Regulations for Lighting Factories, Mills and Other Industrial Establishments, 1918.

Experiments with Varied Intensities.—Discussing the effect of variations of intensity of illumination on functions of importance to the working eye, before the Illuminating Engineering Society, October, 1920, C. E. Ferree and Gertrude Rand said:[1]

"Some of the beneficial results of increase of intensity may be summarized in six (6) points: (1) Slow, but substantial gain in *acuity* for all but low intensities where the gain is rapid; (2) gain in speed of discrimination; (3) gain in speed of adjustment; (4) gain in the power to sustain clear seeing; (5) if the task, not the visual angle, is kept the same for the different illuminations, i.e., if the working visual angle is changed to sustain the same percentage to the minimum visual angle at which the observer can just discriminate detail at the different illuminations, there seems to be no measurable effect of increase of illumination on the power of the normal eye to sustain the clear seeing of its object for a period of time. (6) Does the eye tend to fatigue more under the high illumination?"

In one series of experiments four observers were used and the acuity was determined at 0.001, 0.005, 0.01, 0.015, 0.02, 0.05, 0.01, 0.2, 0.4, 1, 2, 3, 5, 10 and 20 foot-candles of light normal to the test object.

Determinations were made of the time required to change the eyes from a position of exact adjustment for a clear seeing of the test object at 20 cm. ($7\frac{7}{8}$ in. to one at 6 meters (19 ft. 8 in.) and back again to 20 cm. ($7\frac{7}{8}$ in.)

The ideal condition is to have the illumination of correct intensity as uniformly distributed as possible over the field of vision with no extremes of surface brightness.[2] Dr. P. W. Cobb holds that the visual acuity is best when the brightness of the surroundings is about equal to that upon which the vision is centered.[3] Cravath finds that the comfortable limiting ratio between the brightest surface and its surroundings varies somewhere between 1 to 100 and 1 to 200 and preferably until we have more evidence, the contrasting brightness of adjacent surfaces should, if practicable, be kept below the 1 to 100 ratio where long-continued work is done.[4] No brilliant light source should be so located that it is visible. It is especially a source of discomfort when it comes from below as reflected from working surfaces. The theory is that the lower part of the retina has for centuries past been the part that has received the greater intensity of light and has become adapted until this excess

[1] Ferree, C. E. and G. Rand. Effect of Variations in Intensity of Illumination on Functions of Importance to the Working Eye. Transactions, Illuminating Engineering Society, 1920, v. 15, pp. 769–792.

[2] Black, N. M. Modern Illumination and Its Relation to Ocular Comfort. Wisconsin Medical Journal, 1914–1915, v. 13, p. 316.

[3] Cravath, J. R. Ocular Relations of Interior and Exterior Lighting, American Encyclopaedia of Ophthalmology, 1916, v. VIII, p. 6,140.

[4] Ibid.

stimulation causes less discomfort than light in excess coming from below onto the upper part, even of sun origin, as reflection from sand, snow or water. It is also a fact that the upper lid and upper lashes protect the pupil area to a greater extent than do the lower.

Reflectors or shading devices used with lamps placed above the heads of the users should be constructed so that the shades intercept the light emanating from the lamp at all angles more than 25 degrees from the vertical.[1]

The Massachusetts code gives "15 degrees or less below horizontal for light less than 20 feet high." The position of the shading can be worked out in each individual instance without regard to the theory of angles if the basic principle is considered that no artificial light should be placed so that its undiffused light will shine directly in the eyes of the user or those near by for any considerable length of time. The more fixed the position of the user the more important this is. As a first step the least that can be done is to use diffusing glass globes, reflectors or shades between the eyes and the light. All are agreed that glare must be controlled.

The three types of lighting systems may be briefly and practically summed up as follows:

Types of Lighting Systems—Direct.—The advantages of the direct system are low cost of installation and maintenance, economic distribution of lamps, and little loss by absorption. The disadvantages include a tendency to over-light the work and leave sharply contrasting dark areas around it. Such localized lighting with opaque reflectors should only be used in connection with some good system of generalized lighting.

Semi-direct.—The semi-direct in which the brightness of the bowls is reduced below 250 milliamberts meets certain requirements. These reflectors are best when made of dense glass or similar material, highly polished on the inside so that the globe gives about the same brightness for equal area as the reflecting ceiling. This requires a greater wattage than the direct systems but there is a reduction of the glare and a much better diffusion.

Indirect.—In this system the source is hidden by an opaque bowl and all illumination comes from ceiling reflections. The glare is reduced to a minimum, shadows are practically abolished and the greatest diffusion is assured. Fatigue is much slower than with either of the other two systems for work that requires reading. Reading and similar use of the eyes seems to offer a very different condition in fatigue development than do various forms of work. Highest acuity and least loss from fatigue cannot be had at the same artificial intensity (both being obtainable under correctly controlled daylight only.) "For all purposes of clear seeing,

[1] American Encyclopaedia of Ophthalmology.

whether the criterion be maximal acuity or the ability of the eye to hold its efficiency for a period of work the best results are given. . . . by the systems that give the best distribution. The effect of distribution, however, on the ability of the fresh eye to see clearly is not nearly so great as it is on the power to hold its efficiency for a period of work."[1] Indirect lighting is, therefore, probably the best artificial system for office use, but might be a hindrance in other kinds of work because of a decrease in the possibility of judging distances, due to the artificial appearance created by the elimination of shadows. Intensity on the working plane with indirect illumination usually specified is 2.5 to 3.5 foot-candles.[2] The use of an opaque eye shade did not increase efficiency; in fact reduced it with indirect system unless the shade was lined with white.

Daylight.—Daylight from windows is superior in that it is light from a large source that strikes the desk tops at an angle which is usually such that the glare from papers is reduced to a minimum. The window area should be as large a percentage of the total wall area as possible. *Translucent* shades to cut out direct sunlight must be fitted to windows where needed, working from the bottom upward or from the top as conditions indicate. Ground glass and the like should be avoided in window sashes that are at or below the level of the eye, as they introduce a brightness equal to or greater than that of the sky on a part of the retina which is particularly susceptible to irritation from glare. The contrast to the adjoining walls and floor is also much too great. Fireproof glass is used to a great degree at the present time, making this a common condition. Clear glass gives an area of brightness only equal to that of the landscape. When the adjoining building makes the angle from the sky very sharp, prism glass (there are several commercial forms) may be used, preferably only in the upper half.

Placing of Machines.—The position of machines is of great importance in getting the best results from window lighting. This must be worked out according to the nature of the process and the location where maximum intensity is desired. The north exposure, "saw tooth," roof illumination meets most requirements but is available only where low property values permit the use of one-story plants. It has to a great degree been taken for granted that day-light supplied the best illumination and up to the present time this is probably true, where it is of proper intensity and properly controlled, for the diffusion is more easily secured, the limits of comfortable intensity are much wider apart, and fatigue is much slower in developing than with most artificial lighting. This may not continue to be, when lighting practices develop efficiency;

[1] Illuminating Engineering Society Transactions, v. X, 1915.

[2] Black, N. M. Modern Illumination and Its Relation to Ocular Comfort. Wisconsin Medical Journal, 1914–1915, v. 13, p. 316.

and the perfect uniformity, obtainable only with artificial means not influenced by weather changes, may bring a sufficient advantage to make it the superior form. Certainly the daylight is the cheaper and will continue to be so for a long time.

Need for Campaigns in Smaller Plants.—The cost for providing adequate illumination for the entire industry of the country would amount to one-half per cent to one per cent of wages.[1] The cost per capita of correcting vision, instituting and carrying out measures of protection against hazards and bringing the lighting up to good standards, is definitely greater in the small plant than in the larger organizations—those employing two thousand workers or more—and the small plants are in the large majority. These smaller plants are therefore less ready to take up any of these measures unless the early returns of a dividend can be clearly shown. Reports of more study, the example of the earlier ones to take the steps, must be brought before them constantly so that efforts to check preventable loss along these lines may become more nearly universal.

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Earle B. Fowler.

[1] National Safety Council, Chicago, News Letter No. 10.

CHAPTER XVII

PURCHASING AND SALES POLICIES

By C. E. Knoeppel

Waste from Neglect of Protective Policies.—Investigations into the operation of industrial enterprises have frequently disclosed wasteful conditions—particularly in concerns which have enjoyed a long period of prosperity due to the nature of the product or some other special advantage—which are attributable to a failure to adopt a protective policy in the event of a contraction in sales volume. As a result of a great demand for goods many of these companies have failed to follow conservative plans. Much waste can be charged to this fact, including the waste due to the enormous fluctuations in production. It was common among such companies to sell all the product they could make practically at their own price. These who "plunged" most heavily into production successively "pyramided" their plant capacity until a point was reached where the output facilities exceeded those required to meet the normal demand.

This condition has resulted from the domination of the business by financial and sales interests. The process may be outlined in this way:

As the industry grew and more and more business rolled in, more capital was secured or money borrowed, to be invested in fixed assets to permit of further increases of output. The working capital, however, was not usually correspondingly increased. With the sales department calling for volume of output it was natural that maximum production should be sought almost regardless of costs, because the apparent profits were large. As this policy was extended, additional equipment was installed; night shifts were put on; more buildings planned and the sales program broadened. So long as demand kept pace with the increasing production the industry prospered. But at the first temporary slackening of demand stock piled up, and soon the working capital was found to be insufficient. Then came shut-downs, unemployment, disruption of the producing and sales organizations and possibly refinancing controlled by other than the original owners.

The result of a faulty purchasing and sales policy has been here briefly sketched with reference to a rapidly growing industry. This same policy is no less harmful in an established industry where an attempt is made to secure the major volume of profit through the appreciation in value of stocks of raw materials, rather than from efficient production.

To trace the effect of these faulty purchasing and sales policies upon the operation of industry it is wise to realize the distribution of responsibility among:

Financial backers and owners—or capital.

Executives—or management.

Workers—or labor.

Industrial stability is firmly founded when based upon the proper interdependence of banker, manager and worker. But because management is the keystone of the industrial structure, the managers as the performing executive agency are chiefly responsible for the improvement which will do away with the present industrial shortcomings.

Responsibilities of Management.—Management's manifold responsibilities are positive, well defined, unescapable:

1. To establish sound business policies.
2. To finance the enterprise.
3. To control the expenditure of funds.
4. To develop an organization whose functions are logically assigned to competent individuals.
5. To design, test, improve and warrant a product which is to be distributed in relation to demand and competition.
6. To build or secure plant and equipment and utilize them economically and effectively.
7. To procure adequate supplies of proper materials.
8. To maintain a suitable supply of labor and supervise and co-ordinate its effect.
9. To organize and sustain proper relationships between owners and workers.
10. To formulate procedure based upon practicable and economical methods.
11. To manufacture and sell at a profit.

Most of these responsibilities have a bearing upon or are influenced by the purchasing and sales policies. The most serious faults of the latter as indicated in previous paragraphs lead to:

Uneconomic and speculative purchases.
Unscientific price setting.

Results of Speculation and Unscientific Price Setting.—Speculative purchases and unscientific price setting injure both industry and commerce through bringing about:

1. Unemployment.
2. Reduced wages.
3. Reduced operation of plants.
4. Exaggerated seasonal demand.
5. Losses in a falling market after plant purchases have been made at high prices.

6. Alternate and excessive business fluctuations. At one time depression and business stagnation: At another time activity and over-expansion.
7. Abnormally low prices in depressed periods and abnormally high prices during excessive production.
8. Unnaturally high costs during periods of operation which are either below and above normal.
9. Irregular but periodic idleness of capital, plant, material and labor.

Need of Stabilization.—The evils mentioned in the preceding section affect the buying and consuming that react to price changes. If high prices are very high, demand is stifled because of a concerted waiting for lower prices. If prices are too low demand is unduly stimulated, for too free buying creates a false indication of need, which tends to increase production beyond normal requirements. Too free buying also is soon reflected in higher prices, whose inflation above a seasonal level deters buying, stifles demand, and consequently lessens production.

Both effects are vicious. The one lessens production directly by inflating prices; the other lessens production indirectly by first over-estimating demand which as a consequence inflates prices. If, on the other hand, we produced pig iron at a more uniform monthly tonnage rate during dull times, we should not have an abnormally low price; the temporary excess production would furnish pig iron in good times without an abnormally high price.

The stabilization which this process brings can be likened to the conservation and use of a water supply. By storing the flood water and releasing it at a uniform rate over a long period irrigation is supplied when and as needed. Uniform production to cope with and satisfy nation-wide variations in demand will come only by adopting this policy of storing in slack times and releasing in boom times. The evils of economic and speculative purchasing and unscientific price setting can be cured only by a change in policy, not by a modification of administrative methods.

Speculative Profits and Unforeseen Losses.—Far too often the faults in purchasing have been considered a necessary evil. Depreciation in inventory values upon a falling market was regarded as something to be expected, as well as gains on a rising market. Wise financial management anticipated the former condition and congratulated itself on the latter. This situation is shown strikingly in the reported 1920 statements of two large manufacturing companies. One was able to charge the larger part of these losses (amounting to $11,151,444) against reserves previously set up to meet such a contingency. After setting aside a considerable new reserve to meet any new losses that may arise, this company was able to show adequate working capital. The other company not only failed to anticipate such losses (amounting, in its case, to $18,247,000, estimated as of December 31, 1920), but actually had reduced its working capital in the face of an enormous expansion of fixed investment. The results were fatal. In a newspaper advertisement in the spring of 1921, referring to this latter company, a further provision is shown in its balance sheet of $32,850,000, to care for depreciated material on hand and on contract.

Combined with the thought that uneconomic purchasing is a necessary evil is the desire to increase profits by speculating in raw materials, buying when they are low in price and selling the product made from them after they have appreciated in the market. This form of speculation is a recognized practice in the purchasing of many great staple materials, such as cotton, wool, leather, crude rubber and sugar. Industrial failures are frequently recorded, caused by "getting caught" with high priced stocks of material. On the other hand profits are frequently made from plants most inexpertly managed as producing units merely through "luck in guessing the market for material."

The Material Adjustment Account.—It will not do to say that the losses due to uneconomic and speculative purchasing cannot be discovered and responsibility placed where it belongs. It is management's business to discover such losses and to separate them from losses due to operating as well as from those due to volume. To do this with even a fair amount of trade co-operation, means to advance a long way toward policies which will stabilize industry.

It is therefore recommended:

1. That raw material be charged at current prices.
2. That use be made of a "material adjustment account" for raw materials.

If the first recommendation is adopted the advantage from speculative buying is removed. Variations between the actual cost of materials and the cost charged at current prices may be adjusted by means of the account named in the second recommendation.

Into the "material adjustment account" is charged the difference between the actual and current material costs. This practice is particularly desirable for pig iron, scrap iron, coal, steel products, coke, rubber, lumber, cotton, wool and other materials of a staple nature. The account so established would exhibit the profit and loss as between the purchase price of material and the price which is charged into the cost. For example, suppose pig iron to be purchased at $35 a ton and suppose the market later to drop to $30. The cost records would be charged at this latter rate of $30 covering the tonnage actually used, and the "material adjustment account" would be credited with the same figure. A second entry, however, would credit the inventory account, at the actual cost of $35, for the tonnage so used, with a corresponding charge to the "material adjustment account," the difference representing the loss on the material so used. The cost would then be figured on the basis of the normal condition which existed at the time the material was used. The difference would be carried to profit and loss at the end of the year.

An Adjustment Account for Overhead.—The same principle applies to overhead. By ascertaining the normal capacity of a plant—which may vary from 75 to 85% of full capacity—by standardization of overhead, by determining fair standards of performance per hour for the various operations, by using current prices for labor and material, it is possible to fix normal or standard costs. Add a normal profit and a normal selling price is secured.

Charge the difference between actual and standard overhead into an adjustment account, the balance of which can be carried into profit-and-loss at the end of the year. It is plain that this charge will decrease as we approach normal, and that it will cease altogether as soon as normal is reached. Moreover, as we go above normal and reach full capacity the total charges will be offset (in whole or in part) by credits to this adjustment account. It is not a difficult matter to carry out this plan. The burden account would be charged with actual expenditures, and the work-in-process would be charged with the standard overhead; while the difference between "standard" and "actual" overheads would be charged to "burden profit-and-loss account."

The time is coming in industry when purchasing profits and losses and volume profits and losses will be carried forward from year to year, on the argument that business does not arbitrarily stop at one moment in a year, and take on a new form in the next moment. Business is no longer a day-to-day affair, nor a month-to-month matter. It will get away from the year-to-year aspect also, so that a period of years, cycles, effect of good and bad years can be plainly visualized.

Profits due to volume and to purchasing made in one year should be shown in such a way as to constitute a fund to offset losses in another year. Further, by working on this basis profits will be more carefully studied and dividends will then be paid and buildings and equipments added to, from operating profits and not from the more or less accidental profits due to purchasing and volume.

The reason we pay profits taxes in one year when there are profits, and get no rebates in the next when there are losses, which is proving harmful in industry, is because there is now no way to visualize and calculate profits and losses for a period of years, and this must be the next forward step in industrial accounting, sanctioned by our government.

The method to pursue in handling is to set up reserves for volume and for purchasing and to treat them the same as most concerns treat the Reserve for Bad Debts. This is the recommendation of the Fabricated

Production Department of the U. S. Chamber of Commerce and is an excellent one.

Foundation of Financial Support.—Although these recommendations are aimed primarily to correct purchasing evils in industry they lay the foundation for securing owners' and bankers' support for an enterprise by presenting the opportunity to observe the relations between (1) Purchasing profit and loss; (2) Volume profit and loss; and (3) Operating profit and loss.

Market Analysis.—Domination of a business by any one factor is prejudicial. If the sales factor dominates, over-optimism is apt to result in a faulty sales policy which ties up tremendous sums in materials, finished stock, plant and equipment, all beyond the amounts needed.

A large proportion of trade fluctuations come from failure to develop concerted and intelligent market analysis. Often the exchange of inter-trade statistics (e.g., between the automobile and rubber industries) can be made mutually informative and helpful. Not alone current output data but information as to available world supply of respective material could turn hysterical grabbing into intelligent anticipation of real needs.

Wastes of Distribution.—Extravagances of distribution are an upstanding shame to American business. They may equal or exceed the more patent industrial wastes of production.

Beginning as "missionary" work believed to be necessary in "educating the public" to some new product or new use, extravagant methods and practices grow beyond the bounds of common sense and become an active danger to any trade which facilitates or even countenances their continuance. "Demonstration" and "guaranty" are twin sources of distributive effort that often over-run into rank extravagance. Besides the highly competitive spirit that often encourages extravagant advertising campaigns, the unequitable allowance to favored or insistent customers raises the cost of distribution—and sooner or later must find its way into the selling price—whereby all purchasers are forced to pay for the concessions of the few who actually profit by them.

Service Expenses.—Another class of distribution expense concerns so-called "service" during a stated period after purchase. Under this guise, free-handed supervisors may travel about, "adjusting" and "entertaining" in a way to foster their personal popularity rather than that of their firms. Akin to this is the too common extravagance of trade shows and conventions where good fellowship and mutual inspiration sometimes degenerate into excesses that reflect upon the trade as a whole.

Service-expense frequently takes the form of "allowances" to retain the customer's goodwill, when in point of fact the sales department thus finds a way to charge off considerable sums to "faulty products" and thus make a concession, which as a matter of truth is no more than a gift to the customer. A continuance of extravagant allowance policies results in more or less open antagonism between salesroom and factory. In extreme cases, "sales mistakes" masquerade as "concessions" to customers' goodwill. Lest this statement be allowed to pass without full understanding, it may be said that in a certain important industry about 10% of the output is "adjusted" by the sales department, although a representative factory declares that only one of its products in every thousand is considered a "second" by the plant inspectors.

Sales Expense.—Sales expense has too long been considered a necessary evil, supposed to be uncontrollable and therefore neglected. Here again the responsibility of management cannot be escaped. It is possible to segregate and analyze sales expense in the same way and degree as all other expenses. It is possible to make sure that every proper item of sales expense is charged to the sales department. It is also possible to establish checks which will prevent extravagances.

The necessity for an adequate sales policy to overcome existing evils leads to these recommendations:

1. Charge every item of sales expenditure to the Sales Department.
2. Arrange for a review of sales programs by the Finance Department to check extravagances.
3. Place responsibility for customers' adjustments in some division other than the Sales Department, and give the Manufacturing Department a voice in preventing "below specification" purchases.

C. E. Knoeppel.

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