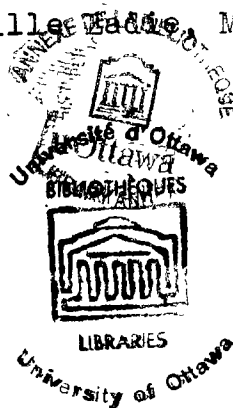


THE DEVELOPMENT OF SCIENTIFIC METHOD IN THE MANAGEMENT OF  
BUSINESS ENTERPRISES

A Thesis Presented in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Philosophy at the  
University of Ottawa

by

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February, 1944

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CHAPTER I  
INTRODUCTION

The past half-century has witnessed the introduction into business management of a body of accepted rules and procedures which can logically be termed scientific. Prior to the pioneering work of Frederick W. Taylor in this field, business management was primarily a matter of applying the hard lessons of personal experience with little opportunity afforded to management to avail itself of the experience of others, and without serious effort to consolidate and unify the results of such experience into accepted procedures for the guidance of management as a whole.

The present thesis is an attempt to consider briefly how these rules and procedures were conceived and how they and other related ideas have developed into modern management.

Following the chapter on Taylor, the remainder of the thesis is divided into three parts as follows:

Part A - "Management and Methods" - in which are considered those aspects of management's development which have more to do with techniques than personalities. All aspects of the application of scientific methods to office management are combined under this part for the sake of convenience.

Part B - "Management and Men" - in which are considered the developments which place particular emphasis on the working force and its relationship to management.

Part C - "Present Achievements and the Future" - in which

an attempt is made to summarize present accomplishments and future possibilities in the field of management.

It must be borne in mind, in connection with the subdivision between Part A (dealing with Methods) and Part B (dealing with Men), that in reality no important aspect of management deals exclusively with one or the other.

Management will never become a pure science, since many of its most essential phases involve the human element, and in human relationships the establishment of fixed laws of universal applicability is not possible. Throughout the thesis, therefore, the term "science" should be defined as "accumulated knowledge systematized and formulated with reference to the discovery of general truths or the operation of general laws".

## CHAPTER II

### FREDERICK W. TAYLOR, PIONEER

Frederick W. Taylor (1856-1915) is universally regarded as the father of scientific management. He it was who first applied scientific method to the problems of business management. It seems particularly appropriate, therefore, that a prominent chapter of this treatise should be devoted to a discussion of the life and work of this man.

#### Milestones of Taylor's Career -

The main periods of Taylor's career are usually regarded as follows:

- (a) the years spent as an apprentice in the Enterprise Hydraulic Works in Philadelphia (1874-1878).
- (b) the years spent as an employee of the Midvale Steel Company (1878-1890).
- (c) the years spent at the Bethlehem Steel Company (1898-1901).
- (d) the remainder of his life, during which he continued to study the problems of science in management and to teach his principles with missionary zeal (1901-1915).

#### His Background -

Taylor as a youth was afflicted with weak eyesight and it is probably due to this "misfortune" that the business world was given the benefit of his attention and the results of his life work. Although his parents were well-to-do and

his early employment was not essential for support, Taylor, when it became evident that his weak eyes would prevent his entering College, decided to enter a machine shop as an apprentice at the age of eighteen.

From this point on the story of Taylor's life becomes inextricably bound up with the story of his work and the introduction and early history of scientific management. This man brought to his work high native ability, a practical view-point not dulled by years of academic theorizing, and an extremely well developed sense of timing and precision. This latter point is well borne out and is undoubtedly due in great part to his early interest in sports. In 1881, he and a friend, Clark, won the doubles tennis championship of the United States, and tennis is highly regarded as a game requiring and developing a keen sense of timing and precision. When he set his scientific mind to the problems of the machine shop, it was inevitable that scientific methods would be introduced.

The early progress of his methods was slow and laborious, and to a weaker character the difficulties would have been overwhelming. Taylor, however, possessed that proverbial attribute of genius - an infinite capacity for taking pains - and his efforts were eventually crowned with considerable success.

Frank Barkley Copley, in his admirable biography of Taylor, makes this observation:

"An egotistic desire to be original, to do great and glorious things, to be revolutionary, is notoriously

a weakness of youth. If Taylor himself really came to do great things, it was just because the desire to do them was early knocked out of him. Beginning in the management field with no desire other than that of adding his humble improvement to what had been found good, he followed a strictly evolutionary course throughout." (1)

#### The Midvale Steel Company -

The four years as an apprentice at the Enterprise Hydraulic Works were a period of unconscious preparation, and the twelve years which followed at Midvale Steel Company were the most active of his entire life.

He entered the Midvale Steel Company at the age of twenty-two, and when he left there at thirty-four, he had already made achievements which may well be regarded as exceptional. During this period he studied at nights, and qualified for the degree of M.E. at Stevens in 1883. From 1878 to 1881, he resorted to every method he could conceive to force his men to increase production (a fact which aroused great animosity towards him and much criticism of his achievements). Following this came investigations into time study, metal cutting, and belting, and years of struggle to build up a system and develop an organization which would facilitate the establishment and maintenance of his scientifically determined standards.

In 1883 and 1884 he designed and superintended the construction of a new machine shop with many new features.

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(1) Copley, F. B., "Frederick W. Taylor, Father of Scientific Management" 1923.

He showed an ingenuity for invention, not only of management devices but also of mechanical ones, the latter being evidenced by his designing in 1889 of the revolutionary steam hammer. Most remarkable, however, was the development of the new and revolutionary system of shop management.

"Soldiering" -

The beginnings of Taylor's studies may be seen in efforts in the shop to stop "soldiering". He was convinced that practically all workmen of that time soldiered on a job but he did not hold them entirely to blame for it. He admitted that as a workman he too had soldiered, but he developed a great loathing for the practice and when he became a gang boss he determined to put a stop to it.

The only weapon he could think of at first was "fear" and he employed it to the full. Immediately he encountered opposition from the workers, with threats and sabotage of machinery, the latter blamed on Taylor by the workmen who claimed that he drove them and the machines too fast. After about three years of this open hostility the men finally tired of threats, fines, and firing and settled down to a fair day's work.

Taylor then started to reconsider the reasons why some workmen soldier, a re-diagnosis of the case which, if he had undertaken earlier, might easily have prevented much of the criticism levelled at his work from the ranks of labour. He found several reasons for this unfortunate condition:

- (a) the almost universal ignorance on the part of the

employers of what constituted a "fair day's work".

- (b) the fact that men lose individual initiative when they work in large groups, either through lack of adequate recognition of individual effort or pressure from the other workmen in the group not to destroy present easy conditions by proving that far more can be done.
- (c) the clumsy efforts of employers to remedy the condition by means of "piece rate" payments, which, when they resulted in higher earnings, were quickly cut, thus destroying the one incentive which brought forth the better efforts.

#### Fair Day's Work -

Taylor realized that before he could seriously start to develop any scientific means of getting a fair day's work from the employees of the plant, he must first determine exactly what a fair day's work was. Once this was determined, it would then be possible to set rates which would not have to be cut and which could continue to act as an incentive for better performance.

The idea of employing the stop-watch for this purpose occurred to Taylor. It had been used by a mathematics teacher in his early schooling to determine the proper length of time to allow for the solution of problems by the students. The stop-watch as an instrument of scientific management became the centre of severe censure by workers.

Taylor realized, too, that if his results were to be

worth-while he must make his studies under carefully prepared conditions. The workman's speed would depend in great part on his surroundings and equipment, on adequate lighting, a convenient arrangement of tools and equipment, and a constant and properly located supply of the materials with which he must work. To this end a large section of the shop became in reality an industrial laboratory wherein thousands of experiments were carried on.

#### Increase of Management's Functions -

In order to "set the stage" for this accurate measurement of a fair day's work, Taylor soon realized that it would be necessary to transfer from the worker to the management many responsibilities. One example of this was the tools. No longer would it be possible to leave the provision, selection, sharpening and repair of tools to the worker. A tool room was provided where scientifically selected tools, each for a specific purpose, were supplied by the management. They were sharpened, kept in repair, and replaced as required. Taylor's tests showed, for example, that the ideal load for a shovel was  $21\frac{1}{2}$  pounds. Shovels of various sizes were, therefore, provided, the selection to be determined by the nature of the material to be handled. If no shovels were available of the size required, they were made to order.

#### Task and Bonus -

After the "fair day's work" in any particular job under the given conditions was determined, the next step was

the remuneration of the worker on a basis that would induce him to live up to this scientifically predetermined standard of performance. Several different sliding scales were used, particularly the "task and bonus" - a plan originally suggested by Gantt, an assistant of Taylor. The plan involved the setting of a task, that is a definite amount of work in a given period of time, and a bonus to each workman completing the task. The bonus varied from 30 to 100 per cent above current wages.

"All previous plans advocated the payment of ordinary wages to give the workmen an incentive for doing more or better work, but Taylor paid such wages to induce workmen to accept the standards determined by scientific method. It should be recognized that here, coming into being, was an entirely new thing in management, the "central idea" of which, as Taylor came to describe it, was this:

(a) To give each workman each day in advance a definite task, with detailed written instructions, and an exact time allowance for each element of the work.

(b) To pay extraordinarily high wages to those who perform their tasks in the allotted time, and ordinary wages to those who take more than their time allowance."  
(1)

#### Records and Accounting -

As would be naturally expected, the introduction of such a system increased many-fold the number of records re-

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(1) Copley's "Taylor"

quired and the amount of paper work to be done. The introduction of the system with its increased overhead expense was justified only if the extra costs involved were repaid with interest in decreased running expenses of the business. One of Taylor's valuable contributions in the problem of keeping track of costs was the transfer of cost accounting work from the general accounting department to the planning room which was required to schedule the work of each employee and machine. In the planning room many of the records required for cost accounting were already prepared and accurate cost accounting became, in large part, a by-product of its normal function. The papers and slips designed to plan and control operations became the documents on which were based both the cost and production records.

#### Taylor's Contributions of a Mechanical Nature -

Scientific studies in business management provide a very fertile ground for invention. Taylor, himself, was the inventor of many mechanical improvements in industry. Outstanding among these were his invention of the improved steam hammer and his discovery of high speed steel.

The steam hammer, which was invented while Taylor was at the Midvale Company, was the outcome of one or two years of careful collection of data from all over the world concerning machines already in use with particular emphasis on the construction of parts which had resisted wear and breakage. Finally he had all the data he required and set about the designing of his own hammer. The results were exceptionally good

and his invention proved to be a great improvement.

Perhaps his most important invention or discovery of a mechanical nature was "high speed steel". His experiments, contrary to all the best opinion of the time, showed that a much higher cutting speed could be achieved by a tool which had been heated almost to the melting point and then cooled by a blast of cold air. One responsible engineering authority conservatively estimated this discovery to be worth fifty million dollars per year to the machine industry of the United States. It was also estimated that by means of the high-speed tools made possible by Taylor's discovery, the United States was able in the World War (1914-1918) to produce munitions at five times the speed otherwise possible.

The Mechanism of Scientific Management -

Taylor in his book entitled "The Principles of Scientific Management" discussed the mechanism of scientific management and presented these elements:

- (a) Time Study with the implements and methods for properly making it.
- (b) Functional or divided foremanship and its superiority to the old-fashioned single foreman.
- (c) The standardization of all tools and implements used in the trades, and also of the acts or movements of workmen for each class of work.
- (d) The desirability of a planning room or department.
- (e) The "exception principle" in management, or the standardization of handling routine problems at

the lower levels so that the time of the higher executives is released for dealing with the "exceptional" cases only.

- (f) The use of slide-rules and similar time-saving implements.
- (g) Instruction cards for the workman.
- (h) The task idea in management, accompanied by a large bonus for the successful performance of the task.
- (i) The "differential rate".
- (j) Mnemonic systems for classifying manufactured products as well as implements used in manufacturing.
- (k) A routing system.
- (l) Modern Cost System.

Taylor emphasized, however, that these were merely the elements or details of the mechanism of management, and that in its essence scientific management consisted of a certain philosophy which results in a combination of four great underlying principles:

- (a) The development of a true science.
- (b) The scientific selection of the workman.
- (c) The scientific education and development of the workman.
- (d) Intimate friendly cooperation between the management and the men.

#### Opposition to the Taylor System -

As might be expected with any system which strove to make such radical innovations in industry, Taylor's ideas

met with considerable opposition. This opposition might well be divided into two classes; (a) that emanating from personal opposition and the offence of vested interests, on the one hand, and (b) the opposition of organized labor, on the other.

Laziness and ignorance on the part of management and offended pride were main elements of the first type of opposition. The spectacle of industrial leaders arguing vociferously against the Taylor system (with complete ignorance of its finer points) was not at all uncommon. Moreover, the implication that double the previous production could be achieved with no increase in expense was a sad blow to the pride of the foreman and manager who considered such claims as impudence. Opposition of vested interests is to be expected with any major change in industry and such opposition was extremely vocal in Taylor's case.

By far the most potent (and the most regrettable) opposition, however, came from organized labor. At that stage in their development labor unions did not recognize any greater responsibility than that of fighting "capital" in the interests of their own members. The idea of employer and employees cooperating in the interest of the business as a whole had yet to be born. This violent antipathy on the part of the workers towards the employers was due, of course, in large part, to the vicious short-sighted policy of earlier employers of labor. Early unions were organized to fight employers, not to cooperate with them. Labor wanted to limit output, to "make work", in order that more employment would be created and higher wages would follow. It was inevitable, therefore, that Taylor's

efforts to speed up production would run into this organized opposition. As soon as organized labor declared war on the Taylor system, the latter soon fell into opprobrium and those employers who continued to use it did so quietly and with all outward manifestations of opposing it.

Even today many workers believe themselves opposed to the methods proposed by Taylor in spite of the fact that these very methods have been instrumental in increasing his wages, shortening his hours, and in general improving his working conditions.

#### Some Causes and Results of this Opposition -

Taylor himself was to some extent responsible for the opposition his ideas created. His earlier efforts to get a fair day's work, as was mentioned previously, were not based on any scientific judgment of what constituted a fair day's work but rather on a rule by "fear". He opposed unions because of a mistaken conception of their ultimate purpose. Taylor failed to realize that unions could justify bargaining on behalf of all the workers without justifying unequal effort for equal pay. It is believed that if Taylor could have foreseen the more enlightened leadership of labor unions of a later day he would have modified his own attitude towards them.

Organized labor's opposition led to a congressional investigation which resulted in 1915 to the attachment of the following rider to appropriation bills:

"PROVIDED, That no part of the appropriations made in this bill shall be available for the salary or pay of

any officer, manager, superintendent, foreman, or other person having charge of the work of any employee of the United States Government while making or causing to be made, with a stop-watch or other time-measuring device, a time study of any job of any such employee between the starting and completion thereof of the movements of any such employee while engaged upon such work; nor shall any part of the appropriations made in this bill be available to pay any premium or bonus or cash award to any employee in addition to his regular wages, except for suggestions resulting in improvements or economy in the operations of any government plant; and no claim for service performed by any person while violating this proviso shall be allowed."

The adoption of this rider was an overwhelming political victory for labor and a crushing blow for Taylor, which is thought to have been a contributing cause of his death shortly after. Paradoxically, organized labor was Taylor's most successful opponent in spite of Taylor's conviction that the improved lot of the worker was fundamental to successful operation of industry.

#### Commendations of Taylor's Work -

In spite of the criticism which Taylor's efforts aroused in many quarters there are others who praised his efforts and abilities. In France, during the First Great War, the Taylor system became the object of governmental measures. The Minister of War, M. G. Clemenceau, issued a circular to manufacturers prescribing its adoption and arranged a series

of lectures explaining its fundamental principles. About ten years before, M. H. Le Chatelier in the Revue de Metallurgie had introduced Taylor's work to the French engineers, and it was immediately recognized as of unusual significance.

Even in Russia, Premier Lenin in 1918 declared "We must introduce... the study and teaching of the new Taylor system and its systematic trial and adaptation."

Justice Brandeis of the Supreme Court of the United States once said: "I quickly recognized that in Mr. Taylor I had met a really great man - great not only in mental capacity, but in character".

Other testimonials of a similar character are legion. Perhaps they might be summed up in the words of Ordway Tead, widely recognized present-day authority on Personnel: "The significance of the intellectual contribution of Frederick W. Taylor is out of all proportion to any recognition it promises to get."

### CHAPTER III

#### PLANT LAYOUT AND WORK ROUTING -

One of the early considerations of factory managers employing scientific methods had to do with the arrangement of the factory itself, with the equipment and machinery it was found necessary to use, and with the channeling of the work as it passed from one operation to the next. Prior to the introduction of scientific thought on this subject, the layout of the plant was not a particularly serious consideration to the management. It was not unusual to find plenty of incidents in otherwise well managed companies (according to the standards of those days) where the product had to be moved great distances from one operation to the next. The plant had just been allowed to "grow up" with machines and other departments being added whenever it was considered that such additions would increase the profit-making possibilities of the company. The arrangement and location of equipment was determined almost entirely by one factor - the availability of the space required.

#### The Importance of Scientific Planning of Layout -

It is entirely likely that the importance of this factor in management was not realized by those who first started to put it into practice. By accident two continuing operations in close proximity were found to take less time, or, perhaps, the laziness of a workman prompted him to suggest that if two particular machines were placed closer together he would not have to transport the material or semi-finished product so far. In any event the idea did find fertile ground

in the mind of someone who was in a position to do something about it. Through years of development, that simple thought has now grown into an important phase of industrial engineering. Scientifically designed layout results in considerable savings through:

- (a) reduced transportation of materials and semi-finished products.
- (b) fewer and shorter non-productive periods as the product is moving to its ultimate completion.
- (c) less non-productive work involved in unnecessary transportation, and
- (d) more and faster production with no greater (and possibly less) fatigue to the workmen.

#### Factors Influencing Decisions Concerning Layout -

Perhaps the most potent factor influencing decisions to be made concerning plant layout will be whether or not the plant itself exists - whether it is intended to build a factory or whether it will be necessary to arrange the layout within an already existing factory. In the first case, only the most scientifically designed plan will be the best, whereas in the second case the most scientific may not be possible due to limitations of space and shape, and the best plan (under the imposed restrictions) will be that which provides the most logical solution to these conflicting considerations.

Between these two extremes of (a) being able to build a new plant to suit the needs of the business, and (b) being definitely restricted by existing space and shape, there

are, of course, all degrees of combination. Increase in existing space may be possible through an addition to the factory. Such an addition may be horizontal on adjacent land, if such land is available and if the nature of the operations to be performed lend themselves most satisfactorily to horizontal movement; or the addition may be vertical by adding another storey to the existing plant if such an arrangement is most desirable and if (an important consideration) the existing building will support the extra weight.

There are many other factors which must influence the decisions concerning layout. The importance of each will vary in each case and they are not, therefore, listed with any idea of priority of consideration. Such factors include:

(a) Kind of machinery to be used. Large, bulky machines will, of course, require much greater space. The use of high speed machines will demand adequate safety precautions to protect the operators which in turn may require considerable space depending on the nature of the protection required. Heavy machines will, of course, require suitable foundation which may demand their location on ground level in spite of advantages to their location elsewhere. Particularly noisy machines may require fairly large and space-absorbing sound-proof enclosures in order not to interfere unduly with the efficiency of other workers in the plant; or it may be desirable to place such machines in some more remote location than that dictated by convenience alone.

(b) Quantity of machinery to be used. Not only the type of machinery to be used but the quantity of it required must

be taken into consideration and will affect the ultimate decisions made concerning layout.

(c) Nature of the product. This factor, in addition to influencing layout will, of course, be an elementary consideration in arriving at a decision on the factors discussed above. If the product lends itself to continuous process on mass production, it will likely be found desirable from the economy point-of-view to plan layout in this way. Continuous process production insofar as it influences layout is discussed in greater detail later in this chapter. If, on the other hand, the product or products do not lend themselves to mass production methods, or if the business is one which does "jobbing", then it will be found necessary to plan the layout along functionalized process production lines. This, too, is discussed in greater detail below.

(d) Quantity of Production. Even if all other factors are equal, the quantity, or anticipated quantity of production must be considered. If the quantity is large it will be necessary to provide greater space for storage of materials and "banks" of supplies or partly finished products at the logical locations throughout the plant. If the quantity is small, and the required storage space consequently less, the general situation may be altered sufficiently to justify a relatively major rearrangement of equipment.

(e) Permanence of Production. If the anticipated length of life of the process of production is relatively short (for example, where models or designs change rapidly and to such a major extent as to justify major rearrangement of machinery

and equipment), it may be considered proper to make some of the installations on a basis of temporary expediency even at the expense of sacrificing certain immediate economies, since scientific methods of layout must be evaluated in terms of their long-run contribution to efficiency and economy. An expensive installation to serve a short life can be justified only if the resulting increase in profit is greater than the cost involved.

(f) Power. The type of power used and the means of its transmission is an important consideration in practically every type of modern plant. In this respect self-contained motor-driven machines allow for considerably greater latitude in planning the layout since they can be located practically anywhere and have their electric power brought to them by wire. Under such conditions the question of "power" will have little influence in the layout decisions and other factors will have relatively greater weight. On the other hand, the power in the plant to operate the equipment may have to come from an overhead drive shaft, each machine being supplied by belt drive. If such is the situation and a major change in the type and transmission of power is not desirable, the power driven machines must be located accordingly. If the layout is being planned from the very beginning of the plant and if it is found that location of the machines in such a line is scientifically correct for the particular operations involved, then overhead drive transmission of power may be installed at the start, justified on the basis of economy.

(g) Internal Transportation. The means used for trans-

portation of raw materials and the product through its various stages of production must also be considered. In the case of small and light parts this factor may be a minor one unless, of course, it is desirable to transport them by conveyor where continuous process or mass production methods are indicated. Heavy and bulky materials are more likely under either continuous process or functional process methods to influence layout.

All of these factors, and others the importance of which will vary with the nature of the business and its local conditions, must be considered before the management can arrive at layout decisions based on scientific methods. Usually there are one or two factors of major importance which must be given great weight in such decisions and other factors will have a minor influence. Frequently, however, there will be no apparently obvious solution and it will then be necessary to consider many possible ones until the most efficient and economical is found.

#### Special Considerations Affecting Layout under Conditions of Functionalized Process Production -

Plants which confine themselves to "jobbing" are organized on a basis of functionalized process or job production. The best example of this type is the machine shop. Here one finds, normally, a great variety of products with many different sequences of operations. It is usually quite impossible to establish any definite channel for the movement of all products through the various stages of production. Work will be

coming to a grinding machine, for example, from many different machines and possibly the same article may return for further grinding at a later stage of its production. Back-tracking of this kind may be inevitable but it should be cut to a minimum. Under such conditions location of machines or departments does not require such careful consideration, although certain basic rules should not be ignored. For example, machines receiving semi-finished products from several locations should be centrally located in order to avoid unnecessary transportation. Machines normally engaged in the early stages of production should be located conveniently to the stockroom of raw materials and, conversely, machines normally engaged in the later stages of production (finishing, polishing, etc.) should be located near the storeroom of finished products or shipping department.

In spite, however, of what might appear to be a situation offering little hope for scientific planning of layout, much can be accomplished by a study of the products and the sequences of operations which their production entailed. The management must not be entirely influenced, however, by past experience particularly if the trend appears to be away from articles which have represented a large part of its former output or if plans are being made to tap other markets. A study of the products, no matter how diversified, and the required sequences of operations will usually reveal a certain general pattern, if not in the majority of cases at least in a fairly high percentage of them. This sequence pattern should form the basis of decisions concerning revised arrangement of machines and layout generally. The exceptions to the pattern

must also be considered, of course, since they may have to do with products the transportation of which may be extremely difficult to the new machine locations indicated by the majority in the sequence pattern. Such a situation is rarely the case, however, and the sequence of operations for the greater number of items generally indicates the more economical arrangement of the machines.

#### Special Considerations Affecting Layout under Conditions of Continuous Process Production -

There are various other names by which this type of production is known, such as mass production or line production or assembly line. The chief characteristics are the standardization of the product and its movement through the various operations to its ultimate completion along a recognized channel. If the plant is turning out a single product and if that product adapts itself to mass production methods, continuous process production is indicated as the most logical and economical. This means that plant equipment and machinery must be arranged in the same sequence as the operations required to complete the product.

There are many advantages to continuous process production if the product of the plant can be adapted to it. Some of these are:

(a) A much higher degree of specialization in each operation can be achieved. Each workman, since his work is standardized, can more easily achieve greater speed and accuracy. Moreover, since an intimate knowledge of many operations is

not required of him, it is possible for him to become a skilled worker much more quickly. The popular objection to such highly specialized work - monotony and boredom - is more imaginary than actual if the worker has developed the proper attitude towards his work and if he realizes just how his particular job fits into the completed whole as an essential operation.

(b) Much time and expense can be saved by mechanical handling of the semi-finished product and other materials required in passing from one operation to the next. Conveyors will vary with the nature of the product, whether it is small or large, light or bulky, etc., and with the nature of the various operations required, whether the semi-finished product must be removed from the conveyor at various steps in its completion, or the necessary operation performed while the article continues to move on the conveyor, or the conveyor be an integral part of the machine performing a particular operation.

(c) Since the fundamental factor in continuous process production is the standardization of the article and the operations required for its completion, there is greater possibility of mechanization in the operations themselves. This means that it is frequently possible to re-design machinery and equipment to take over much of the arduous labor from the worker, thereby enabling him to complete more mechanically perfect operations with less fatigue. This has been one of the factors in the greatly increased production under modern management which has resulted in definite benefits of higher pay and shorter hours for the worker.

As was mentioned before, any decision regarding layout must take into consideration the cost involved and can be justified only on the basis of greater savings resulting from the change. Occasions may arise, and frequently do, where the single standardized product of the plant may be adapted to continuous process production methods and yet continuous line movement through the required operations may not be justified. This situation will arise where the total production of the plant is not sufficiently large to justify purchasing separate machines for each operation. In such a case it will be more profitable to "back-track" the article at certain stages in order to use full time certain equipment capable of two different operations, or the same operation at different steps in the production, rather than have two machines for the same type of work at different steps but each in use only half the time. In general, however, it is usually best to avoid "back-tracking" as such practice tends to confuse the normal channel.

#### Combination Functionalized and Continuous Process Production -

Relatively few modern plants can be organized and plan layout on purely continuous process production lines. Certain of their departments, it will be found, can operate best on a functional basis, feeding their particular products (possibly parts) into the main assembly line at the proper stage. If the final product is fairly complicated and composed of many parts, such as motor cars or refrigerators, many departments will be required and in them, depending on the nature of the particular part with which each is concerned, will be found

all combinations of functional and continuous process production. Layout and all the factors entering into its planning may logically vary throughout the plant.

#### Flow of Traffic and Materials -

The ideal for the flow of the product through the various operations is generally considered to be a straight line. This, however, may be found impractical and variations may be introduced. If, for example, receipt of raw materials and dispatch of finished product are only possible at one end of the building the "line" may become a circle. So many factors may affect decisions in this regard that it is usually unwise to allow the straight line concept too much weight in the decisions, as long as the layout is arranged so that the product moves directly to the next operation without waste of time or space. The main advantage of the straight line is, of course, the ease with which mechanical conveyors can be installed. Other factors may affect decisions concerning the type of conveyor to be used; for example, if the force of gravity can be put to work in moving materials it obviates the necessity of using power for this purpose, and gravity chutes can, of course, be any desired shape, spiral, straight, or otherwise.

In any production line involving continuous process methods, there is always a primary channel for the flow of traffic and materials. There may be also one or several secondary or contributory channels depending on the number of parts "contributing" or being added at different stages in the production. These contributory channels may run parallel to the

main channel feeding their products into the main channel at the required time and place and in the necessary quantity, or they may be separate departments or even separate factories if the quantity justifies it.

"Banks" of materials or parts may be found necessary at various locations throughout the plant in order to avoid delay to the main production line when parts from the contributory channels do not arrive in the required quantities or at the required time due to machine break-downs or unavoidable transportation difficulties from distant locations, or when certain machines must be shut down at periodic intervals to allow for retooling. The size of the "bank" will be determined by the length of delays for break-downs and retoolings based on past experience.

#### Graphic Presentation in Planning Layout -

The normal conception of a plan, that is scale drawing on paper, does not adapt itself particularly well to planning the layout of a factory or office because it is desirable to make many changes as the various possibilities are being considered. This difficulty is overcome by the use of a scale plan on paper recording only the limiting factors of factory size and shape, and any existing "immovables" such as supporting pillars, solid walls, elevator shafts, doors, etc. Temporary restrictions, or those which can be moved if necessary, should also be marked on the plan but in a different manner - possibly with dotted lines. "Templates" or small pieces of cardboard are then cut to scale to represent each

machine. The templates can then be arranged on the plan and moved at will until the most scientifically correct layout is achieved. Thumb tacks or pins are used to fasten the templates in their proper places on the plan.

It may be desirable to prepare a more realistic picture of the proposed layout, particularly if advice is to be sought from foremen or workers who may not be accustomed to visualizing plans on paper. If such is the case, a model of the factory may be necessary with scale models of the machinery and equipment.

Time spent at the planning stage with drawings and templates is usually very profitable and even minor changes should be made at this point. Such changes later when new construction is under way or when machines are actually being moved is extremely costly in delays and resulting confusion, and should be avoided if at all possible.

#### Provision for Expansion -

Scientific planning of layout must take into consideration not only the immediate requirements but also future probabilities. This involves provision for expansion without the necessity for major alterations of the present layout. Realistically the management should also at this point consider the possibility of future contraction of output particularly in lines for which the market is insecure or which are affected seriously by fashion or model changes. The amount of weight which should be given to probable future requirements will vary with the past experience of the company and the industry and

with scientific analysis of the market and its trend. Such market analyses provide a valuable guide to management's planning for the future and should be undertaken, if not continuously, at least at specified periodic intervals. The importance of market analyses to any particular organization will vary with the internal difficulty of adjusting production to changed demand.

## CHAPTER IV

### JOB ANALYSIS, TIME AND MOTION STUDY, JOB SPECIFICATIONS

#### Definition -

Job Analysis, or the breaking down of a job into its elements, their study and evaluation, is a basic subject in any consideration of the application of scientific method to the problems of business management. Analysis has, of course, from the beginning been considered a fundamental of scientific approach in any field. Tead and Metcalf define Job Analysis as "a scientific study and statement of all the facts about a job which reveal its content and the modifying factors which surround it". (1)

#### Early Application -

Analysis of the job was one of the fundamental contributions in the early work of Frederick W. Taylor. His "Principles of Scientific Management" reveals how he took one job - that of loading pig iron - analyzed its components and, as a result of this analysis, was able to eliminate many non-essential elements and increase the capacity of the man on the job from  $12\frac{1}{2}$  tons to 47 tons per day.

Like many another tool of science, however, this new found method of stepping up daily production was soon abused by short-sighted management. The pace of production schedules was increased, piece rates lowered, and men soon found that greatly increased effort was not giving them commensurate reward. More recent thought has, however, eliminated many of these

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(1) Tead and Metcalf, "Personnel Administration, Its Principles and Practice"

earlier difficulties and Job Analysis is recognized as an acceptable means of eliminating unnecessary effort on the part of the worker hence increasing his productive capacity with no increase in fatigue, or frequently with a decrease.

#### Time-Study -

In the earlier conceptions of Job Analysis only one method appeared dominant - that of analyzing the job into elements and determining the amount of time required to perform each of these elemental motions. Early students of the subject reasoned (and one can see their point of view) that Time was the one major factor. Time was the basis of compensation to the worker - Time meant money to the employer. If the worker could perform more essential movements and less non-essential movements in a given period of time, he would accomplish more.

#### Taylor's Classification of Time-Study Work -

With this emphasis on the time factor of performance, time-study developed. Taylor classified it into (a) analytical work, and (b) constructive work, as follows: (1)

##### (a) Analytical Work

1. Dividing the work into simple elementary movements.
2. Noting and discarding all useless movements.
3. Studying the same elementary movements of several workers, timing them by stop-watch and picking out the most effective and quickest method of

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(1) Taylor, "Shop Management"

making each elementary movement.

4. Recording with adequate description each elementary movement, timed and indexed.
5. Studying the job from the point of view of unavoidable delays, accidents and interruptions, and determining how much time should be added to the time of a good workman to take care of these factors.
6. Studying the job from the point of view of the new workman and determining how much time should be added to take care of such lack of familiarity with the job.
7. Studying the job from the point of view of fatigue and determining how much time should be added as rest periods and at what intervals these rests should occur.

(b) Constructive Work

1. Selecting the combinations of elementary movements frequently found in the same sequence and recording and indexing them.
2. From the various records, selecting the series of elementary movements which should be used in the complete operation of performing the task or making the article, (that is, selecting the fastest time for each movement) adding the proper amounts for delays, interruptions, lack of familiarity with the work, physical fatigue, etc.,

and summing them all up to determine the proper time for performance of the entire operation.

3. Studying surrounding conditions having an impact on the operation being performed with a view to eliminating conditions tending to delay; for example, defective or improper tools, unsanitary conditions, etc.

#### Opposition to Taylor's Methods -

Opposition to the methods of Job Analysis and to the results achieved came from two main sources. The first and most voluble opposition came from the ranks of Labor. They resented the fairly obvious result of such studies in a company - speeding up of movements with a comparatively small increase in pay. They resented, too, the tendency to regulate their work day with such precision. Men do not like to be told how to do their work. At another day and in another country not so imbued with democratic principles stemming from a still pioneer America, such regimentation might have met with far less opposition.

Another source of objection was made vocal by other students of management problems. In reality, they were simply bringing "down to earth" the objections of the worker who found himself deluded by this new system. These students objected to Taylor's emphasis on time as the all-important feature. Taylor's measure of efficient workmanship was "the amount of work done in a unit of time, or the amount of time required to perform a unit of work". Gilbreth was an early proponent of the idea of "motions per operation" as a more logical basis of analysis. (1)

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(1) Gilbreth, F.B. and L.M., "Motion Study", "Fatigue Study", "Applied Motion Study"

### Gilbreth's Philosophy of Work -

F. B. and L. M. Gilbreth regarded the new idea of motion-study as "both an attitude of mind and a philosophy of work". As a philosophy it:-

"...looks upon man as the centre of creative activity, and thinks of tools, machines, and power as enabling him to accomplish more, with less effort and fatigue, and with more interest in his work and in what it accomplishes .... It covers a belief in individual differences and individual responsibility to use one's assets and compensate for one's handicaps by cooperating with others for the common good...." (1)

### Steps in the Gilbreth Method of Job Analysis - (2)

(a) Determine whether or not the study should be made. Frequently a little careful observation of the particular problem will reveal that it is not one requiring Motion-Study technique to resolve it.

(b) If it is decided that the study should be made, it is then necessary to state the problem clearly and in detail so that one can determine how much time, effort, and money the study justifies. What are the expected results? Are these expectations reasonable? What are the possible, probable, and certain savings of the study to be undertaken?

What will these savings cost in time of investigation, materials, tools, skilled and unskilled labor?

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(1) Gilbreth, L.M., "Time and Motion Study Techniques"

(2) Gilbreth, L.M., "Motion Study" Handbook of Business Administration, Chapter VIII


Are by-products expected? If so, what will they be worth? What is the expected time lag between the commencement of the study, the discovery of the best method, and the teaching of the selected operator? Will all operators be taught the new method? If the expected savings are appreciable with certain savings in any event, if by-products will occur, and if the time lag between the commencement of the study and the eventual savings is short, the conditions would appear to be very favorable for the success of such a study.


- (c) Assume that it has been decided to undertake the study. It is frequently desirable to record the present practice of doing the work. If obvious changes for the better can be made such changes should be made before commencing the motion study.
- (d) Everyone concerned with the study should be told why it is to be made, what is to be done, and what is expected in the way of results. If the workers are not familiar with motion studies, the purpose and technique of such studies should be clearly explained. Wide cooperation should be encouraged and this can best be achieved by arousing wide interest. Ensure that as many people as possible take part in the study. An early study in the organization in which many people take part, watch what is going on and assist in the compilation of records, will be an expensive study but it will assist future studies immeasurably.

(e) The preparation of a Process Chart is the next step. The various steps through which the work passes should be carefully set down. It may be necessary to study all the workers engaged in any one process to note appreciable variations which can be seen without the aid of a camera. This Process Chart technique is changing and developing constantly and in many cases it will reveal the solutions without proceeding to the later steps. This is frequently the case where the investigator is thoroughly familiar with motion study techniques or where the product is changing or where the anticipated savings are not large and it is felt that the study does not justify too large an expenditure of time.


(f) On the Process Chart it is normal practice to employ standard symbols to indicate each step. This obviates the necessity to explain each step in written form and definitely visualizes each step.

















Recognized Process Chart symbols employed by Gilbreth are as follows:

 Stores Requisitioned

 Stores Bought

 Stores Received

 Several kinds of Components - Not Considered Desirable to List Individually

-  Worked Materials Requisitioned
-  Worked Materials Ordered
-  Worked Materials on Hand
-  Merchandise in Storage Ready to Ship
-  Storage as Part of Process
-  Permanent File of Documents or Materials
-  Temporary File of Documents or Papers
-  Operation Symbol
-  Moved by Operator Performing Operation of That Number
-  Moved by Man
-  Moved by Boy
- MOB** Moved by Messenger Boy
-  Moved by Elevator
-  Moved by Pneumatic Tube
-  Moved by Conveyor
-  Gravity
-  Belt

- Ⓚ Moved by Truck
- Ⓟ Information by Telephone
- Ⓛ Moved by Mail
- ◇ Inspection for Quality
- Inspection for Quantity
- ◻ Inspection for Quantity and Quality  
(Quantity most Important)
- ◻ Inspection for Quality and Quantity  
(Quality most Important)
- ◻ Over-inspection for Quantity
- ◻ Over-inspection for Quality
- ┌ Inspection for Quantity on the  
Exception Principle
- └ Inspection for Quality on the  
Exception Principle
- ◻ Over-inspection for Quantity on  
the Exception Principle
- ◻ Over-inspection for Quality on  
the Exception Principle
- ◻ Inspection for Quantity and the  
Operation Performed Simultaneously
- ◻ Inspection for Quality and the  
Operation Performed Simultaneously



Inspection for Quantity and Quality  
and the Operation Performed Simul-  
taneously (Quantity most Important)



Inspection for Quality and Quantity  
and the Operation Performed Simul-  
taneously (Quality most Important)

In its simplest form the Process Chart is merely a statement using symbols as indicated above showing the various steps involved in the operation under survey. Many refinements of this elementary procedure are, of course, possible. The symbols are arranged in their proper order vertically on the paper starting at the top and moving through the various steps to the bottom. The space at the sides is used to record other pertinent information and as many refinements as are considered desirable for the particular study. They may include (among other things) the following:

- (i) distance travelled
- (ii) who does the work
- (iii) the work of the left hand and the work of the right hand charted side by side to indicate what moves are made by each and when in relation to the other.
- (iv) time required for each step by stop-watch readings.

After the Process Chart has been made it is then possible to determine what further detail study is required and in some cases at what step in the

process such additional work will most likely be productive of the greatest results.

- (g) When the Process Chart has been made, and advantage taken of the improvements which the study thus far has indicated as desirable, it is then necessary to decide whether or not a more exact study of motions and times are required. If it is decided that additional detail along such lines should justify the additional work involved the micromotion method is used.

#### Micromotion Method of Job Analysis -

This method of analysis is employed to supplement the results achieved by the use of the Process Chart in any study where exact motions and the times of such motions are required or where a detailed study of the elements of the motions should be sufficiently profitable to justify it.

Before such a decision can be made it is necessary to consider certain fundamental factors:

- (a) What possibility is there that this particular type of job will continue? If the nature of the work is such that changes in product, design, etc., will result in fundamental changes in the job and if such product and design changes are frequent, then a heavy expenditure of time and money on a micromotion study might not be justified. On the other hand, if high savings are possible in a short time, the study may be justified.

- (b) How many persons are engaged in the same type of job? In other words, will it be possible to apply the findings to many workers thereby multiplying the benefits and lowering the unit cost of the study?
- (c) Is the nature of the work such that minute savings in motions will result in large total savings? Such would be the case where a relatively few motions are repeated over and over again.

All of these factors must be considered and decisions reached before it is possible to say whether or not Micromotion Method is justified.

#### Micromotion Technique -

The fundamental basis of this method of analysis is the employment of the motion picture camera to record the movements of the operator. By this means it is possible to study the results over and over again and by means of slow-motion projection to slow down each movement, no matter how slight it may be, to a speed at which the trained eye can see and analyze every element involved.

At this point, too, certain decisions are necessary:

- (a) Who is to be filmed? (It has already been decided what is to be filmed at the time certain of the steps on the Process Chart revealed themselves as justifying more minute study.) If the study to be conducted is something of a novelty in the organization it is usually desirable to photograph all the workers doing the particular operation under study - or as many as

wish to be included. A small expenditure of time and film on this will create greater response among the workers and will win their cooperation. For purpose of the actual results, however, it is necessary to photograph in reasonable detail all the best workers.

- (b) Selection of the best workers is done by observation, by consulting any previous work records, by consulting the foreman and by talking to the workers themselves. If any of the workers show evidence of natural laziness, they too should be photographed in reasonable detail since lazy people very frequently develop efficient motions through a natural abhorrence of unnecessary movement and fatigue.
- (c) Selection of the size of film to be used. This problem has practically resolved itself in recent years by the improvements introduced by the film manufacturers in the smaller 16mm film. Formerly the larger size was more satisfactory because of the sharpness of detail but the smaller size now gives satisfactory results with considerably smaller equipment and less bulk.

#### The Combination of Time and Motion -

Any Micromotion study is incomplete without recording in the picture the passage of time. This must, of course, be registered with extreme exactness if the film record is to be used later for minute study of the motion cycles and the elements

of these motion cycles. The Microchronometer is set up for this purpose within the camera's field. This instrument registers time in terms of one-two thousandths of a minute.

#### The Filming -

Adequate lighting of the work space is, of course, essential to good results. The "subject" should be as completely at ease as is possible. He should have the process explained to him carefully before hand. The camera should be positioned so that all movements are recorded. Film should not be used sparingly - it can readily be edited later and it is far more important to have a complete record.

#### The "Simo Chart" -

After the filming has been completed the next step in the Motion Study is the preparation of a simultaneous motion cycle chart, or "simo chart". This is prepared by the transfer of pertinent information from the film. The chart is made on ordinary cross-sectioned paper in long roll. Across the top of the paper is entered the parts of the body - left arm, right arm, each subdivided in such a way that the detailed motions of fingers may be recorded, movement of the eyes, etc.








The operator views each frame of the section of the film under study and records on the chart by means of accepted conventional signs the various elementary motions employed. The film is viewed through an aperture which lights and magnifies it. The conventional signs used to record the elementary motions on the simo chart are known as "therbligs" - a name created by the reversed spelling of their discoverer "Gilbreth". The











nature of therbligs will be discussed in the next section.

The preparation of a satisfactory simo chart with the use of therbligs requires considerable care and experience and sound judgment. If the motion is not entirely clear or if the operator is in doubt as to which therblig to use, a question mark should be added at the side on the chart. Later sections of the film showing the same motion may clear up the doubt. As the preparation of the chart continues, ideas frequently occur as to means of improving or eliminating certain motions. Such thoughts should be recorded also at the side of the chart.

The "Therbligs" -

Each therblig, or conventional sign used in the preparation of a simo chart, is recorded in a distinctive color. The therblig symbols, their names, and the accepted color of each are recorded below.

SYMBOL	NAME OF SYMBOL	COLOR
	Search	Black
	Find	Gray
	Select	Light Gray
	Grasp	Lake Red
	Transport Loaded	Green
	Position	Blue
	Assemble	Violet

SYMBOL	NAME OF SYMBOL	COLOR
	Use	Purple
	Disassemble	Light Violet
	Inspect	Burnt Ochre
	Pre-Position	Sky Blue
	Release Load	Carmine Red
	Transport Empty	Olive Green
	Rest for Overcoming Fatigue	Orange
	Unavoidable Delay	Yellow Ochre
	Avoidable Delay	Lemon Yellow
	Plan	Brown

These therbligs are elements of the motion cycle, not actually the motions themselves since it is frequently impossible to decide on the actual beginning and end of a particular motion. The seventeen therbligs represent any complete motion cycle, and if new ones are added it will be because (as their discoverer says) some will be further subdivided or because the sum of the seventeen does not make up a complete motion cycle.

### Study of the Simo Chart -

After charts have been completed for all the workers under study it is then necessary to hang them side by side in order to observe the therbligs used and their sequence. Even the slightest variation should be examined closely. A tentative "standard method" is built up by the selection and synthesizing of the most efficient or best therbligs from each chart. Rarely, if ever, will the standard method be the consecutive motion cycles of any one worker. It is more likely that some element from each worker will contribute to the standard method.

### Gilbreth's Rules for Motion Economy and Efficiency -

The "Standard Method" mentioned in the preceding paragraph, which is built up from the best therbligs of many workers, should adhere to the rules for motion economy and efficiency as closely as possible. These rules are given below. (1)

1. Both hands should preferably begin their therbligs simultaneously.
2. Both hands should preferably complete their therbligs at the same instant.
3. Both hands should not be idle at the same instant except during rest periods.
4. Each of the seventeen subdivisions on various kinds of works has a proper range of elapsed time in which it should be performed. While this differs for different people, correct standards from which to deviate should be established.

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(1) Gilbreth, L.M., "Motion Study" Handbook of Business

5. Motions of arms should be in opposite and symmetrical directions, instead of in the same direction, and should be made simultaneously.
6. Hesitation must be analyzed and studied, and its cause accounted for and, if possible, eliminated.
7. Shortest time demonstrated in one part of the study should be used as a mark to attain, and the reasons for the different times required in other parts of the study should be known.
8. Number of therbligs required to do the work should be counted, for the one best way is almost always the sequence of the fewest therbligs.
9. Best sequence of therbligs in any one kind of work is useful as suggesting the best sequence for other kinds of work.
10. Every instance where delay occurs suggests the advisability of providing some optional work that will permit utilizing the time of the delay if so desired, or of making a fatigue study of the interval.
11. Variations of time required for any single therblig should be arrayed and the causes recorded.
12. Lateness of various parts of the anatomy as compared with other portions should be recorded.
13. Since fast motions cannot be made in the same path as slow motions, the learner will acquire the desirable automaticity quickest if he works at the motion speed of the expert from the beginning regardless of the quality of the resulting work.

14. Lateness of the anatomical members of the expert should be observed most closely. Where it is not possible to work from the first at the speed of the expert, this lateness should be copied as closely as possible.
15. Rhythm is most important, and is largely a matter of time and not of distance, although making a motion covering the same distance many times consecutively will effect rhythm to some extent.
16. Awkwardness, grace, ambidexterity, and bimanuality, are all greatly affected by the time element, which affects also hesitation and decision and many other psychological variables.

These rules for motion economy and efficiency are constantly kept in mind by the analyst when making the Simo Chart, and in the later analysis of these charts in selecting the best sequence of therbligs to prepare the Standard Method or "one best way" of performing the operation.

#### Factors to Consider Concerning the Work Place -

Three main factors concerning the work place are considered by the motion study analyst:

- (a) Height of the working surface. This is an important consideration if the worker's arms and hands are to be kept in a restful and relaxed position. The proper height is roughly calculated as the height of the worker's elbow when in the best position to do the work - seated or standing. If the work requires

both sitting and standing the worker should be provided with a chair which will keep him at the same height in both cases. The chair should be provided with casters so that it can be moved by a motion of the foot.

- (b) Circular work space. The most convenient space for work with the hands is circular. If the worker extends his right hand to normal reach and sweeps it across the work table, bench, or desk in front of him, he will have covered the most convenient area for work with the right hand. Similarly, the area covered by such a sweep of the left hand will be the most convenient area for left-hand work. Where these two areas overlap in front will be the most convenient space for work requiring both hands.
- (c) Positioning of tools, materials, machine handles, etc. These should be located in the two-handed work space, if they are not in the way there, or so arranged as to be most easily available at that place.

#### Micromotion Film as a Training Aid -

After the study thus far has been completed, the one best way of performing the operation should be taught to one of the best workers. After he has mastered the sequence of the most efficient motions, it is desirable to make a film of him at work. This film will be invaluable as a training device for all workers employed on the same operation or for teaching beginners later.

### Job Methods Training -

A significant war-time development in the combined fields of Job Analysis and Training is known as Job Methods Training and is discussed in some detail in the chapter dealing with Employee Training Methods.

### Job Specifications -

The detail with which Job Analysis is conducted must be governed by the purpose which the analysis is intended to serve. It is most unlikely that the degree of detail discussed in the preceding pages will be found desirable in many of the operations in the company. In most cases a much less detailed survey will suffice. In other words, the analyst must be constantly aware of the law of diminishing returns in his work and must not carry the investigation beyond the point where its expense will not be justified by further savings.

The value of Job Analysis in the standardization of work motions of the most efficient character, and the employment of the results for the training of new employees on the job, has already been mentioned. Another valuable product of the analysis is the preparation of Job Specifications, or the descriptive summary of the duties and demands of the job and the qualifications required of the worker.

Job Specifications, in turn, may be used for several purposes. The two main benefits to be derived from their preparation are:

- (a) To provide the personnel department with a condensed description of the job's requirements to assist in

the selection of new employees or the satisfactory re-allocation of employees from other jobs within the organization.

- (b) To provide the necessary information for the logical classification of jobs for purposes of salary standardization. This is discussed further in the chapter dealing with Remuneration of Employees.

Job Specifications should reveal briefly the nature of the supervision which the worker receives, the general duties required of the worker, any special or unusual aspects of the work, and whether or not the conduct of the job requires that the worker supervise others. The following two random examples of Job Specifications applicable to civilian employees of the United States War Department indicate the degree of completeness required if the specification is to be useful.

(1)

Title - Miscellaneous Duplicating Equipment Operator

Position No. X X X

Grade X X X

Supervision Received: Incumbent works under the general supervision of an employee of higher grade, performing specific assignments in accordance with previously issued instructions

Representative Duties: Operates multigraph, multilith, vari-type, or automatic-feed addressograph machines or supervises a group of operators of lower grade engaged in operating any combination of the following machines: mimeograph, ditto, electric formograph, electric foot power punch, paper cutter, stitcher, mimeoscope, hand-feed addressograph, graphotype, rotoprint, duplicator, or other duplicating equipment of

simple operation. Schedules and assigns work to subordinates and reviews completed work for neatness, proper assembly, legibility, etc. Assembles completed work and supervises employees engaged in wrapping and tagging for purposes of identification and delivery. Makes minor adjustments and repairs to machines. Maintains files of stencils, plates, copies of reproduced material, etc. Keeps records of activities of subordinates, such as time worked, paper and other supplies used, work completed, etc.

Supervisory Responsibilities: May supervise 5 to 15 junior miscellaneous duplicating equipment operators of lower grades.

(2)

Title - Junior Clerk (Personnel)

Position No. X X X

Grade X X X

Supervision Received: Incumbent works under close supervision of a clerk of higher grade, receiving specific assignments, with work reviewed for accuracy, form, and conformance with previously issued instructions.

Representative Duties: Distributes preliminary employment forms to prospective employees, gives instructions and assistance for the proper completion thereof, and advises as to requirements, examinations, etc. Reviews forms after completion to determine consistency, accuracy, and completeness of information. Fingerprints and arranges physical examinations for appointees. After completion of appointment transaction, checks to insure presence and proper execution of all requisite forms. Checks employment records, personal history cards, and other office records for information required to

determine eligibility of individual employees for administrative promotions. Maintains miscellaneous simple personnel files and records, such as records of injury, examination, and assignment, and files of reports, correspondence, bulletins, circulars, and memoranda. Files such material alphabetically, numerically, or by subject, and posts information to same where required. Supplies information contained therein to authorized individuals upon memorandum request, personal inquiry, or over the telephone.

**Supervisory Responsibilities:** None.

## CHAPTER V

### BUSINESS FORMS

Forms have been referred to by some writers as the "silent organization" and in many respects this title is quite justified. Relationships of authority and responsibility are recognized; the product of the company passes through certain established channels in the course of its completion and is then passed out through other recognized, established channels to its market; the management on the basis of past experience and current investigation establishes recognized operational procedures and controls for the employees and pays them for their labor; agreements are entered into between the employer and the employee on the basis of which certain deductions are made from pay to cover pensions, insurance benefits or bond purchases; salesmen may be employed to sell the products to wholesalers, jobbers, or direct to the consuming public. All of these relationships represent the established organization, and all of them find their ultimate expression in terms of some printed form of the company. Forms are prepared to control (and sometimes to accompany) the materials and semi-finished product through the various operations, to record and control the company's relationship with its customers, to record and control relationships with the employees for purposes of pay, vacations, sickness, pensions, insurance and other reasons, and for a multitude of other purposes. In other words, in a well established, scientifically managed company, the printed forms do represent a paper organization revealing, controlling

and recording the relationships of the more tangible organization of men, management, materials, and money.

#### Primary Considerations in Introducing New Forms -

As with other tools of management the determining factor which should govern the introduction of forms should be the need for them. The introduction of forms, therefore, presupposes an investigation of the system and a determination that it requires additional control or record that can best be accomplished by a new form or series of forms. Not every change in the system of operation, or in the existing relationships, requires new forms. In fact it is usually more desirable to consider alteration in existing ones to meet the changed conditions.

Having determined, then, that a new form is required it is necessary to decide very definitely the purpose or purposes to be served. If the form is required to serve more than one purpose they should be arranged in order of importance to the organization. This is necessary to avoid giving undue weight to relatively unimportant considerations when one is designing it.

The channels through which the new form will move should also be considered carefully. Frequently this will involve a fairly thorough study of the operation to be controlled or recorded, although this study should normally have been already made at this stage. A knowledge of the operation concerned will suggest certain physical qualities required of the new form as, for example, the weight of card stock or paper

to be used, restrictions as to its size and shape, etc. Weight and quality of paper to be used should be governed by the amount of handling the form will receive during its active life and the length of time it must be retained for record purposes afterwards. It would not be good practice, for example, to use a cheap quality sulphite stock for the printing of an important permanent record, since the need for the record would long outlive the paper on which it was placed. Similarly, forms which are to be subjected to rough treatment by workmen in the plant should not be on light weight paper but will serve their purpose if printed on card stock.

A knowledge of standard sizes of paper and card stocks made by the paper manufacturers is important before one starts to design a new form. If at all possible the size of the form should be one which can cut from the manufacturers' standard sizes without waste in order to keep down cost in its preparation. These standard sizes sometimes vary with the quality and weight of the stock and it is usually wise to consult paper manufacturers' catalogues on this point.

The next step before beginning to design the form is to record all the information which it will be required to contain and to indicate the relative importance of the various items. This is necessary so that the later arrangement of spaces on the form will give priority of room and location to the more important items.

#### Design of Forms -

The size decided upon must be sufficient to contain

the necessary information, suitable for the handling it will receive and for the nature of the filing equipment in which it will be kept. Colored stock and/or ink are justified where it is necessary to distinguish the form quickly from others with which it might easily be confused or where the operation being covered has high priority. Colors should, however, be used sparingly; otherwise they cease to have any significance. Moreover many colors have been found to cause deterioration of the eyesight of workers using them constantly. Sometimes two or more colors of ink may be justified on the same form in order to lend emphasis to certain important sections but this necessitates a separate printing run adding considerably to the cost.

Style and size of type also offer opportunity for emphasis of important sections. Style of type should be simple and selected with a view to legibility. Size of type must depend on the amount of information it is considered necessary to print in the space allowed. If the form must be used by workmen under relatively poor lighting conditions in the factory the type should be large and bold-face. Variations in size or style of type may be employed as considered necessary.

Location or arrangement of material on the form is an important consideration. Certain locations have a psychological priority, such as the top corners, since the eye normally falls on those places first, and should be reserved for the more important entries. Related portions which must be used by the same worker should be kept together and arranged in sequence of their use in order to decrease the amount of eye travel

necessary. If the form is to be used primarily as a record then it is necessary to give greater weight to its method of filing. If vertical filing is employed the top line is the most important location and should be reserved for the name, account number, or other main filing item. If flat, visible filing in card trays is to be used, then the bottom line becomes the important one for classification. Decision regarding spacing of the various items must also be made at the time arrangement is being considered. Adequate spacing is important and must, of course, be more liberal if the entries are to be made by hand under rough conditions in the plant than would be necessary if the entries are made by carefully regulated, mechanically spaced accounting machine in the office. If the entries are to be made by typewriter, the spacing between lines must adhere to typewriter spacing, otherwise the operator will find it necessary to adjust the platen constantly with resulting loss of time.

Delay in passing the form through all the steps required may be overcome by its original preparation in duplicate, triplicate, or as required. In this way copies are available for simultaneous work by several individuals. If several copies are required, it is usually desirable to have the forms prepared in sets, each part suitably imprinted as to its distribution.

Several possibilities exist as to the original entry of information on forms. They may be prepared singly or with copies, by hand, typewriter or accounting machine. If the quantity justifies keeping one machine and one operator busy making original entries then continuous forms are indicated

which obviate the necessity for placing each form in the machine separately. In some cases punched cards containing the required information may already have been prepared for other purposes in which case equipment is available which uses the punched cards as the actuating medium, instead of typing by an operator, or it may be found economical to prepare punched cards especially for this purpose. If punched cards are used it is obviously necessary to use continuous forms also.

#### Control of Forms -

Having discussed the purpose and importance of forms in modern scientific business management and having dealt briefly with some of the more important factors in their design, it is now necessary to consider their control - what should be done to ensure that adequate supplies are kept available, that their design and use is critically reviewed at periodic intervals to keep them up to date.

One department in the business, usually that dealing with planning, should be responsible for form control. A record should be maintained of each form by number and name, its purpose, the nature of any intimate relationship with other forms, quantity and date of past printing orders, and the names of supervisors or foremen most closely associated with the actual use to which the form is put.

Supplies of each form available as required on requisition should be maintained in a stock room. A minimum quantity to be kept in stock should be determined and this quantity should be definitely marked either by separate wrapping or segregation

with a "reorder warning ticket" attached. The minimum quantity to be kept in stock should be determined by a combination of two factors; (a) the rapidity of their use, and (b) the length of time required for stock replenishment.

When the "minimum quantity" in stock is reached, a notification to this effect should be sent to the planning department who will reconsider the design and arrangement of the form in the light of changed conditions since the last printing. It is also desirable to consult the supervisors and foremen most intimately associated with the form's every day use to get their opinion and advice. The necessary alterations are made on one copy of the form and this becomes the master copy for the printer. The quantity to be ordered can readily be decided when it is known how long the last supply covered, the nature of the form's use, and whether or not any changes in operation are contemplated which will alter the demand. If the form is standard and its applicability unlikely to be changed, a year's supply is normally justified. If, however, conditions are changing more rapidly, a supply to cover a much shorter period should be ordered. Printer's proofs should be checked carefully by the planning department. When the new supply is received from the printers it is placed in the stock room where requisitions in the mean time have been filled from the reserved "minimum supply".

It will be noticed that the system of form control suggested above does not provide any means of continuous inventory or its audit because forms are usually of no value to anyone but the business for which they were prepared and the quantity

on hand at any particular time is relatively unimportant as long as an adequate supply is maintained. There may be exceptions to this, for example in the case of blank cheques which must not fall into unauthorized hands, in which case closer supervision of such stocks must be maintained.

The modern development of printed forms for every conceivable control and record purpose has been an important contribution of science in business management.

## CHAPTER VI

### SPECIAL CONSIDERATIONS IN THE APPLICATION OF SCIENTIFIC METHODS TO OFFICE MANAGEMENT

The office, according to Leffingwell, is "that part of an enterprise devoted to the direction and coordination of its various activities. It is characterized by the gathering, classification, and preservation of data of all sorts; the making, using, and preservation of all kinds of records; the analysis and utilization of these data, in planning, executing, and determining the results of operation; the preparation, issuing, and preservation of instructions and orders; and the composition, copying, and filing of written messages". (1) The office is, in effect, the nerve centre of the entire organization. In many instances it is the organization itself.

One of the outstanding developments of the more recent stages of the industrial revolution, say since 1880, has been the tremendous growth in the number and percentage of persons employed in clerical occupations. From an insignificant figure in the earlier days of industrial development, clerical occupations (office work of one kind or another) now provide the means of livelihood for more people than any other occupation with the single exception of agriculture. This growth in numbers and in percentage of persons employed in office work has been due largely to the growth in complexity of industry itself. Formerly it was the practice for the business to find its materials fairly close at hand and to manufacture its product on a small scale for local consumption. Such a system involved relatively little

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(1) Leffingwell, W.H. "Office Management, Principles and Practice."

clerical work and in the small enterprises typical of that earlier day, such clerical work was usually done by the owner-manager himself with the possible assistance of one or two office helpers.

Today the picture has changed considerably. Many small businesses still find their materials locally and manufacture their products for a local market, but the greater part of industrial production is carried on on a much wider scale. It is not unusual today to find many of the required raw materials coming thousands of miles from foreign countries and the products of the business being distributed on a world-wide scale. Such wide horizons of industrial activity have increased many-fold the need for direction, coordination, collection of data, analysis, planning, and determination of results, preparation and use of records and written communications, et cetera - in brief, the need for office work.

Scientific methods are applicable to the office equally as well as to the factory. The development of such methods in office organization and administration has been, however, much more recent. Taylor, who conceived the fundamental principles of shop management, which later became known as "scientific management", was, of course, interested primarily in the satisfactory operation of the factory. If, by chance, he had taken a position as office supervisor instead of gang boss, it is quite conceivable that his principles would have developed with the emphasis on their application to the office rather than to the factory. The office of his day, however, did not present the complexities of occupational specialization and mechanical

appliances apparent today, and it did not offer the shop's challenge to his ingenuity.

In the office the tools of the factory become pencils, pens and paper, the drill press or turret lathe becomes the typewriter and the adding machine, the work bench becomes the desk, and the materials and semi-finished product become reports, orders, invoices, and other documents. Job analyses, time studies, and motion studies are applicable to office operations, too. All work requires motions and consumes time and such studies reveal wasted effort in the office as well as in the factory.

Scientific layout and work routing apply, too. The same general factors governing such decisions should be considered. The same careful thought and planning are not usually applied in offices to the convenient and efficient channeling of work. No doubt this is due to the fact that tangible and sometimes heavy and bulky materials do not pass from desk to desk in the office as they pass from bench to bench or from machine to machine in the factory. Papers, files, and documents can be easily carried by the office messenger to the next department but the management frequently fails to realize that the large quantity and delay involved in such practices might justify a major rearrangement of office layout in order to place related operations in closer physical proximity. Over-taxed messenger or pneumatic tube service too frequently results in nothing more than the hiring of more messengers or the installation of more pneumatic tubes.

The employment procedure and the use of tests for the selection and assignment of employees to tasks for which they

are suited are equally applicable to the requirements of the office. Training methods, labor relations, remuneration for services, pension and insurance schemes, safety, fatigue, employees services - all apply to the office and office workers. Some of these problems, it is true, do not apply with equal emphasis in office management. Safety precautions and the prevention of accidents, for example, are important considerations for many factory managers, but rarely does one find an office where they require serious attention. The nature of clerical work is, on the whole, less dangerous.

For the sake of convenience in considering the various aspects of office management and the manner in which scientific method has been applied to them, let us divide the subject into four main headings and consider some of the major components of each as follows:

1. Personnel

- (a) Hiring, records of progress, promotions, misfits, disposal.
- (b) Training, educational courses.
- (c) Tardiness, absenteeism.
- (d) Hours, vacations.
- (e) Grievances.
- (f) Health, recreation facilities, lunches.
- (g) Records of turnover, its causes and rate.
- (h) Job analysis, its applications.
- (i) Salary standardization, incentives, bonuses.

2. Building and Equipment

- (a) Building

(b) Furniture and equipment.

(c) Machines and appliances.

3. Organization and Methods

(a) Organization.

(b) Office methods, routines.

(c) Expense, its measurement and control.

(d) Output, its measurement and control.

4. Records and Communications

(a) Forms, stationery.

(b) Correspondence.

(c) Typing, stenography.

(d) Mailing.

(e) Filing.

(f) Intercommunication.

Hiring, Recording Progress, Promoting, Transferring, and Disposing of Employees -

These phases of management are discussed in greater detail elsewhere in the treatise. They are important ones for the office manager. Naturally he is interested in securing the services of personnel best qualified for the duties they are to perform. The success of the work in the office and the harmonious relationships existing between workers and with the management will vary in direct ratio to the success achieved in the satisfactory selection, promotion and transfer of employees which constitute the office force. Sometimes mistakes will be made in the selection of personnel. Misfits will be hired. When this happens it is essential to the welfare of the office as a

whole that prompt attention be given to their transfer to other jobs for which they are suited. If after fair trial in other types of work it is found that the individual is a chronic misfit in the organization, it is equally important to arrange for his prompt disposal so that he may be employed elsewhere in a position more in keeping with his abilities and personality. Such practice is in the interests of both the company and the individual concerned. It is equally important to the welfare of the office and the harmonious relationships of the staff that prompt action be taken in the promotion of individuals when they have satisfactorily indicated their abilities to handle increased responsibilities. Merit should be the sole guiding principle in making such selections for promotions, because if they are made for any other reason it will be obvious to the staff, morale will suffer, and the promotion incentive to better work will be destroyed. In order that these promotions, transfers, and disposals may be made when deserved, it is necessary for the office manager to maintain adequate and unbiased records of each employee's work. Such records need not be maintained daily or even weekly but a definite system must be instituted whereby unsatisfactory or unusually good work is brought to light without delay.

#### Training and Educational Courses -

The day is past when management can afford to drop an employee into a job and leave him to learn it. Under the highly competitive conditions of modern business it is necessary that each employee receive careful instruction in his duties so that he may become an effective producer without unnecessary delay.

In order to accomplish this a definite training program should be set up. It may take the form of a company "school", or personal instruction by the supervisor or a senior clerk, or both. The important thing is that the program of training must be definite, clearly understood by those responsible for its operation and never left to chance. Educational courses of a general or institutional nature may be on a continuing basis. Many progressive companies find such courses sufficiently valuable in improved employee relationship and general level of efficiency that financial and other types of rewards are given for satisfactory completion.

#### Tardiness and Absenteeism -

Both these conditions sap the efficiency of an organization and steps should be taken to correct them. Very often a positive approach to these problems is more effective than a negative one. For example, an extra day's vacation might be made contingent on punctuality and perfect attendance or a high standard of each, rather than cancellation of benefits or financial loss for failure. Many organizations allow reasonable leeway in these matters to take care of emergencies before making a deduction from salary.

#### Hours, Vacations -

Hours should be definite and in line with other offices of a similar nature in the community. The general trend in recent years has been towards shorter hours in offices and, with the exception of periods of unusual strain such as the war years, this trend will likely continue. Many companies require shorter hours

of work during the summer months in order to allow their employees greater opportunity for recreation during the fine weather. Such progressive policies are usually reflected in improved employee relations and in the greater popularity of the company in the community which again reflects itself in a higher grade of new employees through wider choice of applicants. Vacations, too, should be definite and, provided the convenience of the company is not seriously disturbed, employees should be allowed to take them at the time of their own choice. Summer is and will remain the popular season for vacations. Some companies try to overcome this seasonal peak by offering longer vacations if taken at other seasons. Longer vacations for veteran service are frequently allowed as a reward for long and faithful work and as an added incentive to remaining with the company. Enlightened policies on such matters pay dividends in improved management-employee relations, higher morale, and a happier and more stable staff.

#### Grievances -

Every member of the staff should know how, and through whom, to lodge complaints. The normal procedure should be through his supervisor, but another channel should be available to him. His grievance should be considered seriously and he should be informed of the action taken or should have the reasons carefully explained to him why no action is or can be taken. No recriminations should result if the grievance is made or complaint lodged in good faith and the benefit of any doubt in such a situation must remain with the employee.

#### Health, Recreation Facilities, Lunches -

The health and general welfare of the staff are also responsibilities of the office manager in most offices of small or medium size. In larger offices a medical department may be in operation, but even then it will be found desirable that a very close liaison exist with those responsible for office management. Frequently many of the physical and mental difficulties of the employees can be traced directly to certain conditions of work which should be changed. Adequate recreational facilities assist materially in maintaining pleasant working relationships among members of the office staff. Such facilities may include competitive athletic teams of various kinds and provision for individual sport. Music, dramatics, hobbies, dancing, and many other forms of recreational association may be encouraged. The larger offices, on the whole, are more likely to make such provisions. This is perhaps quite natural because of the larger number of employees from which groups with common recreational interests may be formed. In recent years there has been a considerable increase in the number of companies establishing lunch rooms for the benefit of the members of their staff. Some companies operate their own lunch rooms while others enter into a contract with an industrial caterer. In many cases these lunch rooms are operated at a financial loss in order to encourage the staff to use the facilities. The loss is justified on the basis of improved health standards resulting from the adequate and balanced diet provided.

#### Records of Turnover -

Turnover of personnel is very costly. It not only

nullifies all the work and time spent in the selection of the new employee but represents a substantial loss in terms of the time spent on training. It is generally recognized, therefore, that precautions must be taken to prevent unnecessary loss of personnel. The first requisite in attacking this problem is full knowledge of the percentage of turnover of staff, and its classification by causes and departments. A study of such figures may point the finger of suspicion at certain unpleasant working conditions in the office which can be corrected. "Unpleasant working conditions" may include an unpopular supervisor. In some cases the cause may be traced to inadequate selection methods. A study of the figures in comparison with other companies of a similar character in the same community or in the same business may, on the other hand, reveal that the turnover though large in numbers is not out of proportion. In any event, however, no decisions can be reached and causes eliminated if the figures are not available for study. It is important, therefore, that the office manager sees that such particulars are collected and maintained for analysis purposes.

#### Job Analysis -

The scientific analysis of jobs by time and motion studies is discussed in greater detail elsewhere. The modern office has many jobs of a repetitive nature that adapt themselves to analysis of this kind, such as machine operation, card sorting, record posting, etc. The office manager must make certain, of course, that such studies have the full cooperation of the clerks concerned since friction or resentment will quickly

destroy any advantages of improved motions. Sometimes considerable improvement can be made by encouraging the clerks to analyze their own and each others motions, or by the organizing of small discussion groups at which good and bad examples of motion economy (or the lack of it) are shown. Such efforts, if they succeed in getting the cooperation of the clerks, will make the latter more critical of their own work habits and will likely have desirable results.

#### Salary Standardization, Incentives, Bonuses -

The value and justification of salary standardization receive lip-service support from many companies who have not made any serious scientific effort to establish such methods. Certain principles receive general recognition in this respect, as, for example, remuneration commensurate with effort and responsibility, promotion for merit, unfairness of withholding promotion because of employee's extreme competence in present post, etc. It is unfortunately true, however, that many companies have yet to classify positions according to importance and to establish salary ranges for each class, which is necessary if inconsistencies of remuneration and promotion are to be overcome. The establishment of such standards within the office is a responsibility of the office manager. Incentives and bonuses for increased production or conscientious application to duty should also be considered in the office. They need not be of a financial character; indeed many companies have found incentives and bonuses of other types (for example, increased vacation periods) to be very popular and to bring forth greater effort.

Building -

Anyone with a knowledge of arithmetic can calculate the amount of floor-space required to house the office staff and furniture and equipment used, but adequate floor-space is just one of the many factors to be considered. Many scientific improvements in the "physical" conditions of office employment have been made in recent years. These new developments include such fields as illumination, acoustics, air conditioning, inter-communication, and many others. Knowledge of developments in these rapidly expanding fields is an essential for modern, scientific office management.

Before the management starts out to seek new or additional office space, or before it calls in architects and construction engineers to plan a new building, it must make a thorough study of the departments and operations for which the space is required. Time spent in this early planning stage will pay the company many times over in the prevention of later and more costly alterations or the even more costly continuance over a period of many years of inefficient layout necessitated by physical limitations of the building itself. Among the factors requiring thorough consideration in the "pre-architect" planning stage are:

- (a) The inter-relationship between sections and departments of the office and the advantages and disadvantages of close proximity in each case. Advantages are evident where large numbers of documents, files, and records pass from one section or department to another, or where two sections or departments must

have frequent access to the same master sets of records, or where frequent personal liaison or consultation is necessary. Such a study may suggest changes in the routines requiring this close proximity and if such changes are in the interests of more efficient operation they should be made before the study is completed and decisions made concerning new locations. An example of a disadvantage to proximity of departments might be the case where one department uses a great deal of noisy, vibrating machines, and another department requires quiet for mental concentration. After every department has been listed and studied in its relationship to every other department, the investigator should thoroughly consider what improvements in methods can be made which would tend to nullify the advantages or disadvantages listed. Such improvements should be made at this stage. The nullification of an advantage or disadvantage should not, of course, be considered a reason favoring the change unless the continued proximity or wide separation of the two departments in the new quarters poses a serious problem of layout. As a result of this study it will be apparent which departments must, for the sake of operational efficiency, remain in close physical proximity in the new quarters. This becomes one major factor in the provision and allocation of space.

- (b) In practically all offices, some departments are growing in size while others may be declining, and in each case

there may be examples of these processes taking place with different degrees of rapidity. In some cases this may not represent a long term evolution of the business but may be due to a cyclical fluctuation, as, for example, the great increase of over-due accounts collection work in times of business depression and its decline in times of easy money. Management must forecast the space needs of the different departments as far in advance as possible in order to minimize the necessity for future alterations or moves. This forecast should be based on past experience, a study of the market for the company's product and how changes in demand will affect the operations performed by the various departments, and future company policy. Emphasis in this case must be placed on the long-term needs of each department or section. This becomes a second major factor in the provision of space.

- (c) Physical factors of building construction normally govern the location of certain service facilities such as vaults, supply and stock rooms, public reception and waiting rooms, etc. Vaults, for example, if they are to withstand the shock of serious fires, must be constructed as a block on their own foundation. This eliminates the possibility of having vaults in different locations on different floors. Supply and stock rooms should be located at or near the freight delivery entrance. Public reception and waiting rooms must be near the main public entrance. In some cases

these factors will influence the location of certain departments requiring the close proximity of these services.

Many other factors of varying degrees of importance enter into decisions concerning the provision of new space for the office. When a company reaches the point in its development where additional space is required, it should immediately delegate to a responsible and well-informed person on its management the responsibility for study and analysis of all of these factors. This individual should continue to work in close collaboration with the architect in the later stages of planning if a new building is to be constructed, or if hired space requires alteration.

Private offices for supervisors should be provided only after thorough investigation of the needs of the individual case. When considered necessary for interviewing or undisturbed work, they should be of temporary construction so that their later removal, should the demands of the department change, will be relatively easy. The upper part of the wall facing the staff should be of transparent glass so that the value of the supervision will not be destroyed. The provision of private offices to satisfy the vanity of individuals should be discouraged. If such a practice is started the management will find that it has established a precedent, and other supervisors who previously were quite satisfied to occupy desks with their staff, will expect similar private accommodation.

#### Furniture and Equipment -

Certain improvements have been made in recent years

in the design and construction of office desks, tables, and chairs which increase the functional efficiency of these items of office furniture. There is a definite advantage in the standardization of sizes of clerical desks in order to allow greater latitude in arrangement with regular aisles. A standard size for such a desk is 30 by 50 inches, but many other sizes are available on the market and may be justified if the nature of the work to be done requires larger work space. Normal height of desks is 30 inches but in this respect standardization is not so easily justified. For comfort (and therefore for working efficiency) the desk height should be adapted to the person using the desk. This can be accomplished by purchasing desks with feet allowing for adjustment in height or by providing foot rests as required to compensate for the length of the employee's legs. Apart from desk size and height there is little to justify standardization except the relatively small advantage of lower original cost. The nature of the desk selected, the number, size and arrangement of drawers, the provision for inseting calculators, typewriters, or other equipment at the proper level, or tubs for card records, etc., should be determined by the nature of the work to be done. If each clerk is provided with the same type of desk as his fellow worker in spite of wide differences in the nature of the job to be done, the efficiency of the worker will suffer. Even a relatively small inconvenience when multiplied by thousands of operations over a period of years will cost the company many times the price of a special desk for that particular type of operation. This does not necessarily mean that a desk must be made to order

to suit the convenience of each individual job in the office. An analysis of the nature of office work will reveal that the different types of operations may be classified according to desk requirements, and that desks may be fairly closely standardized within each class. If, however, a special type of operation indicates the desirability of a special desk, such a desk should be provided in the interests of efficient operation. Desks should not have highly polished surfaces or glass tops which cause glare or reflection of light. The most satisfactory type of desk top is a neutral shade linoleum or plastic of similar composition. Desk color should be subdued in shade and in reasonable harmony with the surroundings to prevent eye distraction. The main body of the desk should be well off the floor and have as few legs as sound construction and steadiness demand in order to facilitate floor cleaning.

Adjustable posture chairs are available and in each case the chair should be adjusted to the physical requirements of the individual. After "fitting", the adjustment should be securely locked to prevent unintentional change in height or location of back rest and the chair labelled with the name of the individual concerned. Proper posture at work has been found to decrease fatigue and has proved an important factor in the maintenance of health in sedentary occupations.

Files and filing cabinets are available in considerable variety and here, too, selection should be made with due regard to the specific requirements of the job. Generally speaking it is desirable to arrange files in height and location most convenient to the clerks working with them in a sitting position.

This means that files should be decentralized as far as consistent with efficient operation. There is no particular virtue in arranging files in large blocks unless many people require reference to all sections almost simultaneously. If several people are required to work at files for long periods in a standing position with frequent bending and stretching, the system should be reconsidered with a view to greater specialization and decentralization of the files and their location in more convenient positions. Where small files require frequent reference by only one clerk it is usually desirable to house them in the individual's own desk, either in a drawer or in an inset tub flush with the top of the desk, or in special equipment provided for that purpose and conveniently located beside the desk. If small files require reference by two or more clerks at different times, they may be equipped with wheels or easy-running casters, so that the files may be easily moved to the most convenient position for each clerk in turn.

In all decisions concerning the purchase of furniture and equipment, the office manager must give consideration to two conflicting factors. On the one hand, standardization is usually cheaper in original cost and allows greater latitude in using the furniture or equipment for other purposes than that for which it was originally purchased as the requirements of the office change. On the other hand, adherence to standardization prevents the selection of furniture and equipment most suitable to the requirements of specific jobs. The advantages of specialization are more frequently overlooked (because the unit saving in each operation is very small and must be considered over a long term).

## Machines and Appliances -

During the past few years great strides have been made in the creation and development of new types of office machinery and appliances. It is intended in this section to confine the discussion to a few considerations which should be given by the management to the selection of the appropriate equipment and not to discuss the many types of such equipment available or the multitude of machine applications in the modern office. Most of the larger office machine manufacturers have established departments whose main purpose is to assist companies in the selection and adaptation of the products of that particular manufacturer to the company's needs. Such services by manufacturers have been extremely helpful in introducing labor-saving machinery to office operations. The management must always, however, bear in mind one important fact - the manufacturer's main motive in maintaining service departments of this kind is to increase the sale of his products. It is unnatural, therefore, for the manufacturer to consider the possible application to the company's problems of other products available on the market. To minimize prejudice in this respect a company which makes reasonably large purchases of office machines has three possibilities open:

- (a) the maintenance of certain specialists within its own organization whose responsibility it is to study the possibilities of available machines of competing manufacturers.
- (b) the hiring, for specific studies of this kind, of responsible independent consultants who are in a position

to determine scientifically the needs of the operation and the machinery best suited to it.

- (c) allowing more than one manufacturer to investigate the requirements of the operation and to submit a solution based on the use of his particular product.

In any event the final decision must be made by the management and if the decision is to be sound it must be based on a thorough knowledge of the operation to be mechanized and a reasonable knowledge of the various mechanical devices available for it. For this reason it is necessary for the office manager to keep abreast of developments in the office machine field, or, in larger organizations it will be found necessary to maintain specialists on the staff for this purpose.

#### Organization -

The organization of the office and the inter-relationship of personal responsibilities and authorities should never be allowed to become hazy or confused. Efficient operation demands that the organization be clear cut and that each department head, supervisor and clerk have a definite understanding of the demands of his job and its limits. If personnel fail to appreciate these delimitations of authority and responsibility, difficulties will follow. Either there will be certain aspects of the office work for which no one feels responsible and which will therefore suffer from lack of attention, or, personal animosities will arise from a feeling that someone else is intruding into another's field of responsibility. It is important, therefore, that the management makes a definite and clear statement

of the organization. It is realized that an organization chart has certain definite short-comings in that it cannot hope to show all the shades of inter-relationship existing in a complicated, large, modern office, and also that it implies a fairly static organization instead of a dynamic association of individuals. Nevertheless, as a definite start in the clarification of limits of authority and responsibility the organization chart is very useful and should be instituted if it is not already in use. The chart may include or be supplemented by a statement of the functions of all departments and sections. Insofar as possible the chart and statement of functions should be available for perusal by all members of the organization. If this is not possible due to the size and complexity of the office it is at least essential that the organization and statement of functions of the particular department should be available to the personnel of that department. It is important that the relations of the department to other departments and to the organization of the company as a whole be shown.

Organization charts and statements of functions should, of course, be kept up to date at all times. Under the conditions usually prevailing in the modern office the organization, or inter-relationship of functions, individuals, and operations, is constantly changing. If the graphic and written manifestation of these relationships does not truly represent them, it is misleading and worse than useless.

Office Methods, Routines -

Office manuals and departmental manuals should be

maintained for the guidance of the staff. The office manual should be a practical and useful handbook of general information for all members of the staff. The department manual should contain complete operational instructions for each job. It need not be in printed form but at least copies of instructions governing each operation in the department should be available to the office manager, the department head, and the individual performing the operation. These instructions should be kept up to date so that they will be available for the instruction of new workers, and to ensure this the instructions should be reviewed periodically.

Suggestion contests encourage the employees to seek improvements in their jobs and are frequently productive of ideas of considerable merit. Such contests may be either periodic or continuing. To handle suggestions for improvements a committee is usually appointed which can be augmented by the advice of the department head concerned where necessary to judge the merit of any particular suggestion. To encourage the wholehearted cooperation of the staff some incentive must be provided. This may take several forms - a financial reward varying in amount with the importance of the suggestion, extra "time off", publication of the accepted suggestions and the photographs of the clerks making them in the company magazines or newspaper, etc., or a combination of any of these. Progressive management realizes that the workers themselves are in a good position to see ways of improving their work and is anxious to tap this source of valuable ideas and to reward them adequately.

With the great variety of tasks to be done in the

large modern office, the various routines through which work passes are likely to become quite complex and rather confusing to any who are not entirely familiar with them. It is customary in such offices, therefore, to have certain specialists whose duty it is to study the methods and routines constantly with the object in view of their improvement and simplification. In some cases a special department may be set up for this purpose, known variously as methods department, planning department, systems department, etc. Specialists doing this type of work must be particularly careful to give credit for new ideas where credit is due, otherwise they will encounter a passive but effective resistance on the part of the clerical staff whose operations they are investigating.

#### Expense, Its Measurement and Control -

Most companies operate on a reasonably small profit margin, particularly if the industry is highly competitive. Such a situation demands that the management know quickly and accurately the financial situation. If expenses get out of line the profits from operation will be affected. Prior to the commencement of a financial period, and in some cases every month, the management will prepare a budget as a guide and control for the ensuing period. The budget will place an estimate and limit on all the major expenses to be incurred, which may be subdivided into departments. Submission of the office budget for approval by the senior management and adherence to it during the financial period will be a responsibility of the office manager working with the department heads. Departmental expense

statements should be prepared at certain periodic intervals, usually each month, for submission to and approval by the management and for comparison with the budget for the period. In this way the management is kept informed regularly of the expense situation and is in a position to take effective action as considered necessary or desirable, based on actual facts and not on guess work. Conditions in many modern industries change so rapidly that this regular and up-to-date control is essential to profitable operation.

#### Output, Its Measurement and Control -

The measurement of output in the office is an important prerequisite to effective control and scheduling of work. Without effective means of measurement it is impossible to direct the effort of the staff into the most productive channel. Records may be maintained on the output of individuals as well as departments if the latter are found insufficient to effect the necessary control or if they reveal a situation requiring further investigation. Such records are most valuable for comparison purposes over long periods. Frequently they will reveal severe fluctuations which should be investigated carefully in order to determine the causes. As a result of these investigations and the revelation of the causes of the fluctuations it may be possible to remedy the conditions giving rise to the low periods of productivity, or to alter the routing and scheduling of the work in order to maintain an even, steady flow. An even rate of production is in the interests of both management and staff since it avoids periodic over-time work and unnecessary

pressure on the clerks and enables the management to estimate more accurately its future personnel requirements. In many offices it is impossible to eliminate entirely the peak loads at certain times of the month or at certain seasons, but adequate production records and scientific work scheduling will ease the situation considerably.

#### Forms, Stationery -

A separate chapter of this thesis has been devoted to a discussion of the importance of printed forms to the modern business. Their standardization and control are of great importance in the office since the essence of office work is the written word or the maintenance of records or communications on paper. It is essential, therefore, that the management of the office establish an effective system for the study, standardization, production, and control of the forms required in keeping with the needs of the organization.

#### Correspondence -

Letters are by far the most important means used in business for the conveyance of information to its customers, sales representatives, or others outside the immediate confines of the office. It is important, therefore, that the letters emanating from the office convey information accurately, completely, and graciously. If this is not the case, much irritation, and loss of time, money, and goodwill will result. Most modern companies realize the importance of letters in the conduct and development of the business, and take active steps to improve the efficiency and general tone of their written

communications. Efforts to improve correspondence take various forms. Classes for the training of correspondents may be established to assist them in developing a proper technique. Correspondence manuals may be issued giving helpful suggestions and indicating the policy of the office in regard to style and form. Periodic bulletins also assist in keeping the importance of good letters before the dictators and stenographers. Contests are sometimes run to encourage a competitive spirit. All of these means of improving correspondence are worthy of trial and should have a favorable effect on the general standard of letters.

Such efforts should not, however, be spasmodic; to be effective they should be continuous. Correspondents, like others, will get into inefficient ruts and become careless unless they receive constant and effective reminders of the importance of their work. If the size of the office and the number of dictators are sufficient to justify it, a correspondence supervisor may be selected whose duties it would be to keep constantly reviewing copies of out-going letters and offer advice and suggestions for improvement to the dictators as required. If a correspondence supervisor is appointed, he should be formally "introduced" to the staff by the management. This introduction might take the form of a circular letter or publication of the fact in the house organ. The announcement should attempt to sell the idea of correspondence improvement to the staff in such a way that dictators will welcome his advice and help and not resent the intrusion. Even with this assistance the correspondence supervisor or adviser must be extremely tactful in his approaches if he is to succeed without causing irritation and resentment.

Most large offices are required to send out many communications conveying exactly the same information to different recipients. When this is the case it is often found desirable for the sake of economy to prepare form letters by other means than individual typing by hand. Form letters are justified only where it is important to imply that the case has received personal attention and where the form letter exactly resembles normal typing. Form letters which are poorly reproduced and, therefore, obviously prepared in quantity, do not create a favorable impression with recipients and should be avoided. One of the more recent developments in the quantity production of form letters is the automatic typewriter which is driven electrically and actuated by means of a perforated roll similar to the player piano.

#### Typing, Stenography -

In an office of several departments, there will likely be found considerable variation in the typing and stenographic demands of the various departments and even within the same department from day to day or at different periods during the month. In order to make full use of such services, stenographers and typists should be provided within each department only in sufficient quantity to take care of minimum needs. An additional pool of typists and stenographers in a central typing room should be available to take care of further demands. This centralized pool provides an excellent opportunity for the training of new personnel since the typists and stenographers from the central typing room receive many varieties of work from the different

departments. The central typing room also provides the logical location for associated services such as duplication work and the issuance of circular letters.

The introduction of dictating machines has resulted in considerable saving of time in the preparation of letters and other documents. While the dictator records his letter verbally on the dictating machine the typist proceeds with the transcription of previous recordings or with other work. The need for stenographers capable of taking shorthand has decreased considerably in the modern office.

#### Mailing -

Mailing facilities are invariably centralized in the office if for no other reason than the control of the supply of stamps. If the mailing needs of the office are large, postage meter machines are available which automatically seal and stamp by metered impression. Such machines are available in many sizes and varieties depending on the needs of the business and are capable of handling large quantities of mail matter rapidly. In the same department are normally located the facilities for the receipt and sorting of incoming mail. In this respect, too, if the amount of incoming mail justifies it, electrically operated machines are available for the opening of envelopes. In order to speed up the distribution of incoming mail to the various departments in the morning, it is customary to augment the usual staff by personnel from other departments. In the same department may be found teletype equipment or other facilities for the dispatch of telegrams and cables.

## Filing -

General correspondence files in the office are usually centralized for the sake of economic operation and control but other types of files may be found in other departments if their use is limited to the needs of that particular department. Filing systems must be determined to meet the particular needs of the company and the nature of the material to be filed and it is impossible, therefore, to make very many general statements concerning this important aspect of office work. The test of a filing system is the ease and rapidity with which a letter or other document can be found when required.

Several varieties of card files are available, each having certain advantages for different requirements. If the cards do not require frequent or rapid reference, ordinary vertically filing facilities are best because they are economical in cost and space requirements. On the other hand, if the cards receive frequent reference and if the information on them must be available quickly, some form of visible equipment is necessary. Many varieties are available from which the management can make selection to suit the particular needs of the job.

Since floor space and filing equipment within the office itself is at a premium, some provision must be made elsewhere for the storage of files after they have become inactive but before they may be destroyed. It is usually possible to estimate the required life of all office documents. Some documents of an important legal nature may require permanent retention although this is unusual. Others may safely be destroyed after a few years or even a few months. Others will have out-

lived their usefulness by the time they are removed from the active files within the office. All files removed to storage should be properly labelled on the outside of the container or package so that they may be found if required. The date on which the contents of the container may be destroyed should also be clearly marked, a practice which facilitates the elimination of useless material without the necessity for later review.

#### Intercommunication -

Intercommunication in the office should be efficient and rapid in order to expedite the work. If for any reason intercommunication is inefficient, the clerks will be tempted to do it themselves by personal liaison, a practice which should be discouraged in the interests of efficient operation of the office as a whole. The telephone is one of the most important means of intercommunication in the office. Other means must be employed, however, where it is necessary to transport documents from one location to another. Intercommunication of documents may be accomplished either by messengers or mechanical devices. Messenger service is justified within the department as a supplement to other inter-departmental mechanical delivery systems, or throughout the entire office if the number of deliveries is small, or if the extra speed of mechanical delivery is not required. Messenger service, when used, should be operated on a definite time schedule and not less frequently than three times an hour so that the staff will be able to depend on it and will not be encouraged to make personal deliveries to save time. The use of messengers for personal errands should be discouraged as

it tends to disrupt the normal service of intercommunication. Pneumatic tubes are used extensively by larger offices usually for inter-departmental deliveries but sometimes even for deliveries from one location to another in the same department. The advantages of this means of intercommunication are the speed with which documents can be passed over relatively long distances, and the large quantities which can be handled. The disadvantages include relatively high installation cost and inflexibility. Much of the latter can be overcome by having a central clearing station which redispaches the carrier to its destination rather than have direct pneumatic tube communication between operational departments, although this involves an extra handling and delays the delivery slightly. Other types of delivery not involving the use of messengers are available including chutes and dumb waiters, all of which have certain advantages under special conditions. To sum up, the essential characteristics of office intercommunication systems are absolute dependability, speed consistent with the demands of the office, and thorough coverage of all needs so that clerks will not have to leave their desks for this purpose.

#### Conclusion -

The foregoing discussion does not pretend to cover all aspects of management in the modern office. It is intended only as a brief survey of those problems which have received or are receiving the benefit of scientific thought in their solution.

## CHAPTER VII

### EMPLOYMENT PROCEDURE

One of the more important aspects of modern business management is the selection and maintenance of the body of workers required. Careful, scientific selection will contribute immeasurably to the general level of efficiency of the organization by providing a working force which is capable and interested in the welfare and prosperity of the company. Careless or haphazard selection brings together a heterogeneous group incapable of cooperative business effort and such lack of homogeneity will imperil the success of the enterprise and may lead to its complete failure. Few organizations, of course, hire workers without some attempt at selection but this selection may be nothing more than a very cursory interview and a quick appraisal of the applicant by a very busy manager.

With the rapid strides of the past few years in the science of personnel selection, the business which fails to avail itself of the new methods is needlessly courting trouble. Much of the labor unrest, absenteeism, sickness, low production, and high rate of labor turnover in many companies can be traced to lack of adequate selection methods which allows workers to be placed in occupations for which they are unsuited either in temperament or training.

Selection is important, too, for the worker, who will fail to find adequate outlet for his ability in a position unsuited to him. The psychological conflict engendered by such a situation may easily result in frustration, dissatisfaction

and possibly in illness. Lacking a natural interest and aptitude for his work it is highly unlikely that he will be able to achieve full measure of success in the job and his income will suffer.

The work of selecting new employees is normally the responsibility of certain selected individuals within the organization - the personnel department, if such exists. The individuals upon whom this responsibility is placed should be carefully selected with particular emphasis on sound judgment, pleasant and tactful manner and wide knowledge of the company's operations and its personnel requirements. They should be employed in such work only after a period of employment in other departments where they have had personal opportunities to appreciate the relationship between individual jobs and the wider picture of the company's operations as a whole.

The judgment to be exercised by the personnel department in the selection of new employees is not, however, based entirely on personal experience. Definite standards for their guidance must be provided, not only as general "terms of reference" but as specific descriptions of the requirements of each job to be filled. These descriptions known as "job specifications" are discussed in greater detail elsewhere. They provide the personnel department with the more intimate picture of each job to be filled as well as providing the management with the basis for setting up job classifications used in the standardization of wages and salaries.

### Sources of Applicants -

The emphasis on different sources of supply of new workers will vary with the stages of the business cycle, the local fame or notoriety of the organization, the state of the local labor market and its nature, the requirements of the company, and many other factors. If the nature of the company's business is such that it has not been adversely affected by conditions which have caused a cutting down of other company's staffs in the same locality, then the "source" of applicants presents no particular difficulty. An adequate number of job seekers will be constantly available. This same situation may apply at other times if the company enjoys an enviable local reputation which is an asset of no mean importance and one which any company should guard.

There are other times, too, when government regulations (as in war time with selective service) give certain organizations a handicap or an advantage in this matter depending on the nature of the business and whether or not it is considered an essential. Both of these situations are, of course, unusual to some extent and should not receive great attention in a treatise of this kind. It is intended to assume a normal state of affairs, that is, a situation where several companies are in reasonable competition for their labor supply only a part of the demand being satisfied by unsolicited applications. Under such conditions each company must seek employees and some of the main sources which must be considered are discussed below.

(a) Advertising in local papers and trade magazines.

In advertising for employees considerable thought should be given

to the nature of the coverage given by the medium under consideration to insure that the greatest proportion of the desired class of people are being approached. This, of course, should be an elementary consideration in advertising but it is sometimes overlooked. For example, not infrequently one finds advertisements in large local dailies seeking the services of senior executive personnel who could be approached much more directly and much more economically through trade publications in the industry concerned. If, as is more usually the case, the company is seeking general shop or office employees, advertisements in local dailies would be a logical means of approach. If the local labor market has been fairly well exhausted due to a local industrial boom the newspapers of other nearby cities or towns may be considered. Such out-of-town advertisements are sometimes accompanied by an offer to pay travelling expenses of selected workers to their new location, the actual selection of the new workers being made in the locality in which the advertising is conducted. The value of out-of-town advertising for workers at the lower levels is frequently doubtful, however, due to the natural reluctance on the part of most people to leave the communities in which they live.

(b) Advertising by hand bill, poster, billboard, etc. Numerous media of advertising apart from newspapers and magazines are available and if the company is in urgent need of more workmen it may employ them all. Records of the results achieved from each and their relative cost should be kept for future guidance. More intimate discussion of the relative value of each medium belongs in the realm of advertising.

(c) Technical and trade schools and colleges.

Large employers of local labor should keep in close touch with the educational institutions in the community which train the type of personnel required. Most technical and trade schools and colleges have an employment advisor or someone on the staff responsible for such duties. Schools encourage close contact with local employers in order to give better vocational guidance to their students and to insure that their graduates get jobs. The company's personnel department should maintain friendly relations with the school authorities to insure best results for all concerned. Close relations of this kind frequently lead to changes and improvements in the school curriculum to the mutual advantage of student, school, and business. Where specialist graduates from universities are required, it is frequently necessary for the personnel department to maintain liaison with institutions of higher learning in distant cities. This should be done on a personal basis at least once a year, the visits being timed to come possibly two or three months prior to graduation. Tentative agreements are normally made at this time with the selected members of the graduating class and their expenses paid to come to the office of the company for final interviewing by more senior executives and to give the students concerned the opportunity of inspecting the operations of the company.

(d) Scouting.

Scouting for new employees is not particularly common in industry except at times when labor is very scarce. If employed, special precautions should be taken to insure complete understanding of the terms of employment by the individuals approached.

Scouting is not justified unless the change will represent a genuine gain to both parties. It should never, of course, degenerate into mere proselyting.

(e) Employment offices and commercial agencies.

In most large cities the government operates employment offices which may be of assistance in securing new employees. There may also be found in the larger centres various types of private employment offices and commercial employment agencies. Many of these fill a genuine need in bringing together specialists and employers who are seeking their services. They normally make a charge to the applicant for their services (frequently as a percentage of his first month's pay in the job which the agency secures for him) or they may be supported by a group of companies which they service, in which case no charge is made to the applicant. The private employment offices or commercial agencies are usually confined to specialists or executives since the handling of ordinary labor through this channel would not be profitable. As the numbers and degree of specialization in industry increase so the number of specialized agencies will increase as profit-seeking ventures.

(f) Philanthropic institutions.

Certain non-profit organizations such as churches, lodges, trade unions, Y.M.C.A., etc., maintain employment offices for the benefit of their membership and frequently provide a good source of applicants.

(g) Friends and relatives of present employees.

The company should not overlook the possibilities of securing new employees through the contacts of its own employees. This

source will be found most fruitful if the company enjoys local popularity and maintains a high standard of labor relations.

#### The Application Form -

It is customary procedure in modern business to require the applicant to complete an application form. The form serves two purposes; (a) to provide the interviewer with the necessary information on which to base his judgment concerning the general desirability of the applicant, and (b) to be retained by the personnel department as a permanent record of the employee's background if he is hired. Normally the applicant is given a brief preliminary interview before he is asked to complete the application. This serves to eliminate the obviously undesirable and to save further time if no vacancies exist. Frequently in the latter case, however, the application may be completed for future attention when required.

Many variations of the application form exist and considerable variation is justified depending on the extent of background information required in different industries. There are certain items of information which are normally found on all application forms. Such items are:

Date of application

Name of applicant

Address of applicant

Age of applicant

Educational background with space provided for the names of schools or colleges attended, the dates and number of years of attendance, and any degrees secured.

Marital status and number of dependents

Physical disabilities

Previous employment with space provided for names of former employers, the dates and number of years of employment, and positions held.

References

Signature

Such items as the following may also be included in the application form:

Church affiliation

Clubs, lodges and other organizations of a social nature with any offices held by the applicant.

Next of kin

#### The Interview -

After the applicant has been given a reasonable time to complete the form he is interviewed by a member of the personnel department specially selected for this duty. The interviewer is guided in his talk by the information provided on the application and he may enter additional details on any points requiring enlargement. Sound interviewing can be achieved only after experience based on sound knowledge of the company's requirements and the proper technique of interviewing. Although the interviewer should retain the guiding influence in the interview, he should not attempt to dominate the applicant or in any way discourage him from asking questions concerning the company and the opportunities of employment. The interview provides an opportunity for improving public good will towards the company

even when it is not possible to offer employment. It is not customary at this stage to conclude an agreement for employment since this would provide no opportunity to check the information provided by the applicant through schools, former employers or references.

#### Tests -

Great strides have been made in recent years in the development of tests of aptitudes and abilities to assist in the selection and proper placement of personnel. Such tests are at best, however, only a tool and do not obviate the necessity for a scientifically conducted interview and appraisal of the applicant. Such value is being secured from tests, however, that it is intended to deal with them in greater detail in the next chapter.

#### References -

The names of two references are frequently required of applicants on the application form. They should preferably be in different occupations or professions in order that the sum of their contacts with the applicant may cover more facets of his character and personality. Contact with references by the company is considered more satisfactory than letters of reference addressed "To whom it may concern" carried by the applicant himself. Needless to say, no applicant will carry or produce at the interview a letter of reference which is anything but favorable to the applicant. Contacts with references should be treated in the strictest confidence and the person referred to should be encouraged by this knowledge to give a frank and

unbiased opinion of the applicant. Letters to references should indicate the nature of the employment contemplated so that an opinion as to the suitability of the candidate can be given in reply. A form of questionnaire has been found most suitable by many companies since it can be worded to bring out the desired information and is easily answered which results in a higher proportion of replies from the persons consulted.

#### Medical Examination -

In any large business organization necessitating the close contact of many workers, it is important that precautions be taken against the introduction of new workers with communicable diseases. It is equally important to guard the new employee against his possible introduction to a job which he is physically or mentally incapable of performing in a satisfactory manner. For these reasons it is considered highly desirable to require some evidence of medical fitness before employment. The larger companies maintain their own medical departments where applicants undergo examination after they have been interviewed and found satisfactory for employment, after tests have indicated that they have the necessary ability and/or aptitude, and after the references have been consulted. The severity and nature of emphasis of the medical examination will depend entirely on the nature of the employment for which the applicant has been chosen.

#### Final Selection -

After the medical examination has been completed and has indicated that the applicant is physically satisfactory a

final selection interview is necessary in which he will be officially hired and informed of the internal practices and regulations of the company. All points of doubt should be cleared up at this stage and the new employee should be encouraged to seek clarification on any matters of which he is still uncertain.

Placement and Follow-up -

The employment procedure is not completed until the new employee is officially introduced to his new duties by his department head or new supervisor or foreman, and until arrangements have been completed for periodic check-ups on his work and progress. Such check-ups are important to make certain that the new employee has been properly selected for the particular job which he has been given. Not infrequently these later follow-ups reveal that the employee is not progressing favorably in his new work and that a change to other employment is desirable. In the interests of both company and employee such changes should be made without delay when the need for them becomes apparent. Such changes are, of course, costly and should be relatively few if a scientific selection is being made and the proper employment procedure is being followed.

## CHAPTER VIII

### THE USE OF TESTS IN EMPLOYEE SELECTION AND ASSIGNMENT

A noteworthy development in recent years in the field of personnel management has been the increase in numbers and validity of the tests available to assist management in the selection of new employees and in their assignment to tasks for which they are best suited. The history of employment tests has been somewhat checkered. During the early period of their use personnel managers seized upon them as a panacea. Here at last was a ready-made method of selecting employees without fuss and bother; no decision was to be required of them; the results of the test were to indicate without fail which applicants should be hired. This early over-emphasis on the value of tests was, it proved, illogical and almost disastrous. The natural reaction against the use of tests when it became apparent that they did not and could not achieve these wonderful results went much too far the other way and for some time the value of this tool in the selection and assignment of employees was practically ignored. In more recent years, however, employment tests are receiving the recognition due them. They are being constructed more scientifically and their sponsors are more cautious in their claims. Today they are recognized as an important aid in selection and are widely used by employment managers. It is necessary to emphasize, however, that they do not and cannot replace sound judgment in the selection procedure. They are a valuable tool but only a tool.

Students of business management and psychologists have

developed tests of many types designed to measure many things. Today there are well over three thousand tests - educational achievement tests, occupational proficiency tests, trade tests, intelligence tests, interest tests, personality tests, character tests, and many others - each with a definite purpose of measurement of some human quality, achievement, or capacity. To attempt to discuss them in any degree of detail would be quite impossible within the confines of a treatise of this nature. It is intended only to consider briefly the interest which management has in tests and to describe some of the more commonly used.

The tests which are of most interest and use to industry fall into two general classes:

(a) tests designed to measure the individual's present proficiency, achievement, or knowledge of a particular occupation or trade, and

(b) tests designed to measure the individual's future capacity, his aptitudes, interests, etc.

Management's interest in these two main classes of tests will be apparent. Management is interested in securing the services of new employees with the present ability or proficiency required of the job. With the high degree of specialization in modern industry and the very frequent necessity for a company to train its own specialists, however, management is also intensely interested in the selection of personnel with the necessary aptitudes for the work. The first class of tests (those dealing with present proficiency or trade knowledge) does not offer a particularly difficult problem to management. It

is relatively easy to determine whether or not an applicant can operate a turret lathe, a typewriter, or a comptometer satisfactorily. Such abilities can be quickly gauged by standard operation tests, the measurement of ability being based on the time required to complete a specific operation and the number of errors made. It is not intended, therefore, to discuss this class of tests in further detail.

The second class of tests (those dealing with future capacity or aptitude), on the other hand, provides the means of measuring the future possibilities of the worker. It is not easy to determine whether or not an applicant has the necessary aptitude and interest to become, after suitable training, a good operator of a turret lathe, typewriter, or comptometer. For this reason the contribution made by this class of tests to scientific selection of personnel has been much more important and will be discussed in greater detail.

Capacity or aptitude tests of greatest interest to industry in general fall into four main classes: (1)

- (a) tests of manual aptitudes
- (b) tests of mechanical aptitudes
- (c) tests of clerical aptitudes
- (d) vocational interest schedules

Under each of these classifications the more important and widely known aptitude tests will be discussed.

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(1) This classification of the tests selected for discussion follows that of W. V. Bingham in "Aptitudes and Aptitude Testing".

TESTS OF MANUAL APTITUDES

1. Minnesota Manual Dexterity Test - W. A. Ziegler's Rate of Manipulation Test (Placing).

The test measures the speed with which a person picks cylindrical blocks all of the same size and places them in holes in a board. Satisfactory performance depends on speed of arm and hand movements and is not complicated by judgment of differences in size or shape or in coordination between eye and hand movements. Its main use in industry is in ascertaining aptitude for semi-skilled factory operations requiring this type of manual dexterity as, for example, food wrappers and packers, or any type of occupation requiring little expertness but only rapid movements of hand and arm. In the interpretation of results standard norms are based on samples of men and women representative of age and occupational distributions of workers in an urban area. Standard norms for the test are as follows:

Raw Score (in seconds)		Standard Score	Percentile Rank	Letter Grade
Men	Women			
138	...	7.5	99.4	A plus
145	144	7.0	97.7	A minus
152	150	6.5	93.3	B plus
159	156	6.0	84.1	B minus
167	162	5.5	69.1	C plus
175	168	5.0	50.0	C minus
184	174	4.5	30.9	D plus
197	181	4.0	15.9	D minus
213	190	3.5	6.7	E plus
222	198	3.0	2.3	

The vocational significance of the test is indicated by the following list of occupations showing in the first column the average Standard Score of people in the occupation and in the second column the percentage of the general population falling below this score.

Butter packers . . . . .	6.6	94
Butter wrappers (1 lb block) .	6.4	92
Food packers . . . . .	6.2	88
Bank tellers . . . . .	6.05	85
Semi-skilled workers . . . . .	5.38	64
Skilled manual workers . . . . .	5.25	60
Stenographers and typists . .	5.13	55
Garage mechanics . . . . .	5.13	55

2. Finger Dexterity Test - Johnson O'Connor's Worksample No. 16

Finger dexterity tests indicate aptitude for types of bench work involving the rapid manipulation of small objects, as the picking up and placing of small parts required in the assembly of clocks, meters, etc. The equipment required for the test consists of a tray of small cylindrical brass pins and a metal plate with 100 drilled holes. The pins are picked up three at a time and placed in the holes until all are filled. Standard norms for the test are as follows:

Raw Score (in seconds)		Standard Score	Centile Rank	Letter Grade
Men	Women			
183	166	8.0	99.86	A plus plus
194	175	7.5	99.4	A plus

Standard norms (continued):

207	186	7.0	97.7	A minus
221	197	6.5	93.3	B plus
238	211	6.0	84.1	B minus
257	226	5.5	69.1	C plus
280	244	5.0	50.0	C minus
307	265	4.5	30.9	D plus
340	290	4.0	15.9	D minus
382	319	3.5	6.7	E plus
434	356	3.0	2.3	E minus
503	402	2.5	.6	E minus minus
598	462	2.0	.14	

Vocational significance is indicated by the results achieved by persons engaged in the following occupations. The first column indicates the Standard Scores of people in the occupation and the second column the percentage of people in the general population falling below these scores.

Women engaged in meter and		
instrument assembly . . . . .	5.7	76
Bank tellers . . . . .	5.86	80
Garage mechanics . . . . .	5.03	50
Skilled workers . . . . .	4.9	46
Semi-skilled workers . . . . .	4.9	46
Butter wrappers (1 lb block).	4.57	36

The results have indicated that persons scoring below average on this test have not a good chance of satisfactory adjustment to a job requiring rapid manipulation of small objects.

3. Tweezer Dexterity Test - Johnson O'Connor's Worksample No. 17

Tweezer dexterity indicates aptitude for work requiring the use of small hand tools. The test itself measures the speed with which a person can pick up pins using tweezers and place the pins, one at a time, in the holes provided in a board or metal plate. It resembles the finger dexterity test but satisfactory performance requires great steadiness and a high degree of eye-hand coordination. Persons doing well on one test do not always do well on the other.

Standard norms for the test are as follows:

Raw Score (in seconds)		Standard Score	Centile Rank	Letter Grade
Men	Women			
255	249	7.5	99.4	A plus
271	263	7.0	97.7	A minus
289	279	6.5	93.3	B plus
309	297	6.0	84.1	B minus
333	318	5.5	69.1	C plus
360	342	5.0	50.0	C minus
393	369	4.5	30.9	D plus
432	401	4.0	15.9	D minus
479	440	3.5	6.7	E plus
539	487	3.0	2.3	E minus
615	544	2.5	.6	

A high degree of the type of dexterity measured by this test would be of value to persons engaged in die-making, watch-making, and other delicate assembly work, laboratory work,

dentistry, surgery, and other occupations requiring rapid and precise manipulation of small tools. The average manual occupation does not require this type of dexterity; skilled and semi-skilled workers as a class rate about average in their performance.

4. Manual Versatility - L. R. Frazier's Card-Dropping Tests.

Manual versatility is important to a worker whose work varies from hour to hour or day to day. Manual versatility is best judged by giving the candidate several related tests. One of the more important for measuring this is Frazier's Card-Dropping Test. The candidate sits at a table in which two slots have been cut. Beyond the slots are two racks of small cards. The test measures the speed with which the candidate picks cards, one at a time, from the rack and drops them through the slots; first, with the right hand; second, with the left hand; third, with both hands at the same time; and fourth, with both hands alternating.

Norms based on the performance of 366 girl applicants for factory work are as follows:

(Raw scores in seconds)					
Average Right	Average Left	Together	Alternating	Total	Centile Rank
79	83	104	112	554	90
83	88	109	116	578	80
84	89	111	119	589	75
86	91	113	121	596	70
88	93	116	125	610	60
90	96	119	129	622	50

92	98	122	133	637	40
94	101	125	137	641	30
96	103	128	139	662	25
98	104	130	142	673	20
103	109	136	150	699	10

A candidate who scores above the fiftieth centile in all four variations is more likely to succeed at work requiring manipulative operations than one who scores high with one hand and low with the other or with both hands simultaneous or alternating.

5. I. E. R. Assembly Test for Girls (Shortened Form) -

H. A. Toops' Test, Revised by Burr and Metcalfe.

This is in reality a battery of eleven manual tests published by the Institute of Educational Research in 1923. It is designed to measure a girl's aptitude for working with her hands. In each case the reproduction of a model is required, most of them calling for finger dexterity, manual versatility, and appreciation of simple spatial relations of objects. The Burr and Metcalfe revision has eliminated four of the original sub-tests which proved unsatisfactory or were particularly time-consuming without contributing materially to the total result. The nature of the sub-tests and the credits possible for each are as follows:

Test B. Inserting tape	0 to 10
Test C. Making rosette	0 to 10
Test D. Cross stitch	1 to 10
Test F. Assembling chain of clips	2 to 10

Test G. Tape sewing	1 to 10
Test I. Card wrapping	1 to 10
Test K. Trimming paper	1 to 10
Maximum total score	- 70 .

Candidates for simple assembly jobs or for training for such work should score at least 50 per cent on sub-tests B and C. Candidates for training for more difficult assembly jobs should score at least 50 per cent on sub-tests F and I. Fifty per cent on sub-tests D and G is considered necessary for candidates to be trained for sewing. A low score on sub-test K (less than 6) indicates a serious deficiency in the coordination of eye and hand. A total score of less than 38 has been found to indicate unsuitability of the girl for any sort of factory bench work.

#### TESTS OF MECHANICAL APTITUDE

##### 1. Minnesota Mechanical Assembly Test.

The Minnesota Mechanical Assembly Test measures the candidate's ability to assemble simple mechanical objects from the parts provided. Thirty-three disassembled objects are used, the parts for each being placed conveniently in a compartment of a tray. There are three trays in all, called Boxes A, B, and C. A time limit is put on the assembly of each item, scoring being done on the basis of the amount of the operation properly completed.

Below are listed the various objects used in the test together with the time allowed (in seconds) for its assembly, the number of connections to be made, and the possible score on each.

Box A.	Time	Connections	Scores
1. Expansion nut	35	3	0,3,6,10
2. Hose pinch clamp	60	1	0,10
3. Hunt paper clip	65	2	0,5,10
4. Wooden clothes pin	70	2	0,5,10
5. Linked chain	110	5	0,2,4,6,8,10
6. Bottle stopper	125	3	0,3,6,10
7. Push button door bell	170	3	0,3,6,10
8. Bicycle bell	195	4	0,2,5,7,10
9. Corbin rim lock	250	5	0,2,4,6,8,10
10. Coin purse (formerly used)			

Box B.	Time	Connections	Scores
1. Safety razor	45	3	0,3,6,10
2. Monkey wrench	45	2	0,5,10
3. Ringstand clamp	65	2	0,5,10
4. Test-tube holder	100	5	0,2,4,6,8,10
5. Spark plug	100	5	0,2,4,6,8,10
6. Inside caliper	200	5	0,2,4,6,8,10
7. Electric plug and wire	210	4	0,2,5,7,10
8. Clover-leaf coin purse (formerly used)			
9. Handle for iron	500	5	0,2,4,6,8,10
10. Mouse trap (formerly used)			

Box C.	Time	Connections	Scores
1. Haemostat	100	2	0,5,10
2. Die-holder	20	1	0,10
3. Pliers	45	3	0,3,6,10
4. Electric light socket	45	2	0,5,10

Box C. (continued) -	Time	Connections	Scores
5. Wing nut	25	2	0,5,10
6. Glass drawer-knob	25	2	0,5,10
7. Rope-coupler	45	3	0,3,6,10
8. Kettle-cover knob	45	4	0,2,5,7,10
9. Lock nut	50	2	0,5,10
10. Ford magneto-post	50	3	0,3,6,10
11. Petcock	50	3	0,3,6,10
12. Hose clamp	60	3	0,3,6,10
13. Radio switch	70	6	0,2,4,5,7,8,10
14. Pencil sharpener	80	2	0,5,10
15. Air-gauge valve	115	3	0,3,6,10
16. Metal pencil	135	3	0,3,6,10

Standard norms for men and women on the test are as follows:

Raw Score		Standard Score	Percentile Rank	Letter Grade
Men	Women			
329	308	8.00	99.86	A plus plus
323	302	7.50	99.4	A plus
318	289	7.00	97.7	A minus
311	270	6.50	93.3	B plus
302	257	6.00	84.1	B minus
293	240	5.50	69.1	C plus
281	225	5.00	50.0	C minus
262	208	4.50	30.9	D plus
245	193	4.00	15.9	D minus
224	178	3.50	6.7	E plus
201	148	3.00	2.3	E minus

Standard norms (continued):

177	126	2.50	.6	E minus minus
171	114	2.00	.14	

The vocational significance of the test is indicated by the following list of occupations showing the average standard score of men in the occupation (column 1), and the percentage of men in the general working population whose scores do not exceed these averages (column 2).

Machinists . . . . .	5.85	80
Manual training teachers . . .	5.49	68
Ornamental iron workers . . .	5.48	68
Auto mechanics . . . . .	5.42	66
Skilled manual workers . . . .	5.05	52
Machine operators (lathe, drill press, etc.) . . .	4.98	49

It was found that 70 percent of garage mechanics tested made a better score than the average office clerk.

2. Minnesota Spatial Relations Test.

Spatial relations or the perception of sizes and forms is measured by the Minnesota Spatial Relations Test. The test requires four form boards out of each of which have been cut 58 pieces of different sizes and shapes. The raw score is represented by the total number of seconds required by the candidate to place the pieces correctly in all four boards. Sometimes the first board is used for practice purposes and the time required for it is not counted. High aptitude in perceiving spatial

relations is considered of value to architects, designers, dressmakers, pattern-makers, sheet metal workers, engineers, layout men, sorters, auto mechanics, etc.

Standard norms for men and women, based on population samples in certain Minnesota cities, are shown below:

Raw Score (in seconds) Boards B, C, and D		Standard Score	Centile Rank	Letter Grade
Men	Women			
608	605	7.0	97.7	A plus
652	648	6.5	93.3	A minus
726	758	6.0	84.1	B plus
814	838	5.5	69.1	B minus
916	933	5.0	50.0	C plus
1047	1037	4.5	30.9	C minus
1218	1156	4.0	15.9	D plus
1442	1354	3.5	6.7	D minus
1583	1571	3.0	2.3	E plus
				E minus

### 3. The Wiggly Blocks - Johnson O'Connor's Worksample No. 5

This test is designed to measure ability to visualize structure in three dimensions. It consists of nine wooden blocks which when assembled properly form a solid rectangular block. Satisfactory data concerning its reliability are not at present available. Ability to visualize three dimensional structure is considered valuable to such occupations as machinist, tool and die maker, draughtsman, engineer, and architect.

### 4. Minnesota Paper Form-Board - Revised by Likert and Quasha.

The paper form-board presents 64 problems in which the

candidate is allowed to study the picture of two or more geometric figures and then indicate which of several other composite figures their union would resemble. The test resembles the spatial relations test except that manual manipulation of the geometric figures is prevented. It is one of the more reliable paper-and-pencil tests of mechanical aptitude. It is considered more reliable, however, to use several tests of such aptitude rather than place reliance on one.

5. MacQuarrie's Test for Mechanical Ability.

This test is designed to furnish an indication of aptitude for acquiring manipulative skills. It requires ability to recognize space relations, speed of decision and movement, eye-hand coordination, muscle control and visual acuity. It is composed of seven sub-tests as follows:

- (a) drawing a pencil line as fast as possible through a pattern of irregularly spaced openings without touching them.
- (b) putting three pencil dots in each of a number of circles as fast as possible.
- (c) putting a dot in each of many smaller circles.
- (d) copying patterns each of which consists of four connected straight lines.
- (e) identifying the locations of dots in squares by reference to the corresponding position of letters in a larger square.
- (f) counting the blocks which touch other blocks in each of several pictured piles.
- (g) to follow with the eye, one after another, each of several numbered lines drawn irregularly through a maze-like pattern and to identify each by the number at the end of the line.

The MacQuarrie test provides only a rough indication of a candidate's manual or mechanical aptitudes and should be used with other tests.

#### 6. O'Rourke's Mechanical Aptitude Tests.

Familiarity with tools is generally traceable to an interest in mechanical things. This test reveals knowledge of tools by recognition of their pictures and the other articles with which they are used, for example, connecting screw driver with screw, wrench with nut, brace with bit, etc. The test is in two parts, one pictorial and one verbal. In the second part mechanical questions are given in multiple-choice form. Candidates for engineering training in most cases score over 6. A score of under 5 should indicate a very doubtful interest in things mechanical.

Norms based on the performance of 9,000 young men entering mechanical occupations are as follows:

Raw Score	Standard Score	Centile Rank	Letter Grade
317	7.0	97.7	A plus
295	6.5	93.3	A minus
265	6.0	84.1	B plus
233	5.5	69.1	B minus
198	5.0	50.0	C plus
172	4.5	30.9	C minus
145	4.0	15.9	D plus
115	3.5	6.7	D minus
			E

7. Stenquist Mechanical Aptitude Tests I and II.

Similar in form to the pictorial part of O'Rourke's Mechanical Aptitude Test, Stenquist's paper-and-pencil Test I consists of 95 problems requiring the candidate in each case to indicate which of five pictures of tools and other mechanical contrivances belongs with one of five other pictures. Test II is a combination of pictures and questions calling for a perception of mechanical relations and an ability to reason about them but not requiring previous experience with machines.

TESTS OF CLERICAL APTITUDES

Tests of clerical aptitude are very useful in the selection of personnel for the various types of office work or in the selection of candidates most likely to succeed in such training. Three of the more commonly known of these tests are discussed in this section.

1. Minnesota Vocational Test for Clerical Workers - Long Form and Short Form Arranged by Andrew.

This test provides a means of determining aptitude for jobs requiring speed and accuracy in checking names and numbers. Both forms are similar in that they are divided into two parts; the first requiring accurate checking of the similarity of two numbers, and the second part requiring the accurate checking of names. The only difference between the two forms is in the number of problems to be solved and the length of time required. The type of aptitude measured by this test is of value to such occupations as bank tellers, accountants, bookkeepers, steno-

graphers, typists, and general office workers. Accountants and bookkeepers make better average scores on this test than 95 percent of the general population. Women tend to excel men in both the number checking and name checking tests.

The following standard norms (for the short form) are interesting:

Raw Score						
Number Checking		Name Checking		Standard Score	Centile Rank	Letter Grade
Men	Women	Men	Women			
173	199	180		8.0	99.9	A plus plus
163	193	163		7.5	99.4	A plus
147	185	146	184	7.0	97.7	A minus
131	165	129	166	6.5	93.3	B plus
112	145	112	148	6.0	84.1	B minus
96	125	95	130	5.5	69.1	C plus
83	109	78	111	5.0	50.0	C minus
67	97	60	93	4.5	39.9	D plus
53	84	43	75	4.0	15.9	D minus
41	70	26	57	3.5	6.7	E plus
29	57	9	38	3.0	2.3	E minus
21	44	0	20	2.5	.6	

Tentative norms based on a limited number of candidates in each occupation show under "Number Checking" the median standard score attained and the percentage of the general worker population failing to attain this score, and the same information for the "Name Checking" part of the test.

Occupational Group	Number Checking		Name Checking	
	Standard Score	%	Standard Score	%
Women				
Typists and stenographers	6.04	85	6.28	90
Office Machine Operators	6.09	86	5.59	72
General Clerical Workers	6.10	86	5.97	84
Routine Clerical Workers	5.70	76	5.61	73
Men				
Accountants or Bookkeepers	6.91	97	6.45	93
Bank Tellers	6.69	95	6.64	95
General Clerical Workers	6.59	94	6.55	94
Routine Clerical Workers	6.35	91	6.19	88
Shipping Clerks	5.75	77	5.72	76

The significance of the test as a measure of clerical aptitude is apparent from the figures quoted above. For example, the average general clerical worker (male) excels almost 95 percent of the general population on this test.

2. Number Checking and Word Checking - Johnson O'Connor's  
Worksamples No. 1 and 43.

Similar in purpose to the Minnesota Vocational Test for Clerical Workers, this test measures superior ability to notice slight differences between pairs of numbers and pairs of words. It is more difficult to administer and the results are not as reliable as those of the Minnesota test. On the other hand, some examiners prefer it because age norms are available for comparison purposes.

3. General Test for Stenographers and Typists - Developed by the Research Division U.S. Civil Service Commission.

This test is designed to measure adaptability, mental alertness, and general knowledge which stenographers and typists should have. It does not measure specific occupational skills. The problems involve practical judgment, vocabulary, English usage, spelling, and reading comprehension.

Vocational norms for stenographers and typists are shown below:

Score	Industrial Employees		Civil Service Eligibles (both)	Civil Service Applicants (both)	High-school Seniors in Stenography
	Stenographers	Typists			
80	100	100	100	100	100
75	99	100	99.5	100	100
70	96	98	94	98	97
65	83	97	81	93	94
60	69	93	65	85	72
55	56	82	46	71	63
50	38	76	25	57	25
45	30	60	6	42	19
40	19	48	0	25	12
35	8	32	0	12	3
30	3	22	0	8	3
25	3	12	0	2	0
20	1	4	0	1	0
15	0	2	0	0	0

The vocational norms quoted above may be interpreted in this

manner. If a candidate secures a score of, say, 60 on this test, he shows aptitude for this type of occupation superior to 69 percent of industrial stenographers, 93 percent of industrial typists, 65 percent of Civil Service "eligibles", etc. Scores on the test are generally interpreted as follows:

- (a) 60 or over - Chances are good for eventual advancement to the intermediate and higher levels of clerical employment.
- (b) 55 - Regarded as a lower critical score for preferred applicants for the more responsible clerical positions.
- (c) 50 - Considered satisfactory for secretarial and intermediate clerical positions. If below this score, the chances for eventual advancement to the higher levels are slight.
- (d) 45 - Below average for clerical employees. Considered a minimum for clerical positions of intermediate responsibility. New clerical appointees on the lower levels in the U. S. Civil Service are required to secure at least this score.
- (e) 40 - Regarded as the minimum to be expected of high-school graduates by many employers of clerical labor. Chances of promotion from simple routine jobs are about even.
- (f) 35 - Considered by discriminating employers as the minimum for applicants expected to continue in routine work.
- (g) 30 - Minimum acceptable to less discriminating employers for routine workers.

## VOCATIONAL INTEREST SCHEDULES

Vocational interest inventories or schedules provide a means of measuring a candidate's interest in various occupations. Interest in an occupation does not necessarily indicate that the candidate has the requisite ability or aptitudes to succeed in it, but a high degree of interest will be an important contributing factor to his success and will compensate to a great extent for other short-comings.

1. Strong's Vocational Interest Blank - Forms A and B for Men; Forms WA and WB for Women.

On this inventory the candidate is required to indicate his liking, indifference, or disliking with respect to several hundred items such as school subjects, hobbies, amusements, occupations, personal activities, etc. Strong, who developed and standardized this interest blank, has found that persons in many occupations have a similarity of interests with others in the same occupation, and that these interest patterns differ from the general population and from those found in many other occupations. The responses of the candidate are then scored against the interests of persons successfully engaged in the various occupations for which the blank has been standardized. Relative interest with respect to the following occupational groups can be determined:

### Group I

Physicist, Mathematician, Engineer, Chemist,  
Physician, Dentist, Psychologist, Architect,  
Farmer, Artist, Musician.

Group IIa

Lawyer, Journalist, Advertiser.

Group IIb

Life Insurance Salesman, Real Estate Salesman.

Group IIIa

Teacher, Minister.

Group IIIb

Y.M.C.A. Secretary, Y.M.C.A. Physical Director,  
Personnel Manager, School Superintendent.

Group IV

Office Worker, Purchasing Agent, Accountant,  
Vacuum-cleaner Salesman.

Group V

Certified Public Accountant.

The special blanks for women provide means of comparing interests with those found in the following occupations:

Artist, Author, Dentist, Housewife, Lawyer, Librarian,  
Life Insurance Saleswoman, Nurse, Office Worker,  
Physician, Social Worker, Stenographer-Secretary,  
Teacher (4 kinds), Y.W.C.A. General Secretary.

2. Manson's Occupational Interest Blank for Women.

This interest blank serves to indicate the similarity of a woman's occupational interests with those typical of women found in each of ten occupations. The ten occupations fall into five groups as shown below:

Group I - Teaching

High School Teacher

Grade School Teacher

Group II - Higher Clerical

Private Secretary

Stenographer

Office Manager

Group III - Lower Clerical

Office Clerk

Bookkeeper

Group IV - Sales

Retail Saleswoman

Sales Proprietor

Group V - Nursing

Trained Nurse

The blank also provides a means of comparing the candidate's attitude towards many occupations with those expressed by women already engaged in the following fourteen occupational groups:

Clerical, Teaching, Sales, Health, Financial, Production, Food, Welfare, Library, Legal, Editorial, Purchasing, Research, and Personnel.

## CHAPTER IX

### EMPLOYEE TRAINING METHODS

With the development in magnitude and complexity of modern industry the importance of training has received wide recognition by management. Modern educational institutions have made important contributions in this field by establishing numerous technical and vocational courses. This has been made necessary by the changing character of high schools during the past twenty-five years. Formerly a relatively small percentage of youth attended secondary schools where they were given a classical education as preparation for university and the professions. The nature of the training given in secondary institutions has always been determined by the future intentions of the students and it was quite natural, therefore, that high school training should be patterned as preparation for university at a time when the students were contemplating higher education. At that time the majority of boys left school to go to work on completion of their elementary schooling, at which time they became factory helpers, apprentices, etc. Their elementary education served only to teach them basic rudiments - the three R's, and the rest of the knowledge required for success in their chosen field was picked up by experience in actual work.

During the past few years, however, a much higher percentage of the youth of the country attend secondary schools before "going to work", until today it is estimated that something in excess of seventy percent of the youth receive high school educations in the United States. The most logical ex-

planation of this fact seems to be the general improvement in the standard of living, increased wages which now allow parents to give their children a better education before requiring them to start contributing to the family income, and a natural desire on the part of the parents to see their children start out in the business world with better training and better chances of success than their parents enjoyed. Today the secondary schools find that the majority of their students do not intend to go on to universities as was formerly the case and educationalists have come to realize that the character of training given in high schools must be changed to meet the needs of the student body. High schools still must satisfy the requirements of university entrance for one group of students, more in numbers but less in percentage of the entire student body, and in addition must prepare the majority of their students for jobs in industry.

Technical and vocational schools at the secondary level and similar courses within regular high schools have increased tremendously in number and variety. In addition to providing industrial training to the youth before entering business these schools have organized important evening classes for the benefit of adults already occupying jobs who are trying to improve their chances of promotion by greater knowledge. Such evening classes for adult education are an important factor in rehabilitation of workers who, through accidents, age, or the rapidly changing aspects of industry or its migration, are finding it necessary to change their occupations.

Management has found, however, that training cannot

be left entirely to the technical and vocational schools. The jobs in modern industry are of such varied and specialized natures that rarely is a new employee found who is thoroughly familiar with the requirements of the job for which he is chosen. His training may have given him the fundamental knowledge required for, say, machine shop work, and the personnel department through sound selection procedure and the use of scientific tests has made certain that the new employee has the necessary aptitudes and personal characteristics needed, but before he can become expert in the work he will undoubtedly require much carefully guided experience. It is in the matter of the "careful guiding" of the experience that training of employees must be undertaken by management.

#### The Importance of Employee Training -

There are two major factors causing the difference between good workers and poor workers. They are: (a) proper selection, and (b) proper training. Selection of employees forms the basis of another section of this thesis and is widely recognized as an essential aspect of modern scientific management. It is intended in this section to deal with the problem of training of employees after they have been selected. Job analyses within the organization reveal for each operation a "one best way" which by scientific analysis and test has proved superior to other techniques which may be followed. The possibility of the new employee finding the best way to do his job if left to his own devices is fairly remote and it is necessary to teach it to him so that the benefit of others' experience

may be made available to him quickly. In this way the employee becomes a useful and efficient producer with a minimum loss of time and before he can acquire inefficient work habits which are frequently very difficult to correct.

#### The Training Program -

Even when the management realizes the importance of training its employees in the approved techniques, it is not sufficient that the matter be left at that point and that each foreman or supervisor be allowed to proceed quite independently in the training of his new subordinates. Such a practice will result in the installation of as many different training methods as there are foremen or supervisors and in all degrees of efficiency in this important work. A specific training program should be prepared and adopted uniformly throughout the organization. The foremen and supervisors and senior workers selected to train others because of their aptitude for "getting ideas across" should be carefully instructed in training methods so that the standard will vary as little as possible between the different sections. Some people have a natural capacity for teaching resulting from clarity of thought, facility of expression, patience, personality, etc., while others will find the teaching of others difficult and boring and would sooner do the work themselves than to be bothered explaining and teaching it. The results achieved will reflect very definitely the aptitude and ability of the instructor. In some cases it may be found desirable to select some other worker in the section to take care of training work rather than have the foreman do it if the

latter finds difficulty in such work or if he lacks aptitude for it. The various stages through which training in an operation should pass are explanation, demonstration, operation, correction, and repetition. First the job should be explained to the new employee and he should be encouraged to ask questions and to clarify in his own mind any doubtful matters. Then the instructor should demonstrate the work with every opportunity given to the employee to observe how it is done. To start, it should be demonstrated slowly with attention specially called to any unusual or particularly difficult points. The next step is to allow the employee to perform the operation himself under the watchful eye of the instructor. The latter should correct the errors and if necessary demonstrate again so that the employee can see where he made his mistakes. Then the employee repeats the operation over and over again until the instructor is satisfied that the employee has thoroughly grasped the approved method. The new worker should be coached and his work should be watched periodically to make certain that he is following his instructions carefully.

#### Types of Training -

The nature of instruction given to employees may fall into three different classes, possibly with two or all three of them running simultaneously. They are:

- (a) general courses
- (b) training on the job
- (c) training of supervisors or junior executives.

### General Courses -

Many industries through their associations have organized courses of instruction available to the employees of the member companies. Typical of such training courses are those provided by the Canadian Bankers Association and the Insurance Institute of Canada. It is customary for the companies concerned to provide classes for the employees enrolled in these courses and frequently to provide some incentive for satisfactory completion of the examinations. This type of training is known as "institutional" and is designed to give employees a wider knowledge of the industry in which they are employed. It is justified by the fact that the employee who has a wider horizon than that provided by his daily job is better able to appreciate the importance of his own job and is, therefore, more likely to be a good worker. Other types of general instructional courses may provide training in the more purely cultural subjects to enable the employees to fill the void in their training resulting from previous over-emphasis on vocational or technical subjects and to enable them to acquire better background for more senior posts in the organization.

### Training on the Job -

This type of training is self-explanatory and represents the largest proportion of training provided within industry. Any training designed to make the employee more competent to handle his daily job should take the form of training "on the job" itself in order to keep the instruction thoroughly practical and to combine the learning process with vital experience. No

matter how well it is done, class room work with only a black-board for the demonstration of examples leaves much to be desired from a practical application point of view.

Some of the larger companies in the United States have arranged practical training programs to fit into instruction given in the engineering courses in the universities. In some cases the student is required to work in the industry during the summers of his university course and receives credits for such work towards his degree based on the reports of his supervisors. Other companies have made arrangements with universities whereby the student after his first two years at university is required to alternate a year of practical industrial employment with each academic year. Such a plan adds two years to the time required to receive his engineering degree but provides the student-employee with invaluable practical experience as a sounding board for the more advanced theory of his later years at university. Some companies hire the student as a permanent employee at the end of his second year at university and then follow the alternating year plan thereafter to combine academic and shop experience. Such a practice has definite advantages in highly skilled engineering posts within the organization for which higher education is required but is not applicable to the big majority of jobs to be filled. For the latter, industry must organize its own training to specialize the employee in the particular job and to teach him the approved method of doing it.

Training of Supervisors and Junior Executives -

If management is to guarantee its own continuity

provision must be made for the training of junior executives and supervisors from which to select persons for more senior posts. Many companies which readily recognize the need for training of workers at the lower levels and which provide adequate programs for such training, still fail to provide any scientific plan for the selection of supervisors and junior executives and for their necessary training in the fields of increased responsibility. Too frequently management selects its supervisors and foremen and even department heads by the simple and illogical expedient of promoting the "best" from the grade below. Such a policy arises from a genuine desire on the part of the management to recognize and reward merit, and from this point of view it is highly commendable, but it fails to recognize the fact that a good worker will not necessarily make a good foreman or supervisor, and that a good supervisor at the lower level will not necessarily make a good department head or junior executive. Many people have a level of development above which they find it almost impossible to rise. Others, perhaps to be found among the junior supervisors and foremen, are capable of development into senior management posts. In order to be able to select and develop supervisory material within the organization for future posts of greater responsibility, it is important that the company adopt a definite plan for selection and training at this level. Training may take the form of small conferences and round-table discussions with more senior executives which will provide opportunities to the supervisors to learn the nature of more senior responsibilities and to express themselves, and will provide the senior executive with the

opportunity of judging the calibre of the supervisors. Small supervisory training groups of this kind may operate separately or be combined with other types of supervisory training, as for example, understudies. The understudy method is very useful and keeps the instruction down to a practical level but it should not be allowed to develop to the point where there are in reality two men doing each supervisory or executive job. On the calibre of the junior executives selected today will depend the soundness of tomorrow's management, and on that will depend the future success or failure of the entire organization.

#### Supervision of Training -

In order to guarantee unity and uniformity in the training program, it is usually found desirable to appoint a training supervisor. This may or may not be a full-time job depending upon the size of the organization and the number of personnel undergoing training. The selection of this person should receive careful thought by the management since his influence will be felt very widely as it is reflected in the training methods applied throughout the organization. He may, but need not, be a former teacher himself although this would be valuable provided he is not inclined academically to theorizing. He must have a sound grasp of teaching method as it is applied to practical work, and his main responsibility will be the instruction of the instructors in these methods. The training supervisor should have a good knowledge of the types of work on which instruction is to be given throughout the company and will provide the instructors with advice and

instructional outlines to insure a uniform high standard. He will hold periodic conferences with those selected to instruct the new employees, either in small groups if certain problems are applicable to a restricted number of sections, or all together. These conferences will provide opportunity for the discussion of teaching policy and demonstration of approved methods. Needless to say, he should have a personality which influences others favorably and a soundness of approach which is readily recognized. A well coordinated training program and its proper supervision is essential to a well trained and efficient staff.

#### Job Methods Training -

During the past year certain new developments have occurred in this field. One of the more significant and more widely used in war plants is known as Job Methods Training or, simply, JM. Although JM has been developed primarily for purposes of rapid training of new employees the method used has revolutionized, to some considerable extent, thought in the field of Job Analysis. Job Methods Training is one of three programs developed by the Training Within Industry branch of the War Manpower Commission of the United States. (1)

JM involves group training of foremen by a qualified instructor in the method, or group training of workers by a qualified foreman. In brief four main steps are involved, which are as follows:

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(1) Stuart Chase, "Teaching Foremen That Workers Are People" (Job Relations) The Reader's Digest Vol.43, No.257, Sept.1943; "Show-How: A Revolution in Management" (Job Instruction) The Reader's Digest, Vol.43, No.258, Oct.1943; "To Do It Easier and Do It Better" (Job Methods) The Reader's Digest, Vol.43, No.259, Nov.1943.

(1) Break down the job, listing on paper all the details exactly as done by the old method.

(2) Question every one of these details -

Why is this necessary?

What is its purpose?

Where should it be done?

Who is best qualified to do it?

How is the best way to do it?

(3) Develop the new method. Take the job break-down and eliminate unnecessary details, combine, rearrange, simplify.

(4) Sell the idea to all the workers who are going to use it and to the supervisor. Get final approval from all concerned on safety, quality, quantity, and cost.

Although the proposed method appears so simple as to cause some doubt as to its effectiveness, the actual results reported from industry are very encouraging. Perhaps it is the very simplicity of the plan and the fact that the workers themselves are encouraged to improve their own jobs that have caused it to succeed so well.

## CHAPTER X

### LABOR RELATIONS AS A PROBLEM OF MANAGEMENT

In the earlier days of industrial development the problem of satisfactory relations between management and labor was not regarded as one of major importance. Employers varied from one extreme to the other in their attitudes towards their workers. Many of them, it is true, regarded their employees as their "children", the factory as "a big family", and were genuinely solicitous of their welfare. The situation in this respect was not unlike the relationship existing between the feudal baron or seigneur and his many classes of subordinates of whom he would demand good service but over whose welfare he would still keep a fatherly watch. Such paternalistic employers were proud of their workers and made it a special point to know them all by name, to know their families and their personal problems, and to see that they and their families received special attention at times of illness or other trouble. Such employers were usually free from labor trouble and unrest because their workers were, on the whole, fairly satisfied with their lot.

At the other extreme of the employer class, there were many who regarded their employees simply as a necessary factor in production, as cogs in the machine of business. They paid them no more than was absolutely necessary to secure their services, felt no obligation whatsoever concerning their general welfare, and if they didn't like the conditions of work they could quit and be replaced by someone else. It was this class

of employer that proved the real menace to industrial health and the general welfare of the workers. It was this greedy, short-sighted, selfish policy which sowed the seeds of industrial unrest and the later development of labor unions as a weapon of self-defence for the workers.

It is not intended in this treatise on science in management to enter into a discussion of the historical development of organized labor, suffice it to say that this development has resulted in untold benefits to the working class. Moreover, its future is bright with opportunities to play a major role in furthering the improvement of industry by the application and development of scientific methods, resulting in continued improvement of working conditions, elimination of industrial unrest before it reaches the breaking point, and great social benefits to the entire nation.

The United States Commission on Industrial Relations which was set up by Congress to investigate this problem arrived at this conclusion:

"The question of industrial relations is more fundamental and of greater importance to the welfare of the nation than any other question except the form of government. The only hope for solution of the tremendous problems created by industrial relations lies in the effective use of our democratic institutions and in the rapid extension of the principles of democracy to industry."

In 1942 the National Industrial Conference Board published the results of an investigation into 2,700 factories employing over 5 million workers. The results indicated that

there was still much to be done to improve the lot of the workman in industry and to bring industrial relations up to the enlightened level considered desirable. Their studies showed that although all companies investigated gave paid vacations to salaried workers, less than half gave this benefit to wage earners. Half of the companies had physical examinations for new employees and group life insurance plans. Only a third had pension plans for workers or gave safety instructions. Less than a fourth had any employee loan plan and less than a fifth paid any special attention through serious investigation to wage standards in the community. Less than a fifth issued books or pamphlets to the employees containing facts about the company. Only a sixth had a periodic publication for the workers or made periodic investigations to evaluate the progress and income of the wage-earners. Only one in ten had any training program for workers or salesmen or gave employees financial statements. Still fewer had company-paid sick benefits or encouraged employee savings through thrift clubs or similar means.

The investigation also indicated that the more successful companies which enjoyed comparative freedom from labor troubles and a high degree of public goodwill were almost invariably the same companies which rated extremely high on the various factors of the investigation indicated above. It seems desirable, therefore, to consider more carefully these evidences of enlightened management and to see how the more scientifically managed companies improve their labor relations. Thomas G. Spates, Director of Industrial Relations for General Foods Corporation and a former member of Industrial Relations Counselors

emphasizes these points for an improved labor relations program:

1. The Organization Chart. This chart which should be available for all to see at will should indicate clearly and simply the lines of authority and responsibility within the organization. Every worker should know at all times to whom and in what respects he is responsible to others. As changes occur (and in modern business changes in authority and responsibility occur frequently) the chart should be changed. It should be up to date at all times.

2. Personnel Administrator. Every organization should have someone responsible for personnel relations. He should be carefully selected with particular emphasis on his training, background and personality. Every worker should know who he is and should be encouraged to consult him. In smaller organizations the chief executive himself may handle personnel relations but this is not normally a desirable situation since workers are frequently reluctant to approach the "boss" with their problems.

3. Labor Policy. This should be definitely thought out and committed to paper. It should be prominently displayed where all workers can see it. Needless to say, it should be couched in simple, straight-forward language that is easily understood and does not allow of misinterpretation.

4. Rules and Regulations. These too should be in writing and a copy available to every worker. If the reason for any particular rule is not patent, an explanation should be given so that all workers can appreciate the justice of it.

5. Employment Procedure. It is fundamental that serious thought be given to the method of selection of new employees and of introducing them properly to their new work. This involves a pleasant and intelligent interview of applicants and their selection according to predetermined standards based on the nature of the job to be filled. It involves, too, a recognized procedure for dealing with employees whom it has been found necessary to lay-off or discharge and for the honest presentation to them of the reasons which have made such separation necessary.

6. Labor Supply. At times when qualified workers are difficult to obtain, it is necessary to tap new sources of supply. This may involve selection from other communities, or a revision of the transfer, promotion and training plan within the organization.

7. Records. Personnel records should be standardized and should present complete up-to-date information on each employee. Such records are essential to any satisfactory system of promotion and transfer within the organization.

8. Training. The system for training of workers should be effective but need not be elaborate. The degree of detail necessary will vary with the nature of the work and the degree of specialization required. Special attention should be given to the training of foremen and junior executives since this is the class from which more senior posts will be filled in the future.

9. Supervisors. Foremen and supervisors represent the important connecting link between management and workers and

are therefore an essential part of any industrial relations program. They in turn should be supervised by higher management to make certain that they are conducting their important duties satisfactorily. They should be taken into the confidence of their seniors, should be allowed and encouraged to express their views, and should be in a position to interpret management's views to the workers under their jurisdiction. They represent an important channel for the presentation of workers' views to the management and for the interpretation of company policy to the workers.

10. Getting the Workers' Ideas. Very frequently the employees are in a position to be of inestimable help in solving many of the difficulties arising in the course of business. They should be encouraged to submit ideas of this kind and particular care should be taken to see that the individual concerned gets the credit for it. This "credit" need not necessarily result in a financial reward. Workmen will often respond to a letter of thanks, or the publication of their names in the company magazine.

11. Grievances. A definite and well understood channel for the presentation of grievances to the management should be available to all employees. It should be simple and direct and it should never result in recriminations. Every worker should feel perfectly free to use it as the occasion demands. This channel may be through the foreman or supervisor but sometimes the worker will hesitate to tell the foreman or may feel that the foreman will not deal with it adequately. In such cases the employee should be encouraged to deal directly with the

Personnel Administrator or his department.

12. Relatives. It is usually a good policy to regulate against a supervisor or foreman having his relatives working in his section. It frequently leads to dissatisfaction on the part of other workers and charges of favoritism, sometimes unfounded but none the less devastating to morale.

13. Wages and Salaries. A definite system should be followed (and known) for dealing with wage increases based on progress reports of the workers. Management should also at periodic intervals give serious thought to the wage and salary scale based on standard rates of pay in the community for similar work.

14. Payroll Deductions. Too many payroll deductions are confusing and displeasing to employees. Serious thought should be given before their number is increased. With very few exceptions (for example Victory Bond purchases) they should be confined to important matters of employer-employee relations such as group insurance and contributory pension plans.

15. Hours of Work should be in strict accordance with the law and with the published regulations of the company.

16. Working Conditions. Adequate space, lighting, ventilation, wash room and recreation facilities are important considerations and pay dividends in improved worker morale and higher production.

17. Safety. If the organization is one which uses high speed machinery liable to result in accidents or if for other reasons the safety of the workers is a consideration, it is important that there be a well developed accident prevention

and safety program. The criterion for effective management in this regard should be the level and trend of accidents in other companies in the same industry operating under comparable conditions.

18. Medical Service. Modern management has recognized the importance of healthy workers. Medical examinations as a part of the program for the selection of new employees prevents other workers from being exposed to communicable diseases and prevents the employment of workmen whose health is such that the proposed employment would be dangerous to them. The standard of health of the employees can be improved and kept at a high level by periodic physical examinations - usually each year, or more frequently if the examination reveals a condition which should be kept under closer observation.

19. Vacations. These should be standard within the organization and handled without discrimination. Usually selection of dates, other considerations being equal, are allowed in order of seniority or length of service. It is not unusual, either, that the length of vacation periods increases with years of service.

20. Group Insurance and Pension Plans. Such plans represent another important advance in modern management. Workers should not have to worry about periods of illness or their own old age after they have given valuable service to their employers. They are additional incentives to continued employment. Such plans must be modern, should be thoroughly understood by all employees, and should be used by the large majority.

21. House Organs. An employee's news letter or house organ is a valuable channel of communication between management and employees. Some companies find it more desirable to mail such publications to the home address of the employee to insure that the employee's family sees it. If the wife and family are interested in the company and know what is going on, the worker is more likely to remain and be happy with his association.

In summary, the scientific approach to the problems of labor relations involves two major factors:

- (a) an increase in confidence between management and labor based on a sound appreciation of the problems of each other, and
- (b) an increasing realization of the stake which labor has in the efficient functioning of the organization, resulting in an increasing labor voice and responsibility in the management of the enterprise.

CHAPTER XI

REMUNERATION OF EMPLOYEES -

The rate or amount of pay received for services rendered represents perhaps the most important single factor in the relationship between management and labor and disagreement on this matter has been the cause of more industrial disputes than any other single reason. Such a situation was, perhaps, to be expected when it is realized that all industrial effort has as its main spring the desire for financial reward, and labor has long contended that it is entitled to a larger share as a factor in production.

The original form of compensation for services was a straight payment based on the length of time worked. This system has certain advantages, particularly its simplicity, and is subject to little possibility of dispute in its calculation. It has many disadvantages, however, one important one being the fact that it obligates the management to pay a definite amount of money in wages but gives no guarantee whatever as to what management will receive from the workers in return. From the workers point of view, too, it is not entirely satisfactory. It provides no incentive to better work since it is quite evident that the poorest in the group would receive the same pay as the best, the laziest just as much as the most conscientious. Under such conditions workers are not encouraged to excel and the general standard of performance will be far below what they are capable of doing. The net result was that the rate of pay had to be correspondingly low in order to keep the unit cost of

production at a reasonable level. Many companies still employ straight time payment wage and salary plans, some by design where in certain operations it is not possible to develop a rate based on production, or in cases where through adequate supervision and thorough cooperation by the staff the standard of production is maintained at a satisfactory level. Other companies maintain straight time payment plans through ignorance of their actual cost or reluctance to disturb the workers by the installation of rates based on production.

Industrial companies were the first to recognize the merits of wages based on production and instituted piece rate plans whereby the worker was paid according to the amount or number of articles he produced. Unfortunately these early piece rate plans were not based on a thorough investigation of what the workers were capable of producing under the given conditions and the workers driven by the incentive of higher earnings doubled their efforts and were soon doubling their incomes. At this stage the companies began to realize that the rates were too high and began to cut them, an action which was resented strongly by the workers who soon found themselves working twice as hard and twice as fast as they had been accustomed to under the old straight time payment plan and making no more money. The whole situation was most unfortunate since it brought piece rate payment plans into disrepute with labor and caused a great deal of industrial unrest. Much of the merit of "pay according to production" was ignored in the subsequent blasts of criticism which blamed the principle rather than the slipshod and ignorant application of it. Industry has profited by the lessons learned

from these earlier difficulties and today the first step taken when the introduction of any form of piece rate is contemplated is a thorough study of the operation on which the new rate is to be applied to make certain that the rate once set is fair to both the worker and the company and will not require alteration unless the nature of the operation itself is changed.

#### Varieties of Piece Rate Plans -

The original form of piece rate plan did not provide any minimum wage guarantee to the worker. One of the first variations was known as the Manchester plan which provided that earnings of an individual would reach at least a minimum guaranteed figure regardless of the quantity of production. Taylor introduced another variation which was known as Task and Bonus. Under this plan a definite "task" or quantity of production was set for each worker on each job. If production reached the amount of the task set, the worker received a higher rate for all units. This higher rate continued for all units produced over the amount provided by the task. The result was a very strong financial incentive to the worker to achieve the task set for him and a sharp increase in his earnings if he reached this goal. In reality, Taylor's Task and Bonus plan was a dual rate system, one applied if the worker failed to achieve the task set for him and the other applied if the worker reached or exceeded his task. Merrick introduced another variation adding a third rate. Gantt provided for a guaranteed day rate until the worker reached the task at which time he would shift to a piece rate with the added incentive of an abrupt increase in

earnings at this point.

All of these piece rate plans which provide for increase in the rate per unit as the total production of the worker increases are known as differential or multiple piece rate plans. In contrast to these there have been introduced piece rate plans in which the rate per unit decreases as production increases. These are known as gain-sharing plans - the company and the worker sharing the benefit of increased production. Halsey, Bedaux, Diemer, Baum, Barth and others have introduced plans of this type. In addition to both the differential piece rate and gain-sharing plans there are still other variations of the straight piece rate which are more or less empirical. They usually provide different rates at different levels of production starting well below full achievement of standard task. Today there are scores of different piece rate plans each claiming certain advantages of fairness to the worker and management and providing incentive for increased production.

#### Other Financial Incentives -

In addition to the incentive provided by piece rate wage payment plans, other forms of financial incentives have been tried from time to time with varying degrees of success in management's efforts to encourage increased production. One of these is known as profit-sharing, in which the company distributes to the employees extra money varying in amount according to the profits of the company. Many varieties of the plan exist providing for different percentages for the workers, based on net profits, profits after dividends, or bearing a direct

relationship to the amount of dividends. Advocates of profit-sharing claim that such payments are justified because of the important part the employees play in increasing the profits of the company, and, of course, no employee ever objects to sharing in the profits of the company especially if they are substantial. Opponents of this plan contend that it is not a satisfactory incentive to increased production, primarily because increased efforts on the part of the employees do not necessarily result in increased profits for the company. More profit may actually result from such a thing as a shift in consumer preference over which the employees have no control than from their increased efforts, and similarly profits may be negligible in spite of the most conscientious staff. Another objection to profit-sharing is the difficulty of distribution in proportion to the just deserts of individuals, since the laziest will likely receive his share along with the hardest workers in the department. Moreover, distribution of profits cannot be made at sufficiently frequent intervals for its incentive effect to have any continuity. The popularity of profit-sharing plans in industry appears to be on the decline.

Another form of financial incentive to increase production takes the form of group bonuses. A standard is set for an entire section or department and extra payment is made for group production beyond that standard. Such a plan may on some occasions have the desired effect in the promotion of a team spirit with each worker anxious not to "let the others down". On the other hand, it may easily result in the better workers limiting their production to average level so as not to "show

the others up".

To a limited extent, various forms of employee savings funds, pension and insurance schemes, and employee stock purchase plans may be considered as financial incentives although the extent of their influence on increased production is practically impossible to estimate.

#### Nonfinancial Incentives -

Since the acquisition of money is just one of the many reasons for human action, management has been interested in finding out other motivating forces, and in putting them into effect within industry. Any incentive to increased effort which does not have its origin in a desire for higher monetary reward is known as a nonfinancial incentive. To follow this very far one would soon find himself delving into the specialized fields of the psychologist dealing with human behavior and motivation. Moreover, from the point of view of the various aspects of management discussed in this treatise, it brings up points more logically placed under management-employee relations than under remuneration. However, some of the more potent nonfinancial incentives should be mentioned. They include such things as opportunity for advancement, steady work, pleasant working conditions, reasonable hours providing opportunity for recreation and other activity, respectful treatment by superiors and commendation for work well done. For these things employees are willing to put forth extra effort without thought of financial gain, and the management is well advised to develop these incentives within the organization in the interests of a happy and

stable working force. To be fully effective, however, they must be based on mutual respect between management and employees which demands fair financial remuneration for fair effort.

#### Incentives for Supervisors -

Supervisors and foremen being in direct and constant contact with the workers under them are in an admirable position to influence the productive efficiency of the employees. It is recognized by management, therefore, that some form of incentive should be provided which will encourage supervisors to increase the production and quality, and decrease the waste resulting from the operations under their control. Supervisors, like others, are influenced by direct financial incentives as well as nonfinancial ones. Within any organization they enjoy the same working conditions, hours, and opportunities for advancement as the employees under them and the same nonfinancial incentives which motivate the employees will influence them. Applying financial incentives to supervisors becomes more difficult since the supervisors are not personally operating the machines. Perhaps the simplest form of financial incentive for him is a definite percentage of the extra pay received by the workmen under his control which will encourage him to see that the workers enjoy the larger incomes resulting from increased production. Many other factors are representative of good supervision such as quality of output, full utilization of equipment and machinery, elimination of waste and breakage, reduction of non productive or indirect labor cost per unit of production, reduction in accidents, and the development of improved work methods and

operational short cuts. Any thorough incentive plan for supervisors should represent all major phases of their responsibilities and in order to accomplish this it will be necessary to measure and record the various factors listed above and weight each in accordance with its relative importance.

#### Salary Standardization -

Many types of work, particularly those found in the office, do not adapt themselves readily to actual piece rate methods of payment. There are other situations where payment could easily be based on actual production but for various reasons a change to piece rate payment is not considered desirable by the management. Under such conditions the management must take other steps to ensure that remuneration is in definite keeping with the efficiency of the employee and the importance to the organization of the job being done. If such a plan is put into operation and administered justly it will act as a very definite incentive to the worker to do better work and more of it in order to prove to the management that he is entitled to promotion and salary increase. The most effective means at the disposal of the management to ensure that remuneration remains in line with merit and is not unduly influenced by seniority of service is to introduce a salary standardization plan.

Salary standardization involves three distinct steps:

- (a) determining by actual analysis the requirements of each job and its relative importance, that is, what it demands of the worker and what it contributes to the operation of the organization.

- (b) arranging all jobs in their proper order for purposes of compensation for the work done, and establishing a classification.
- (c) analyzing present salaries paid within each class and establishing a definite salary schedule for each class showing upper and lower limits and a logical basis of progression for salary increases within the class. The upper and lower limits decided upon should not be influenced by the present high or low salaries paid to persons whose positions are found to fall logically within any particular class.

Let us consider each one of these steps in greater detail.

(a) Analyzing the requirements and relative importance of each job. Job analysis, discussed in greater detail elsewhere, is perhaps the most thorough and scientific means as yet at the disposal of management for the purpose of determining the requirements of each job. However, it will seldom be found desirable to incur the expense of a thorough analysis of even the majority of different jobs in the organization and for purposes of position classification and salary standardization the degree of detail discussed in the chapter of Job Analysis is not necessary. The analysis may be the composite result of observation by the investigator, a statement of duties and responsibilities by the employee's supervisor and a similar statement from the employee himself. The analysis should be used to determine and record actual specifications for the job, which will be of value to the personnel department for employee selection procedure and at the same time form the basis for decision as to the proper

classification the job should receive. For further particulars concerning the writing of Job Specifications, reference may be made to the last few pages of the chapter dealing with Job Analysis, Time and Motion Study, Job Specifications.

(b) Classifying jobs. After each job has been analyzed to determine what qualities and abilities its satisfactory completion demands of the incumbent, and the nature of its contribution to the work of the company as a whole, it is then necessary to arrange all jobs in their relative order of importance. When this is done it will be found that a great many of the jobs are similar in general nature and importance although they may vary considerably in actual detail; in other words they indicate a general similarity which almost automatically brings them together into the same class. Other types of jobs will require much careful consideration to determine their proper classification. There is no particular number of classes into which the jobs must be sorted but it is usually found desirable to have somewhere from twelve to fifteen, which provide a sufficient variety for classification of all jobs up to the executive level without having too many which would tend to complicate the system unduly. A further review of the twelve or fifteen classes will reveal certain normal groupings such as, for example, general clerical, advanced clerical; minor supervisory, senior supervisory; minor executive or policy interpretation, etc. Each of these associated classes or groups may logically be given the same alphabetic identification with divisions within the group being made numerically. For example, job classifications from the low to the high level might be graded somewhat

like this: A1, A2, B1, B2, B3, C1, C2, C3, D1, D2, D3, D4, E1, E2, E3.

(c) Establishing a salary schedule. Having established a logical classification for all jobs up to the executive level in the organization, it is then necessary to establish a reasonable, equitable salary schedule providing a range for each class. The salary range in contiguous classes will, of course, overlap to some extent. In each class the range will indicate the upper and lower limits for salary for that particular class of work, the lower being the smallest salary to which any employee doing that particular type of work is entitled, and the upper being the limit which the management feels such work should receive no matter how efficiently it is being done. Within these limits "steps" should be indicated for purposes of periodic increases when the employee merits them, either by virtue of increased responsibilities or meritorious service. As long as the employee retains the same job he should not be advanced in salary beyond the top limit provided in the salary schedule for that particular class, no matter how long or well he does the work. On the other hand, if he is transferred to another job of a higher classification his salary should be raised to the lower limit of the new class no matter how recently he has been employed. The whole purpose of salary standardization is to keep remuneration in line with the requirements and importance of the job being done.

At the time salary standardization is introduced there will undoubtedly be brought to light many cases where salaries are either below or above the new schedules. Such situations

have been brought about by unscientific salary policy in the past and the sooner such situations can be corrected the better. In this respect it is usually recognized that the company will have to absorb a certain amount of extra salary cost during the period of change-over. Salaries found to be below the minimum limit of the new schedule for that particular class should be increased to bring them within the schedule. It is not, however, considered good practice to lower salaries found to be above the maximum since this would in many cases inflict a hardship on the employee through no fault of his own. Some of these cases can be corrected, where the employee merits it, by promotion to a post within a higher class. In other cases it will be necessary for the management to cease all further increases and for the company to continue to absorb the extra cost for the duration of the employment. Salary cuts to fit the new schedules are likely to be morale destroying and in the long run may prove more costly.

No matter what particular system is used, remuneration of employees should represent a sound effort on the part of the management to reward its workers fairly and justly according to their efforts and their contribution to the operations of the company as a whole.

## CHAPTER XII

### FATIGUE

Fatigue is a physiological and psychological phenomenon which appears anywhere that exertion is required. Taylor in his early experiments to determine the "fair day's work" realized that increased production could be achieved if periodic rest intervals were provided. The proper length and frequency of these rest periods were determined by a trial and error method. If the periods were too short and too seldom the worker did not have an opportunity to recover from previous exertion. If the periods were too long and too frequent much time was wasted and production suffered. During World War I the Ministry of Munitions in Great Britain conducted some revealing experiments on the effect of fatigue on production. Long hours resulting in high fatigue were found to decrease not only the total daily production of the worker but the average hourly production to such an extent that it was proved profitable in terms of total production to shorten the hours of work. The actual length of the working day which produced best results varied with the nature of the work and the conditions under which the work had to be performed.

Many experiments have been conducted in the field of industrial fatigue by eminent medical authorities and many explanations have been offered. There is still much to be done, however, in the practical application of the findings to existing conditions. Perhaps the most difficult aspect of the problem is the apparent impossibility of drawing general conclusions

from the investigations conducted. The amount of fatigue experienced will vary between different persons doing the same job under the same conditions at the same time. Fatigue will also vary with the same person on the same task at different times of the day or on different days. Such a multitude of variants has made it impossible, at least up to the present, to provide any formula to determine the amount of fatigue created in the performance of a particular task. Lacking a definite method of determining this, it has been equally impossible to reduce fatigue to absolute minimum. Its entire elimination is not, of course, considered possible.

#### Mental Aspects of Fatigue -

It has been apparent to everyone at some time or other that the ease with which one becomes tired (that is, experiences fatigue) bears little definite relationship to the amount of physical energy exerted. An example which bears out this fact is children at play who, were they required to apply such energy along less interesting channels, would soon be completely exhausted. Men play golf or tennis or pursue hobbies requiring great expenditure of effort and experience less fatigue than in their less energetic daily work. It might be assumed from this fact that fatigue is related to the interest or enthusiasm which one has for the job in hand.

Mental effort requiring practically no physical exertion also produces fatigue. If the job taxes the intellectual capacity of the worker, fatigue will develop much more quickly. Fatigue will also result when the worker is unfamiliar with the

job or if he is worrying about his performance and whether or not he is "making good". If, on the other hand, the intelligence of the worker is somewhat in excess of the demands of the job, and if he is completely familiar with the operation and knows that his performance is satisfactory, he will experience much less fatigue. Too great an excess of intelligence over the intellectual demands of the occupation may, however, cause a feeling of boredom with equally disastrous results to the welfare of the worker.

#### Physical Aspects of Fatigue -

Perhaps the greatest cause of fatigue in jobs not requiring a high degree of mental effort is the actual physical exertion demanded of the worker. The physical aspect was the first recognized by students of the problem and still occupies a major place in their studies. Physical fatigue is greatest in jobs where the major force of the operation must be provided by the worker, and diminishes as a larger part of the required force is provided mechanically. The introduction of various labor-saving machines has naturally reduced the fatigue experienced by the operator. Usually each job is capable of reduction into terms of optimum physical characteristics of the worker. Certain tasks can be performed best by tall men, others by short men. It would be uneconomical from a fatigue-producing point-of-view to place the tall man on a job requiring a leaning position to watch his work. Equally fatiguing would be a situation requiring the short man to stretch. The physical characteristics demanded of the job and those possessed by the workers

should therefore be given consideration. Physical inequalities can frequently be compensated by minor variations in the location or height of the machine or bench, and if this is possible it is more economical than allowing this factor to prevent the selection of the worker best qualified by experience and mental aptitude.

#### Some of the More Common Causes of Fatigue -

Fatigue may be caused in many ways. Some of them are mental and psychological, perhaps related to the workers personal affairs, and frequently defying satisfactory analysis and correction. Others may relate to the psychological conditions of the employment itself, as for example fear of dissatisfaction by the management on the part of overly conscientious workers or a lack of security in the job. Still other causes may lie in the physical conditions of the work. These causes of fatigue, all of which must be considered a responsibility of the management and should be corrected wherever possible, include the following:

(a) unnecessary vibration of machinery which the worker is required to handle.

(b) inconvenient location of materials which the worker is required to handle.

(c) inadequate arrangements for the disposition of the semi-finished product after the worker has completed his operation.

(d) poor ventilation.

(e) lack of adequate means for disposing of dust and fumes from the factory.

(f) poor lighting of the work space or improper control or location of lighting resulting in glare.

(g) inadequate provision of chairs, stools, etc., for the workers to use between operations or, if convenient, while actually working.

(h) lack of control of noise.

All of these and other factors contribute to fatigue.

#### The Results of Fatigue -

Fatigue prevents the worker from giving full concentration to the task in hand. This results in lower production where, as in most cases, the worker controls the speed of production. It also results in more mistakes and a general lowering of efficiency and the quality of the work produced. Fatigue also has a personal effect on the worker. He feels that his work is taking too much out of him, that the job is too strenuous. If the conditions causing this fatigue are not corrected he will become dissatisfied and may start looking for a change. If conditions conducive to fatigue are fairly general throughout the plant, an unsatisfactory state of labor relations may easily result.

#### The Measurement of Fatigue -

Many tests have been devised for the measurement of the fatigue resulting from certain isolated exercises under laboratory conditions but as yet no thoroughly reliable and practical applications have been made to actual work conditions. The normal means of estimating fatigue in the plant or office is to chart the hourly production throughout the work day. Such a

chart usually reveals a falling off of production during the late afternoon which is attributed to fatigue of the workers. It is agreed that such an assumption cannot be proved satisfactorily but the explanation appears most logical, and until greater strides are made in determining the actual nature of fatigue and in its definition, such means of measurement must suffice.

#### The Reduction of Fatigue -

It is most fortunate that fatigue in industry is considered undesirable by employer and employee alike. Any suggestions or efforts at fatigue reduction made by the one are seriously considered and encouraged by the other. Further success in its reduction has not, therefore, been hindered by any lack of cooperation between management and the employees but rather by ignorance as to the actual causes of fatigue and the means of their elimination. Modern scientific management has already made advances in this respect and further improvements are to be expected. Some of the improvements already made are:

(a) the proper care and adjustment of machinery to eliminate unnecessary noise and vibration.

(b) the sound-proofing of naturally noisy equipment to decrease the disturbance caused by its operation.

(c) the development of sound-absorbing walls and ceilings by acoustical experts.

(d) the development of satisfactory air conditioning equipment to provide proper ventilation and the automatic elimination of fumes and dust.

(e) the introduction of improved lighting facilities in order to minimize eye strain and glare.

(f) improved planning of layout and work scheduling to eliminate unnecessary handling of materials and semi-finished products.

(g) the continued improvement and introduction of new labor-saving machines and devices in order to transfer as much as possible of the effort-consuming work from the workers to the machines.

(h) the development of scientifically designed chairs and stools so that the worker may be as comfortable as possible during the unavoidable delays between operations and while he is actually engaged in the operation if it is possible to perform it satisfactorily in a sitting position.

(i) the development of compensating devices for workers whose physique is not in keeping with the demands of the job.

(j) the development of job specifications which assist in the selection of workers more suited mentally, physically, and temperamentally to the particular job.

(k) the improvement of employer-employee relations which encourage the worker to seek assistance in personal problems from qualified personnel, medical, legal, etc., advisors in the company.

(l) the introduction of rest periods the length and frequency of which have been scientifically determined in order to have the most beneficial effect on the worker and his productive powers.

(m) the distribution either at rest periods or independent

of them of refreshment to the workers. Some companies have found that the distribution of coffee or tea as a stimulant during the late afternoon has more than repaid its cost in higher production for the rest of the day.

(n) the broadcast throughout the plant by means of loud speakers of music which has been shown in many plants studied to decrease fatigue and increase production. In this respect Professor Harold Burriss-Meyers speaking before the American Society of Mechanical Engineers in October, 1942, reported in part as follows:

"Daily output of employees plotted against time showed an increase of 6.8 per cent where music was broadcast, as compared with production figures under precisely similar conditions where there was no work music provided. In over 75 per cent of all factories studied, the total production was found to be greater when music was broadcast than when it was not used." (1)

The British Industrial Welfare Society reports:

"On the whole the concensus... seems to be that music at work does much to relieve the monotony of repetitive work and produces a stimulus to increased output, and in the opinion of the Industrial Welfare Society there is no doubt that this development is not merely a wartime one, but that music at work will remain a definite feature of industry." (1)

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(1) Article entitled "Music in Industry" in Personnel magazine for September, 1943.

## CHAPTER XIII

### INDUSTRIAL HEALTH

In ancient Greece and Rome most of the labor was performed by slaves whose health caused little or no worry to their masters. They were provided only with the barest necessities of life, fed upon scant and unnourishing foods, and quartered in a most unsanitary, unhealthy and inexpensive fashion. Although the lot of the laborers did not improve materially for several hundred years, some of the leading writers of the ancient and medieval periods considered their plight and wrote extensively on the subject. Plutarch's "Lives" reveals some of the conditions of the time relating to the slaves. Hippocrates in the fifth century B.C. described with considerable accuracy certain occupational diseases including those of the smelters, fullers, and tailors. Perhaps the earliest treatise on occupational hygiene appeared in 1473 in which was given advice on how to avoid certain types of metal poisoning. However, the real founder of industrial medicine and hygiene is generally considered to be Ramazzini who published his "Diseases of Tradesmen" in the year 1700.

During the latter half of the 18th century came the industrial revolution with its rapid development of the factory system and its replacement of the guilds as the major means of production. The health conditions of the workers during the early stages of the industrial revolution were deplorable and active reform of these conditions did not begin until about 1830 when prominent investigators were appointed in England to

consider the workings of the Poor Laws. Since that time legislation has gradually improved the lot of the worker by shortening his hours, regulating the conditions of work, and increasing his compensation.

#### The Importance of Industrial Health in Modern Business -

It was perhaps to be expected that leadership in the matter of industrial health should come from the social reformers and not from the business leaders of the period. Industry was short-sighted and early management could not seem to justify any expenditure or self-restriction which would not result in immediate and obvious profit. Modern scientific management, however, realizes the great value of a high standard of health and general welfare for its workers and the community as a whole. In other words it is recognized as sound business practice to improve industrial health. Healthy workers in a healthy community mean greater production of higher quality goods and a happier and more stable working force.

#### The Essentials of an Industrial Health Program -

Dr. L. D. Bristol lists certain measures which are considered essential by leading authorities in the field of industrial health. They are: (1)

- (a) selection of applicants and their assignment to suitable employment.
- (b) assistance to employees in their own health maintenance and in recovery from disease or accident.

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(1) Quoted from the Handbook of Business Administration.

- (c) sanitary supervision of working environment and social assistance in home and community problems.
- (d) research to improve methods and results and to extend the knowledge of industrial health.

#### Health Aspects of Selection and Assignment of Employees -

As has been indicated in the chapter dealing with the procedure for the selection of new employees, the physical examination is an important step in ascertaining the desirability of employing an applicant. The National Safety Council lists certain objects and advantages of the pre-employment physical examination. These are listed below:

##### (a) Objects -

1. To place the worker in the occupation which suits him best.
2. To detect the presence of remediable physical defects in order to enable the worker to correct them.
3. To determine the presence or absence of serious organic disease, either of which may have an important bearing on employment selection.
4. To prevent occupational disease, by excluding susceptible workers from specific hazards.
5. To prevent the spread of communicable disease by the exclusion of infected persons.

##### (b) Advantages -

1. Presents a favorable opportunity for health education.

2. Enables the early discovery of disease.
3. Makes possible the proper placement of the worker.
4. Helps to prevent or lessen the effects of epidemics.
5. Tends to reduce absenteeism, when used as a part of a health service.
6. Is a factor in lessening accident occurrence.
7. Reduces the possibility of unjust claims for injuries.
8. May increase efficiency and production through proper placements.
9. Provides a means of economic control of future medical expense.

The National Safety Council further states that protection for the worker, the fellow workers and the industry are the chief motives which should actuate the inauguration of this important health measure, and that physical examinations should never be made solely with the idea of weeding out the unfit. It is little wonder that modern scientific business management attaches importance to industrial health work when one studies the advantages listed above of only one aspect of the program.

#### Factors Affecting the Workers Health -

Another important aspect of an industrial health program is the study of factors within industry which affect the workers' health and recommendations for the correction of those factors which have an adverse effect. The general sanitary arrangements of the plant require close scrutiny. Adequate lavatory and toilet facilities must be provided and they must

be kept in a sanitary condition at all times. In this respect offices and plants are subject to government supervision so that unsanitary conditions in connection with such facilities cannot go long unchecked.

Ventilation must be provided to allow an adequate supply of fresh air without draft. This necessitates the installation of some form of ventilation or air conditioning equipment since the use of windows alone for this purpose is not entirely satisfactory. The use of windows for ventilation in the winter time lowers the temperature of the work place dangerously since the workers are not clothed for outside activity. Moreover open windows usually prevent the satisfactory operation of the heating plant. In the heat of the summer employees are frequently inclined to leave windows closed in the interests of keeping the room cooler. Realizing the difficulty of controlling the opening or closing of windows by employees, some modern companies have constructed factories without windows giving complete control over lighting by artificial means and air conditioning.

Illumination is of particular importance to industry both for factory and office work. Adequate lighting saves sight and helps materially to prevent accidents. Glare in the workman's eyes must be avoided and shadows within the working space must be eliminated. The amount of light at any one place is scientifically measured by an illumination meter, sometimes also called an illuminometer or foot-candle-meter. The amount of light is measured in terms of foot-candles and the number of foot-candles required will vary from about 20 to 75 depending

on the intensity of illumination required for any particular job. Investigations have indicated the proper amount of light for different types of work and have proved that when the number of foot-candles drops below the required level, errors and spoilage increase materially and fatigue through eye-strain becomes more prevalent.

Dust is another factor having an adverse effect on the health of the workers. Certain industries and jobs are by their very nature more dusty than others and unless steps are taken to eliminate this hazard occupational diseases involving the lungs may result. Many types of filter masks or dust respirators are available for the protection of workers on particularly dusty jobs.

Noise has been found to have a deleterious effect on the nervous system of the workman subjected to it and may lead to functional deafness if allowed to continue over an extended period. Excessive noise should, therefore, be eliminated on health grounds quite apart from adverse effect on efficiency and production caused by distraction.

Fatigue in industry has also received the attention of industrial health specialists. This subject has been discussed in greater detail in a special chapter devoted to it.

#### Industrial Safety and Accident Prevention -

In the past, occupational accidents have stood first on the accident list but with the great increase in the use of motor vehicles, accidents of an occupational nature have decreased in relative importance. For men, who are normally

exposed to greater hazards, the accident death rate stands second only to heart disease on the mortality tables, but this figure includes accidents of all kinds. The attention devoted to accident prevention in industry over the past quarter century has had excellent results with the number of accidental deaths in industry being reduced approximately fifty per cent. The extra pressure of war production, accelerated training, and reduced standards of selection necessitated by the present emergency would naturally have the effect of increasing accidents at the present time although actual figures on this point are not available.

Among the many factors in the causation of accidents are the degree of intelligence, experience, and ability of the workman; the clothing he wears; his habits involving dissipation; his home conditions; the physical factors of his environment, such as factory lighting, heating, and ventilation; the degree of education of his foreman; the management of the plant; the plant housekeeping; the guarding of machinery; the idiosyncracies of the machines upon which he works, etc. H. W. Heinrich, who listed these general causes, further investigated 75,000 cases of industrial injury with a view to determining with greater accuracy the causes involved. The results of the study are most interesting and a brief summary is shown below:

- A. Unpreventable accidents - 2% of all industrial accidents
- B. Preventable accidents - 98% of all industrial accidents
  - I. Supervisory defects - 88% of all industrial accidents
    - 1. Faulty instruction

- a. No instruction given
  - b. Instruction not enforced
  - c. Incomplete instruction
  - d. Erroneous instruction
2. Inability of employee to follow instructions
    - a. Inexperience of employee
    - b. Lack of skill
    - c. Ignorance
    - d. Poor judgment
3. Poor discipline
    - a. Disobedience of rules
    - b. Interference by others
    - c. Fooling or practical jokes
4. Lack of concentration
    - a. Attention distracted
    - b. Inattention
5. Unsafe practices
    - a. Taking chances
    - b. Taking short cuts
    - c. Too much haste
6. Mental unfitness of employee
    - a. Sluggishness or fatigue
    - b. Violent temper
    - c. Excitability
7. Physical unfitness of employee
    - a. Physical defects
    - b. Fatigue
    - c. weakness

II. Physical factors - 10% of all industrial accidents

1. Physical hazards (mechanical, chemical, electrical, steam conditions)
  - a. Ineffectively guarded machinery
  - b. Unguarded machinery
2. Poor housekeeping
  - a. Improperly piled or stored material
  - b. Congestion of material
3. Defective equipment
  - a. Miscellaneous materials and equipment
  - b. Tools
  - c. Machines
4. Unsafe building conditions
  - a. Lack of fire protection
  - b. Lack of exits
  - c. Unsafe floors
  - d. Dangerous openings
  - e. Miscellaneous
5. Improper working conditions
  - a. Improper ventilation (or no ventilation provided)
  - b. Unsanitary conditions
  - c. Improper lighting
6. Improper planning
  - a. Defective layout of operations
  - b. Unwise layout of machinery
  - c. Unsafe processes
7. Improper dress or apparel
  - a. No goggles, gloves, masks, etc.

- b. Unsuitable clothing - long sleeves, high heels, trousers too long, etc. (1)

The fact that 98% of all industrial accidents are classed as preventable presents a tremendous challenge to modern industrial management. It is an inescapable responsibility for management to ensure that physical factor causes of accidents be eliminated, that selection and placement of employees prevent accidents resulting from unfitness of the worker for the nature of his employment, that instruction in the safe operation of the job be complete, and that adequate and strict safety discipline be maintained. Although modern management has already made great strides in the field of industrial safety by scientific investigation and the application of scientifically designed safety methods, there still remains much to be done and management must not rest content until industrial accidents are lowered to and kept at an irreducible minimum.

#### Occupational Diseases -

The term "occupational disease" implies that the disease results from or has some direct connection with the work or occupation of the individual. A great deal of valuable medical research has been conducted in this field and the findings have formed the basis for the removal of the causes or for the provision of safeguards for the worker. It is hardly within the sphere of this thesis to discuss the various types of occupational diseases found in industry. Suffice it to say that business management is most anxious to eliminate such hazards

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(1) Heinrich, H. W. "Industrial Accident Prevention, a Scientific Approach" reported by Drs. Chenoweth and Machle in "Industrial Hygiene".

from employment and most of the financial support for the necessary investigations and research work required comes from the larger companies enjoying foresighted management.

#### Medical Supervision of the Workers and Health Education -

Most of the larger companies today have within the organization a medical department, the primary responsibility of which is the maintenance of the standard of health of the working force. Doctors, nurses, or other trained personnel are available for the immediate treatment of accident cases, or for the diagnosis and early treatment of other sickness. Some of these medical departments are equipped to carry the service to the workers' homes as required. The department is also concerned with the correction of conditions within the company giving rise to accident or illness. Up until a relatively short time ago these were the entire responsibilities of medical facilities in industry. There has now emerged another aspect of medical responsibility - that of health education of the worker. It has been found insufficient to confine the concept of industrial health to the treatment of accident and sickness and to the elimination of personal and physical factors within the company which tend to cause an increase in accidents or sickness. The company medical staff is in an excellent position to convey to the worker valuable advice on the important questions of personal hygiene and general preservation of health which the worker in turn can apply at other times than when he is actually on the job. With the more general acceptance of this enlarged aspect of the industrial health program, one can naturally expect

a further improvement in the standard of health in industry and the community generally.

## CHAPTER XIV

### A SUMMARY OF THE CONTRIBUTIONS MADE TO IMPROVED BUSINESS MANAGEMENT BY THE APPLICATION OF SCIENTIFIC METHOD

It seems desirable at this point to attempt to summarize in general form the contributions made by the introduction of scientific method in solving the many problems confronting the management of business. This summary will, insofar as possible, conform to the general organization of the thesis, that is, the contributions will be considered first insofar as they relate to "management and methods" or the impersonal aspects, and, second, as they relate to "management and men" or the human and personal factors. The writer acknowledges his indebtedness for the idea of this form of presentation to the excellent papers presented before the Taylor Society (now the Society for the Advancement of Management), particularly those presented by Mr. H. H. Farquhar.

#### 1. Management and Methods - Impersonal Aspects -

(a) Increased Production represents the most outstanding contribution of scientific method from the impersonal point of view. This increase has been made without corresponding increases in personnel or equipment used. As might well be imagined, the greatest improvements in this respect have been made by plants which were not noted for their efficiency prior to the introduction of the methods of science. Moreover many of the factors contributing to this increase have represented very distinct gains to the industrial community, as for example, improvement in the selection and training of workers and their conditions

of work which have resulted in less absenteeism and a general improvement in industrial health. Such factors will be mentioned in greater detail when dealing with the contributions from the personal or human side. Other factors contributing to this increase of production have only an incidental relationship to the conditions of the worker and deserve special mention. They are:

- (i) more effective utilization of equipment and tools.
- (ii) more effective use of effort through scientific analysis of the job and its requirements.
- (iii) simplification and standardization of materials.
- (iv) improvement of routing, physical layout, and administrative control of the processes.
- (v) regulation of work to eliminate slack periods and seasonal fluctuations with its attendant quickly recognized benefits to employer and employee alike.

(b) Improvement of Quality is another widely recognized benefit of scientific method. Earlier opponents of Taylor claimed that the increase in speed of production inevitably resulted in poorer quality of workmanship, and indeed many workers are said to have sabotaged their work to discredit him. More recently, however, careful investigations have given rather conclusive proof to the fact that fast, but more closely regulated speed, results in an improvement in quality.

(c) Fast Production and Accurately Predicted Delivery Dates are also recognized benefits of scientific management. Such a condition not only places the company in an enviable

position as a producer of marketable commodities but is also a distinct benefit to the purchaser since he can now count on the receipt of his purchases at the desired time.

(d) The sense of satisfaction that comes from the fact that the business is "under control", that production, profits, and results can be gauged with a great degree of accuracy, should also be listed here as a benefit of the application of scientific method.

## 2. Management and Men - Personal and Human Aspects -

It should always be borne in mind that the entire *raison d'etre* of business is the satisfaction of human wants and that any industrial system will perish if the welfare of people is not recognized as a primary responsibility. The introduction and improved application of scientific methods to our industrial system has, fortunately, resulted in many improvements from the human welfare point of view.

(a) Industrial Peace, in spite of the early opposition of labor, has been particularly evident in companies which have adopted scientific methods. This situation is undoubtedly due to many factors - greater cooperation between management and the workers, a greater sense of satisfaction resulting from higher production and consequent higher wages without undue fatigue, and a well founded feeling that the workers' interests are being considered important by a progressive and enlightened management. The achievement of relative industrial peace is one of the more outstanding contributions of the application of scientific method to business management.

(b) Higher Wages are one of the more commonly recognized benefits.

(c) Shorter Working Day is another recognized result of scientific method. Innumerable cases have proved that shorter hours, up to a certain point, have actually resulted in an increase of total production.

(d) Health and Well-being -

It is widely recognized by intelligent management that the best working conditions for the employees represent the best condition for the employer. One of Taylor's early investigations was in the question of industrial fatigue and his system was built around a scientifically determined relationship between effort and rest. Taylor was one of the first to recognize that adequate rest and relaxation periods must be provided for those engaged in strenuous work if maximum results are to be achieved. The general standard of health of industrial workers has been raised considerably in recent years, due in large part to the realization on the part of management that better hygienic conditions result in less sickness, fewer accidents, higher production and consequently greater profits to the business. This fortunate unity of the profit motive and the welfare of the workers has been an important factor in the success of scientific management. No longer, it is now realized, do the interests of employer and employee pull in opposite directions.

(e) Careful Selection of the Worker -

The careful selection of the employee was early recognized as an essential of the new scientific method. This

selection required a sound knowledge of the job in order that the right type of person might be selected for it, which in turn necessitated a thorough study of the elements of the work to be done. Like so many scientific studies, one investigation called forth others until an integrated system was built up. As we have seen in the chapters of this treatise dealing with selection of personnel, this early idea of careful selection has grown into a large and highly specialized field.

(f) Training of the Worker -

Selection of workers enables management to acquire personnel with the proper physical attributes, elementary background or education and suitable aptitudes, but, in the complexity of modern industrial specialization, selection alone can rarely secure the worker with all the intimate knowledge required of a particular job. It then becomes a problem of training and here too great strides have been made in recent years. Moreover, the introduction of a training system enables management to use on other jobs those workers who have been previously unsuccessful. From a purely social point of view this rehabilitation of misfits has been an important contribution to social adjustment and personal satisfaction.

(g) Initiative and Opportunity -

One of the more potent criticisms of Taylor's work in job standardization was that such work was monotonous and tended to kill individual initiative. This criticism was perhaps true in the earlier days of industrial specialization before men became accustomed to it and learned to direct their initiative to higher levels within narrower scope. Monotony is

not so much a matter of unrelenting repetition as a lack of the proper attitude towards a particular task and its future possibilities.

(h) Reduction of Turnover -

Separation of job and worker, either voluntarily by the worker or involuntarily as in the case of discharge, is due either to lack of satisfaction with the job by the worker or lack of satisfaction with the worker by the management. In both cases the number of underlying causes has been reduced by the application of scientific methods. Restlessness of employees has been reduced by general improvement of working conditions, shorter working day and higher wages. Management has also introduced various benefits such as pension and insurance schemes which give the employee a greater financial stake in his job and encourage him to remain with the company. By a system of promotion from the ranks to foreman responsibility another incentive is added, that of possible improvement in position. On the other hand, management's possible dissatisfaction with the worker is also reduced. By careful, scientific selection those who lack the essential abilities and aptitudes are not hired in the first place and well developed training, placement and replacement methods within the organization ensure that every effort is made to place the worker satisfactorily before recourse to discharge as a last resort.

(i) Confidence, Cooperation and Security -

These three interdependent factors are important contributions of scientific management to business. Under this system the worker has greater confidence in his own

abilities and in his job because he has been so carefully selected and trained for it. This greater confidence gives him a more satisfying sense of well-being and improves his outlook generally. Under such conditions his entire cooperation with other workers and with the management is more easily secured. He has also a greater sense of security in his work because, due to his specialized training, he is difficult to replace. He has become a skilled workman. Management, on the other hand, will do everything in its power to maintain this spirit of confidence, cooperation and security. It means a more satisfied working force, less industrial unrest, higher production and higher profits and represents the best interests of employees, management, stock-holders, and the entire industrial community.

## CHAPTER XV

### THE TREND OF FUTURE DEVELOPMENT

This final chapter is an attempt to consider some of the more important trends in business management today and to interpret them in terms of their likely projection into the future. They are not arranged by design in any particular order of priority or importance since it is not expected that such developments will affect all industry simultaneously with equal force.

An accelerated evolution of management's functions and methods has been under way for the past several years which in some ways has been slowed down by the emergency demands of the present war and in other ways has been still further accelerated by these same demands. For example, hours of labor, which for many years have been growing shorter, have been stabilized and in many cases increased by the present urgent need for the greatest possible war production. On the other hand, government supervision and enforced arbitration of disputes between management and organized labor have been accentuated in the present crisis in an effort to eliminate friction and to keep production up to a high level.

#### Government Supervision by Inspection -

Supervision by inspection of many phases of business management by a government agency has become accepted procedure and will likely continue and increase in the post-war years. Such supervision is not to be construed as actual government control but arises out of the necessity for providing some means

of enforcement for the spate of regulations and restrictions affecting most lines of business. Such a tendency, already apparent before the war and accentuated by the growth of many war-born government agencies, will continue to justify itself by the existence of great post-war problems of an industrial-social nature.

#### Government Legislation -

Closely allied with the supervisory and inspection functions of government is the matter of legislation affecting all branches of business. During the past quarter of a century all countries have witnessed an increase in legislation affecting the conduct of relationships between individuals. Since business accounts for a large part of the relationships necessary in the modern world, much of this body of new legislation has been of an economic nature. Legislation now regulates many aspects of the business field which formerly were left unchecked. The histories of many of the rugged individualists of the business world of a generation or two ago now read like stories of piracy. Much of this legislation is designed, of course, to equalize the bargaining power of any two parties to a business contract - in other words for the protection of the average citizen. Through the medium of democratic representation in government the people have found their voice and will continue to demand legislation to protect their interests. In the post-war years legislation designed to control industry for the social good will undoubtedly increase.

### Greater Specialization of Management Functions -

In the future one can logically expect a large increase in the number and variety of problems which management will be called upon to solve, which in turn will necessitate a much higher degree of specialization within the ranks of the junior executives. Several factors are contributing to this increase in number and variety of management problems. Some of the more significant are:

- (a) Increase government supervision by inspection of business activities which results in increased demands for reports and statistics with increasing frequency and/or requiring greater detail.
- (b) Increased legislation affecting the conduct of business which will require greater and more varied types of control.
- (c) Inventions and new developments opening up hitherto untouched fields of economic activity of a much more specialized character.
- (d) Strong competition within industry for the post-war market in an effort to use the personnel and physical facilities created for war production.

Pressure for specialization will come from without industry (as in the case of the first two factors mentioned above) and from within industry itself (as in the case of the last two).

### Higher Management of a More General Character -

This may appear at first glance as a contradiction of the section immediately preceding dealing with the greater

specialization of management's functions. However, if the number and complexity of problems must result in greater specialization within the junior ranks of management, the senior management must become more generalized if it is to keep the work of its immediate subordinates in the proper perspective. No longer will it be possible for the production manager or the sales manager to step into the general manager's job without thorough training in other aspects of the business if the job of general management is to be done properly. Bias in favor of one branch of the company's operations will have an increasingly disturbing effect to the success of the company as a whole as the degree of specialization within junior management increases. Industry can avoid this possibility by having more of the company's problems thrashed out at the conference table where executives will have an opportunity to see and appreciate the problems of other branches of the business.

#### Greater Emphasis on the Social Aspects of Business -

It is hardly to be expected that business leaders will become, primarily, social workers. There will, however, be gradually less emphasis on the purely profit motive in business enterprises and more emphasis on the social aspects of its operation and the general welfare of its employees and customers. Much of this switch of emphasis will come grudgingly and with perhaps little motive other than a desire to impede the rush of restricting legislation. Much of it, on the other hand, will come willingly from management long desirous of improving the general lot of its employees and increasing its contribution

to the want-satisfying goods available to the consuming public. As a corollary of this, we may expect to find that people will develop a greater knowledge of the general conduct of business, a keener sympathy with its problems, and a higher regard for and greater confidence in its management.

#### Employee Participation in Management -

With the power and prestige of organized labor rapidly "coming of age" one can expect in the post-war years the development of wider viewpoint and tempered judgment by its leaders. The tremendous influence and power of organized labor imposes on it an obligation to insure at all times that this power is employed for the common good of all parties and not for the aggrandizement or other advantage of one. Several instances are on record of labor within a plant being given participation in the management by having representatives on management committees and boards of directors. Management realizes that to be successful it must provide the optimum conditions for the union of men, money, and material in the production of goods and services. Labor disputes arising out of unsatisfactory management-employee relations result in great loss of production; in other words, they result in the negation of management's purpose. This will be overcome to a great extent by closer coordination of the goals of management and labor through joint consideration and solution of problems. This has been tried in many cases in the past with varying degrees of success and there is reason to believe that the movement will increase in momentum and success in the future. Its success must depend,

of course, on complete understanding and mutual trust.

#### Socialization of Industry -

For many years large sections of certain industries, particularly public utilities, have been government owned and operated. Public feeling on the matter of industrial socialization seems to run in cycles and the present phase of the cycle is moving towards socialization. It is reasonable to assume, therefore, that before the present surge has begun to ebb more industries will become national property. Industries in which there is little or no competition concerning the quality or nature of the product or services will likely be sought first. Under government ownership, the management of such industries will no longer be engaged in the struggle of sales competition with other companies and will be devoting a larger part of its time to production, personnel, and other aspects of the business. Industries which have not yet reached full development, and in which much still depends on individual initiative and inventive genius, will likely remain in private hands.

#### The Management Consultant -

When management is faced with new and perplexing problems, it has three courses of action open in seeking a solution. It can work out a solution itself on the basis of past experience. It can seek the answer in the experience of other companies made known through trade journals, management associations, or correspondence. It can retain the services of a specialist who through training, study, and experience is

qualified to analyze the problem and suggest the most logical and effective solution. It is within this last field that the management consultant makes his contribution to the conduct of business enterprises.

As any field of human activity develops complexities, capable of simplification or at least explanation in terms more readily understood, there develops simultaneously a demand for the services of a consultant specialist who is capable of providing the simplification or explanation required. Consultants have appeared in many of the professions, such as medicine, law, engineering, etc. The growing complexity of business management during the past few years has given impetus to the demand for the services of qualified management consultants. The multiplicity of post-war problems - new materials and processes, new types of markets, new legal and social problems arising from industrial-social legislation and increased employee participation in management, changed markets and consumer preferences, and a multitude of others - will give emphasis to the service of the management consultant who in turn will become more highly specialized within the management field.

The application of scientific method to business management appears to be still in its vigorous youth.

BIBLIOGRAPHY OF BOOKS AND PUBLICATIONS  
IN FIELD OF MANAGEMENT

Much attention has been given to the subject of Business and Industrial Management in recent years. This attention and the greatly increased interest of business men generally has resulted in the publication of hundreds of books, pamphlets, and magazine articles in this field. An effort has been made in the present thesis to present a selection of books of interest in Management which have been published since 1938. The selection has been made from the Cumulative Book Index and is presented here as an integral part of the study because, it is contended, no serious consideration of the subject would be complete without such a selective bibliography.

The bibliography which follows is divided into subsections as follows:

1. Ability Testing
2. Business Management
3. Efficiency in Industry
4. Employment Management
5. Employees' Representation in Management
6. Employees' Training
7. Factory Management
8. Files and Filing
9. Foremen
10. Job Analysis
11. Medical Services in Industry and Industrial Hygiene
12. Office Management

13. Time and Motion Study
14. Wage Payment Plans
15. Welfare Work in Industry

It will be found in the bibliography which follows that in some cases the same publication is listed under more than one heading. Such duplication is unavoidable since in many cases the same book deals with several phases of management.

Throughout, publications are listed in reverse chronological order of publication date (that is, 1943 books first and 1938 books last) under each section. Author and publisher are listed after each title.

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M. E. Hamilton - Archives of Psychology  
Test Yourself for a War Job  
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C. Drake - McGraw  
Follow-Up of the Careers of Tested Engineering Students  
S. Horton - Human Engineering Laboratory  
Aptitude Tests for Mechanical Apprentice  
D. Moskowitz - Arco  
Too Many Aptitudes Woman  
J. O'Connor - Human Engineering Laboratory

1941 -

- Clinical Aspects and Interpretation of the Strong  
Vocational Interest Blank  
J. Darley - Psychological Corporation  
Objective Approach to Group Influencing Fields  
S. Horton - Human Engineering Laboratory

Professional Aptitude Tests in Medicine, Law and Engineering  
I. Kandel - Teachers College  
Put Yourself to the Test  
E. Webster - Musson  
Factor Analysis to 1940  
D. L. Wolfle - University of Chicago Press

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Approach to More Objective Oral Tests  
S. Ordway and J. C. O'Brien - Society for  
Personnel Administration  
Occupational Counseling Technique  
Technical Board for the Occupational Research  
Programme - United States Employment Service

1938-39 -

Individual Approach to Scientific Problems  
Human Engineering Laboratory  
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E. P. A. Hunt and P. Smith - City of Birmingham  
Use of Tests in Employment and Promotion  
National Industrial Conference Board  
Prediction of Success in Power Sewing Machine Operation  
J. L. Otis - University of Pennsylvania  
Mechanical Ability of Deaf Children  
M. B. Stanton - Teachers College  
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G. H. Thomson - University of London Press  
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P. E. Vernon - University of London Press

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J. G. Frederick - Business Bourse  
Control of Trends in Executive Progress  
L. H. Kurtz - Author  
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Principles of Profitable Management  
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Business Reserves for Post War Survival  
M. S. Massel - National Planning Association  
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W. Mitchell - University of Chicago Press  
Business as a System of Power  
R. A. Brady - Columbia University Press

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Stabilizing Jobs and Wages Through Better Business Management  
H. Feldman - Harper  
Dynamic Administration  
M. P. Follett - Management Publications  
Scientific Management in Great Britain  
Oxford Management Conference - Management  
Publications  
Practical Business Methods  
Blue Ribbon  
The Manager Today  
R. Pugh - Management Publications  
Straight Thinking  
W. Reilly - Harper  
Higher Control  
T. Rose - Pitman  
Philosophy of Organization  
N. Schreiber - Kroch  
Financial Policies of Business Enterprise  
W. Taylor - Appleton Century  
Getting Things Done in Business  
E. Wilson - McGraw

1941 -

Efficient Management  
H. N. Casson - Efficiency Magazine  
Anticipations, Uncertainty and Dynamic Planning  
A. G. Hart - University of Chicago Press  
Applied Business Finance  
E. E. Lincoln - McGraw  
Problems in Business Economics  
M. P. McNair - McGraw  
Introduction to Business Management  
H. H. Maynard - Ronald  
Middle Management  
M. C. H. Niles - Musson  
Design of Manufacturing Enterprises  
W. Rautenstrauch - Pitman  
Starting Your Own Business  
J. Timms - Pitman

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Introduction to Business Management  
E. Brown - Pitman  
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Prentice-Hall  
Engineering Reorganization  
J. J. Gillespie - Pitman

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How to Cut Waste  
G. L. Gardiner - Elliott Service  
Value of Order  
H. Myers - National Foreman

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R. M. Barnes - Wiley  
Things That Don't Have To Be Done  
G. Harrison - Author  
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J. I. Tucker - Leader  
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C. Lytle - Ronald  
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J. Ramsay and others - National Institute of  
Industrial Psychology  
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R. M. Barnes and M. E. Mundel - University  
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J. Riegel - University of Michigan
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