

1927

Evolution of overhead accounting: Part I. Basic Principles in the treatment of manufacturing overhead, Part II. Designing the overhead structure; Basic Principles in the treatment of manufacturing overhead; Designing the overhead structure

Chamber of Commerce of the United States of America. Department of Manufacture

Follow this and additional works at: https://egrove.olemiss.edu/acct_corp

Recommended Citation

Chamber of Commerce of the United States of America. Department of Manufacture, "Evolution of overhead accounting: Part I. Basic Principles in the treatment of manufacturing overhead, Part II. Designing the overhead structure; Basic Principles in the treatment of manufacturing overhead; Designing the overhead structure" (1927). *Individual and Corporate Publications*. 195.
https://egrove.olemiss.edu/acct_corp/195

This Article is brought to you for free and open access by the Accounting Archive at eGrove. It has been accepted for inclusion in Individual and Corporate Publications by an authorized administrator of eGrove. For more information, please contact egrove@olemiss.edu.

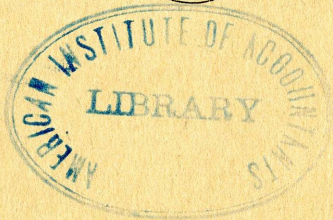
The Evolution of Overhead Accounting

PART I.

Basic Principles in the Treatment
of Manufacturing Overhead

PART II.

Designing the Overhead Structure



DEPARTMENT OF MANUFACTURE
CHAMBER OF COMMERCE OF THE UNITED STATES
WASHINGTON, D. C.

The Evolution of Overhead Accounting

PART I.

Basic Principles in the Treatment
of Manufacturing Overhead

PART II.

Designing the Overhead Structure



FOREWORD

The call back to fundamentals is most certain to follow our excursions into "easier ways" in trying to deal with problems such as this one of overhead expense. It is now generally recognized that it is the most important of the three chief factors in cost accounting. Yet until comparatively recently, even with improved methods in accountancy, the overhead content in the cost of a commodity has been roughly estimated or guessed at. It is now also recognized that it is fundamental that all items of expense taken into consideration in our cost reckonings must be tied in or balanced with our general accounting.

Increasing competition, refinements in machinery and production methods and greater intelligence used in management has brought to the front this problem of more accurately measuring overhead.

We are deeply appreciative of the cooperation and constructive help we have had from the officials and accountants of many concerns to whom we submitted this pamphlet while in the process of development.

It is with pleasure we present it to you as a result of this collaboration.

E. W. McCULLOUGH, *Manager,*
Department of Manufacture.

March 1, 1927.

CONTENTS

Part I

BASIC PRINCIPLES	Page
Definition of Overhead	4
Historical	4
The First Fundamental Discovery	5
The Need for Departmentalization	8
Early Experiments with Machine Hour Rates	8
The Problem of Idle Facilities	10
Machine Hour Rate Method Perfected	11
Vehicles for Overhead Application	11
Today's Problems	13

Part II

DESIGNING THE OVERHEAD STRUCTURE	
Departmentalization	17
Production Centers	17
Service Centers	17
General Overhead Centers	17
Accumulation of Overhead	18
Selection of Overhead Rates	20
Percentage-of-Labor-Wages	21
Employee Hour Rates	21
Machine Hour Rates	21
General Comments	22
Rates-Determination and Revision	23
Unabsorbed Overhead	28
Conclusion	30

PART I.

Basic Principles

No phase of cost accounting has interested industrial executives and their accountants more than that of the treatment of manufacturing overhead. We have looked at the subject from every point of view apparently with the result that there is now no dearth of information on the subject. Instead we are surfeited with it.

There lies our difficulty. Seemingly we have too much talk and discussion of details and not enough of fundamentals. It is high time that we take an inventory of our knowledge of the subject in order to test out whether or not we are right in this conclusion. With this in mind an outline of such a proposed inventory was prepared and submitted to executives and comptrollers of a number of progressive companies, large and small, in all parts of the country. The conclusion was well-nigh unanimous that such a study is desirable. For example, the comptroller of a large company on the Pacific Coast wrote:

“We are getting so clogged up with theories and details in our cost literature that we are losing the advice and support of many able accountants who really have not had time to engage in discussions of side issues and details. They feel, and rightly I think, that the cost man’s imagination is running away with him and he is accordingly erecting innumerable objections and complications—ifs and buts—which really do not exist *if he first masters the fundamentals* and then applies the details in conformity with them.”

Similarly from an executive of a very large shoe manufacturing company in the East came the following:

“We believe a pamphlet prepared in accordance with your outline would be of great value. It is all prepared in such a logical way with none of the confusion which so often accompanies any writing of this kind that we believe a treatise following your outline would be a standard.”

Accordingly, let us undertake this inventory and see if we can eliminate the non-essentials and settle upon that which is fundamental.

DEFINITION OF OVERHEAD

What is overhead? While there is no manufacturer probably who does not have constantly on his mind the injunction "keep down the overhead" and knows what he is thinking about, after all it is a word that is loosely used. At the outset it seems desirable to have a meeting of the minds on the matter.

Overhead is usually defined in accounting text books to include the elements of cost that are left over after charging direct to a product the readily allocated material and the labor that have been directly employed in its manufacture. In this connection, it is pointed out that all items of cost may be divided into two classes, direct and indirect. Direct material, such as the leather in a shoe or the steel in a plow, may be associated with a particular lot of shoes or plows. Similarly the hours of labor put in by the workmen in the manufacture of the shoe or plow may be charged to the order for those products.

Indirect items of cost include such things as the superintendent's salary, power, light, the cost of owning and operating buildings and machinery, and so on.

Overhead is the general term applied to these indirect costs. Some think of overhead as including the indirect costs of manufacture and the cost of general administration and of distribution. In this treatise, however, we are not concerned with distribution and confine our attention to the indirect costs of manufacture as described above.

Overhead thus means manufacturing or shop overhead. By some this class of cost items is called "burden" but for the purposes of this discussion *overhead* will be employed to indicate the indirect costs of manufacturing.

HISTORICAL

A hasty review of the history of overhead accounting is interesting and will prove helpful. Without being too precise in historical sequence or in description, it will be remembered that in the early days of cost accounting in this country it was the popular method to carry one "expense" account in the ledger of the company and to collect therein all of the overhead items throughout the year. Similar-

ly there was an account for "labor". At the end of the year when "stock" was taken and the books closed the total amount of overhead was divided by the total of the labor cost and the results expressed in percentage form.

During the following year this percentage was used in estimating costs for sales prices. In those days no attempt was made to tie in the costs currently with the general accounts and hence there was no way of knowing whether by the use of this percentage in the following year all of the overhead of the business was absorbed. Furthermore, in the plant making a variety of products there was obviously no attempt made to distinguish between the varying responsibility of the different products for the incurrence of overhead. We now know that a product that has required the purchase of an expensive machine should be charged with the overhead incident to the investment in and operation of that machine. This is a truth that we recognize as so fundamental as to call for no discussion.

In an effort to overcome the difficulty arising from the use of the percentage which was obtained from the results of the previous year, arrangements were made to obtain a new percentage each month. The overhead of the month was divided by the labor cost for the month and the results expressed in percentage form. As under the original procedure these monthly percentages were used solely for estimating purposes and costs were not tied in with the books.

During this period also there was usually no accounting control of overhead and the economies which were effected were the result of the natural intuition of the operating man rather than the result of an exact knowledge of the individual items of overhead and their comparison with a budget or "objective" as one large corporation now designates it.

THE FIRST FUNDAMENTAL DISCOVERY

The first long step forward of progress in overhead accounting came with the appreciation that *costs should be tied in with the general books*. Various plans were developed to bring about the integration of costs with the general accounts. Under most of these plans new accounts were opened, such as a "Work in Process" account, a "Finished Goods" account, and an account usually called "Cost of Goods Sold." Material, labor and overhead as incurred were charged to the "Work in Process" account. By some method or other (the exact procedure is of no particular importance to this dis-

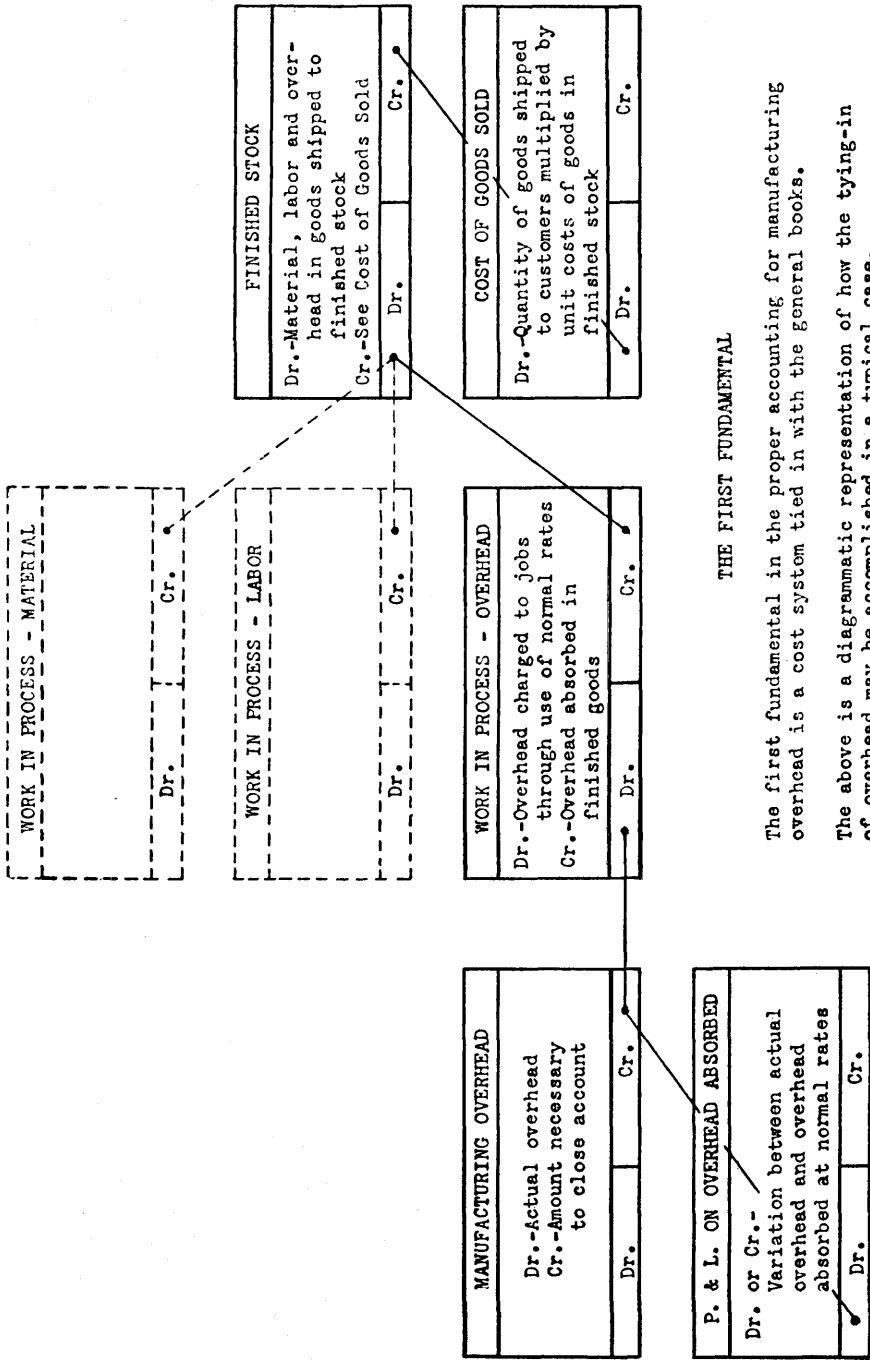


Fig. 1.

cussion) that account was credited and the "Finished Goods" account charged with the cost value of goods completely manufactured. In turn, the "Finished Goods" account was credited and the account "Cost of Goods Sold" charged when goods were removed from stock and shipped to the customer. This, of course, is simply a typical outline of the procedure, which, today, is considered sound. A diagram of the procedure is shown as Figure 1.

Referring specifically to the treatment of overhead, the tie-in procedure calls for the charging of overhead items as incurred to an overhead controlling account. This account (or a separate account designated as "Overhead Absorbed" which is set up solely for accounting convenience) is credited with the amount of overhead absorbed in the costs of goods in process of manufacture. This under the original plan was accomplished as follows: The direct labor wages accumulated against the job was multiplied by the overhead percentage of the previous month. This gave as a result the overhead absorbed by that job and the sum of the overhead items absorbed by all orders gave the total of overhead of the factory absorbed by the production of the month in question.

No consideration was given to the fact that overhead for the various items manufactured bore little relation to the amount of the direct labor charged to them. Neither was there any consideration given to the problem of idleness and its effect upon costs. Nevertheless the procedure whereby the costs were tied in with the general accounts constituted a very important advance in the technique. In fact we have now come to appreciate that one of the first essentials in the satisfactory accounting for overhead is that of tying in the costs with the general accounts. One of our correspondents writes:

"My suggestion would be that you confine yourself (in the writing of the present pamphlet) to advising the installation of cost systems which will tie in with the books. Anything beyond this is so technical and the application varies so in different lines of business that it is hardly worthwhile to cover in general pamphlet. Some man reading them might get the idea that he knew something about cost accounting and could install his own system."

However this may be, and in the development of this pamphlet we are inviting this danger, real or imagined, our correspondent is unquestionably sound in his statement that cost accounting should be tied in with the general accounting.

THE NEED FOR DEPARTMENTALIZATION

Following the realization of the necessity for tying in the costs came the understanding that the old general "Expense" account was a catch-all of no value whatever for the supervision of expense. Accordingly there was evolved a scheme for the accumulation of overhead by departments. At first this subsidiary account arrangement enabled the collection of overhead statistics for a few main subdivisions of the plant, as, for example, the pattern shop, foundry, and the machine shop.

Now however, in many progressive plants there is a carefully developed set of overhead accounts for the various departments which enables the executive to make valuable studies of the economy of operation. For example, from an executive of one of the largest automobile companies comes the following:

"I give you below some actual figures compiled at one of our factories which show the allowances, or objectives as we call them, placed for overhead accounts, and the actual attainments for the last two months and the yearly cumulative. We use statements such as this as a basis for continuous systematic hammering on items over the objectives:

PRODUCTION CENTER D 3M

Overhead Material and Labor Items per Productive Labor Dollar

<i>Item</i>	<i>Objective</i>	<i>August</i>	<i>September</i>	<i>9 Months</i>
Belting	\$.0080	\$.0096	\$.0080	\$.0095
Grinding Wheels ..	.0005	.0004	.0003	.0009
Tools .....	.1755	.1722	.1574	.1875
Supplies .....	.0340	.0446	.0325	.0331
Stationery .....	.0050	.0049	.0044	.0016
Sweepers .....	.0180	.0248	.0214	.0207
Movemen .....	.0550	.0645	.0563	.0545
Inspectors .....	.0800	.0800	.0809	.0934
Supervision .....	.2000	.2055	.1975	.2075

Turning again to the description of the evolution of overhead procedure, this recognition of the need for departmentalization was another step in advance, for besides the additional control it gave over the actual overhead costs of the individual departments, it paved the way for departmental rates of overhead.

EARLY EXPERIMENTS WITH MACHINE HOUR RATES

At this stage in the advancement of the technique of overhead accounting along came the "boom" for the employment of the ma-

chine hour rate method for the distribution of overhead to product. A sketchy outline of the procedure is as follows:

The plant was divided into small shops, each shop presided over by a proprietor—the foreman. At the beginning of the year fixed overhead rates were established for each shop which, from the foreman's point of view, were in the nature of rental rates. His shop was charged with items representing depreciation, taxes and insurance on the buildings; with power, light, heat, elevator service, etc. The number of machine hours for the entire year for the machines in the shop available for production was computed. By dividing the overhead for each little shop by the machine or equipment hours for that particular shop a machine hour overhead rate was obtained.

During the year as the various jobs were sent to each little shop (or department) those jobs were burdened with overhead by multiplying the number of hours the machines were used for each job by the machine rate per hour. Not all of the overhead of the little shop would be absorbed because for one reason not all of the foreman's actual overhead was included in the rate determination. For example, his own salary was not so included. Furthermore, it was unlikely that all of the overhead for which the rates were established would be absorbed because of the fact that the rates were obtained through the assumption that all machines in the shop were busy all of their available time. In order to take care of this situation a rather complicated accounting mechanism was employed to wipe out this excess or deficiency (usually a deficiency) in absorption and spread it uniformly over the production in all centers. This result was accomplished by the use of what were known as supplementary rates. As will be readily seen, any particular lot of products might be entirely innocent of the charge of increasing overhead and yet would be burdened with extra overhead if there was an under-absorption in overhead generally.

This is but a fragmentary description of the method which, because of the extreme interest that was taken in it, probably was instrumental in focusing attention on the fact that if the various products are to be correctly burdened the overhead items should be accumulated by departments, or production centers as they are properly called, actually incurring them or for whose benefit they were incurred.

Although in subsequent sections there will be considerable discussion of the matter of departments or production centers, it seems

wise at this point to be a little more specific as to what is meant by departmentalization from a cost accounting point of view.

A department in cost accounting is frequently a more restricted area than it is when considered from the point of view of organization. For example, the second floor of the plant may be under the supervision of a single foreman and constitute one of the main departments of the plant. In this department, however, there may be machines of dissimilar characteristics and work going on of unlike kinds. Let us consider a machine shop which is under the supervision of a single foreman. There is a row of automatic screw machines, a boring mill, a planer, some sensitive drills, and a number of engine lathes and other tools. Now from an accounting point of view it may be found desirable to divide up this foreman's department into subsidiary accounting departments or production centers, as they more properly may be called.

The automatic screw machines may constitute one such production center. Possibly there will be a production center for the boring mill, another for the planer, and so on. The extent to which there need be departmentalization from an accounting point of view will depend on the conditions in each case and the refinement and degree of accuracy in costs that are needed and desired. Suffice it to say here, however, that the "department" in cost accounting may be and usually is a subdivision of a major department of the business.

THE PROBLEM OF IDLE FACILITIES

The keenest students of overhead accounting in its early history came to see that the fluctuations in volume of business during periods of boom and depression had their effects upon costs. Those who, for example, used monthly percentages of direct labor wages found those percentages varying greatly from month to month. This was natural for as business goes up and down the payroll goes up and down while overhead relatively is fixed; at least it does not vary in direct proportion to changes in volume of business. As the result of watching this phenomenon the conclusion was reached that overhead rates should be determined on what has come to be called "a normal basis," that is, seasonal and cyclical fluctuations in volume should be ironed out and overhead apportioned to work going through the plant on a normal basis. It was observed that under the former plan the taking up of current overhead by current production meant that the cost of the jack knife or the automobile tire *seemed high* when business was poor and they *seemed low* when the factory was running to capacity.

Once this conclusion was reached there came almost immediately a reversal of the policy of absorbing the actual overhead as it was incurred. Under the earlier plan the overhead of a prior year was divided by the direct labor cost of that year and the result expressed in percentage form, as described above. The use of this fixed percentage was employed in the cost work of the subsequent year (the costs being tied in with the general accounts) and caused the absorption of overhead by the product of that year on an unvarying basis, that is, each product made took exactly the same amount regardless of whether business was slack or good. While this was a crude plan from many aspects it was a plan with one element of soundness, namely, it charged overhead to product on a fixed basis. On the other hand, the plan which contemplated the obtaining of a new percentage or "supplementary rates" each month was a step backward for, as stated, the costs of the products made in the slack period appeared high and the costs of the same products made when business was good appeared low.

MACHINE HOUR RATE METHOD PERFECTED

The early form of the machine hour rate method was obviously due for modification. Its principal advantage in its early form came in pointing out that in a plant making a variety of products (in fact, in any plant making more than one product) it is essential to set up production centers (1) for the accumulation of overhead and (2) for the development of rates of overhead by which to burden the various products as they pass through the various centers during the course of their manufacture. On the other hand, as stated, its provision of supplementary rates was founded upon an erroneous conception and yet it was probably due to the development of the supplementary rate plan, as a result of which current overhead was absorbed by current production, that the sound conclusion was finally reached that overhead should be absorbed in costs on a normal basis.

VEHICLES FOR OVERHEAD APPLICATION

Now we come to the discussion of the several vehicles which have been employed by which the overhead is applied to product. These vehicles are called variously "overhead percentages" and "overhead rates." In the early day, as stated, the overhead vehicle was usually a percentage of the direct labor wages. It was soon recognized, however, that the use of this vehicle was not always satisfactory. The plant was not departmentalized and hence but one percentage was developed for the entire plant. It was evident that the use of this per-

centage applied to the differing rates of pay of workers in different departments resulted in the overhead absorption by the products in direct proportion to the amount of the direct labor wages paid to the men who worked upon them. Thus, if a certain operation called for a good man at a high hourly rate of wages the overhead absorbed relatively was high. On another product requiring a different operation a low priced worker might be employed (although he might be assisted by expensive machinery) and accordingly the overhead absorbed relatively was low.

The first great modification of this percentage-of-wages plan came in the use of labor hours instead of labor wages as the vehicle. The use of hours rather than wages eliminated the uncertain value of the dollar and the fluctuating rates of wages. For this reason the use of hours is to be preferred to the percentage-of-wages method, but as shown below there are other factors that must be taken into account.

Later came the development of the machine hour method above described and this method has met with high favor by many well versed accountants because of the theoretical accuracy of its approach to the solution of the problem.

Unfortunately, however, in this study of the evolution of rates and percentages some misconceptions have arisen. These misconceptions in part have come about through too close an adherence to the early tenets. For example, even today it is assumed by many accountants that, whenever the percentage-of-wages method is under consideration, the use of that method contemplates that there will be no departmentalization of the business. Similarly it is believed by many that the machine hour rate method is the only one which is scientifically accurate because of the fact that it does divide the business up into production centers. As a matter of fact, the use of the departmental or production center plan is not confined to the machine hour rate method, but is equally applicable to those methods that employ other vehicles for the distribution of overhead.

In this connection, the comptroller of one of the large electrical manufacturing companies writes as follows:

“I wish to state that in my opinion the percentage on direct labor method for absorbing indirect manufacturing expenses will prove to be a satisfactory basis if the business is divided into manufacturing departments or sections and the overhead for each department or section is determined and absorbed by the product of that section only. I possibly

should add that the overhead should be absorbed on a basis of so called normal production based on records of previous performances or in the event of no such records being available on an adjusted basis as the overhead for a normal production—85 to 90% capacity—is estimated.”*

In short, we must come to the conclusion that departmentalization is fundamental, while the exact plan and the precise vehicle that we shall use to distribute overhead to product constitutes an eminently practical problem and no one rate plan or percentage plan can be selected arbitrarily against all others for universal use or for use in any one plant.

TODAY'S PROBLEMS

Where are we today on this whole matter of overhead accounting? Although we have established these fundamentals that we recognize as sound, are these fundamentals in universal use? An inquiry made by the Department of Manufacture of a considerable number of manufacturers in various industries brought a revelation which may be startling to some. It is this:—In a very large number of otherwise progressive plants the actual handling of the overhead problem is yet in the earlier stages of the developments above described.

For example, the president of a large company engaged in the manufacture of railway supplies writes:

“There is no question but that accounting for overhead is one of the most important problems in industry today, and in a majority of cases much improvement could be made in the method of arriving at costs.

“I regret to say we are still in the old fashioned class of adding a standard percentage on the labor to cover factory overhead and a standard percentage on the sum of this overhead to the labor and material to arrive at our administration overhead.”

The time has come to take advantage of the most enlightened procedure. Unfortunately we are still confronted with the difficulty of separating the essentials from non-essentials, for much of today's literature treats not of fundamentals but of details. While there is a clamor for the scientific treatment of overhead it is too frequent-

*While this comment on procedure is of interest in connection with the particular subject under consideration, attention is directed to the fact that the statement with regard to the percentage of capacity which should be used, namely, “85 to 90% capacity” is without any general significance. The question to be asked is, what is capacity? Certainly few plants can expect to operate their productive equipment over any considerable period at as high a rate as 85 to 90% of the full-time, full-speed production.

ly insisted that the treatment be according to specific and detailed formulae.

Leaving aside, however, all of this confusing clamor, the basic principles which have been discussed above are applicable to any concern in any line of business. To repeat them these principles are:

1. The costs must be tied in with the general accounts.
2. There must be an overhead accumulation by the various centers to which the overhead applies. Overhead accumulated for the various centers in turn must be distributed to the products passing through them by the employment of suitable overhead rates.
3. Overhead must be applied to products on a normal basis.
4. Suitable vehicles (in the form of rates or percentages) must be selected to burden the product as it is manufactured.

Is it practical to incorporate these essentials in a cost accounting system without going into the great detail and expense that some systems seem to contemplate? There lies the problem. The real skill in the development of cost systems comes in the design of methods that embody sound underlying principles yet are devoid of frills and red tape.

With this introduction let us now consider, in more detail and from a somewhat different point of view, the basic principles enumerated above with the object of clearing up common misconceptions and of assisting those who desire to develop fundamentally sound overhead procedure.

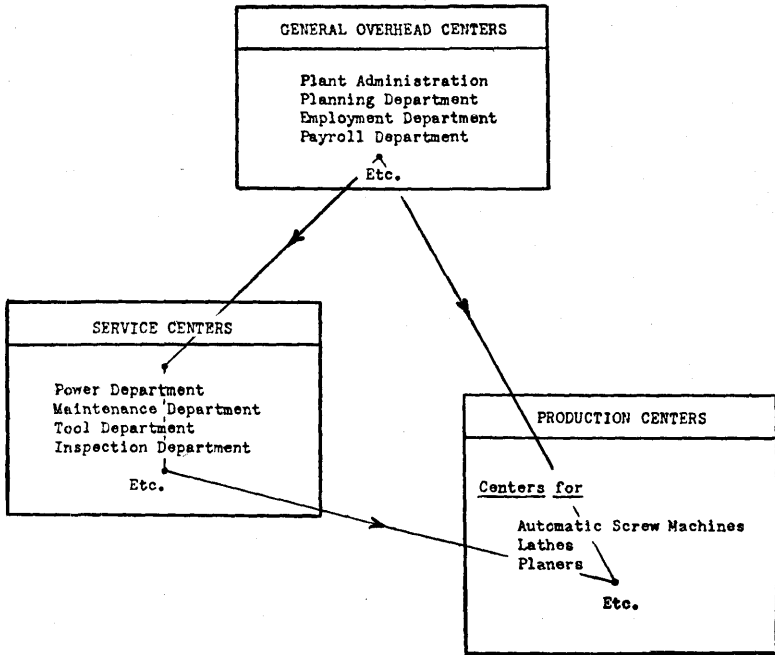
PART II.

Designing The Overhead Structure

Whatever the line of business may be, the design of a suitable overhead structure in keeping with the principles outlined in the previous section involves the taking of the following steps, which will be described in detail in succeeding sections:

1. *The departmentalization of the business*, that is, the division of the plant into production centers, service centers and general overhead centers.
2. *The accumulation of the items of overhead* for the several production, service and general overhead centers.
3. *The allocation of the overhead of the general overhead centers* to the service and production centers according to the responsibility of each for the incurrence of the general overhead.
4. *The apportionment, in turn, of the overhead of the service centers* to the production centers for which the several service centers are maintained. When this has been done all of the overhead of the plant has been applied to the production centers, that is, at those points where it may be distributed to the product going through those centers.
5. *The selection of suitable overhead rate plans* by which to distribute the overhead to the goods produced. The percentage on labor wages, employee hour, and machine hour rates are illustrations of three commonly used rate plans.
6. *The determination of normal rates* which involves two factors, namely, the normal production or output of each production center and the normal amount of overhead for this normal production. The determination of normal production or output is based usually upon the experience of several previous years and the forecast of business to be secured over several future years.

Let us now turn attention to some of the details involved in carrying out this procedure.



THE SECOND FUNDAMENTAL

The second fundamental in the workmanlike treatment of overhead is a carefully devised plan of departmentalization.

The above is a diagrammatic representation of a typical departmental arrangement using machine shop practice. A similar arrangement for any line of industry may be developed.

Into how great refinement need accounting departmentalization go?

Careful study and good judgment are required to determine the proper answer in any individual case.

Fig. 2.

DEPARTMENTALIZATION

The first step to be taken in the development of a workmanlike plan for the handling of overhead is the accounting departmentalization of the business. For this purpose it will usually be found necessary to set up three distinct groups of accounts for the accumulation of overhead according to the following outline: The general plan is shown in the diagram on the opposite page, Figure 2.

PRODUCTION CENTERS. Work on the product in any well arranged factory is conducted in a series of production centers, that is, those operating points where there are single machines, groups of identical machines, or work benches where production is carried on by hand. In some shops the plant arrangement will be so precise that the product travels in a straight line from one machine or group of machines to another until it finally emerges ready for sale. In other plants, laid out with equal care, a different plan of production will be found necessary on account of the assortment of products manufactured. In this type of plant different products will have different routes and combinations of operations. But everything is done in an orderly way and from an accounting point of view it is practical to establish natural production centers for the accumulation of overhead.

SERVICE CENTERS. Every plant, in addition to its production centers will have a number of activities not directly pertaining to production but nevertheless essential parts of it. For example, there must be a source of power, there must be plant maintenance, there may be a tool department, a stores department, and so on. For the purpose of overhead accounting these classes of activities must be set up by themselves and each such group may well be designated as a service center for the purpose of the accumulation of overhead belonging to the activities of that center.

GENERAL OVERHEAD CENTERS. Outside of the factory proper activities are going on essential to the conduct of production and, in order to accumulate all of the overhead belonging to manufacturing, it is necessary that the overhead applicable to the management and administration of the plant be collected. For example, there is the employment department, the planning department and the cost department, and the salaries of the persons engaged in these functions, together with other items of overhead attached to them, must be accumulated. Accordingly, it is in order to establish what may be called general overhead centers.

Considerable ingenuity and care are necessary in the establishment of these three groups of overhead centers. Too fine or too close a division of the manufacturing department will result in too much clerical work, too many rates and red tape that does not yield results commensurate at all in accuracy with the labor and pains that have been taken. On the other hand, it is seldom if ever sufficient to make such gross divisions as foundry, machine shop and general overhead. A real appreciation of what the problem is all about is necessary if the most satisfactory results are to be secured.

ACCUMULATION OF OVERHEAD

Having established the plan of overhead centers the accountant is confronted with the numerous problems connected with the accumulation of overhead. That they are problems is evidenced by the very great amount of literature that is devoted to this phase of the subject. There is, for example, the problem of the allocation of the depreciation of buildings, machinery and equipment to the proper centers. The depreciation allowance on the factory building will probably be split so that the general overhead centers will have their shares. The cost department will have its proportion depending presumably upon the amount of floor space it occupies. The service centers, such as the tool room and stores department, will be charged with their parts. Lastly, the production centers, as the punch press department, will have their shares. Thus the initial distribution of the depreciation charge for the building is accumulated.

In actual practice an account known possibly as "Factory Building" will be opened to which will be charged all of the items of overhead pertaining to it, including taxes, repairs, insurance, heat, and watchman service, as well as depreciation. The total of this building expense will then be allocated to the various centers in much the same way as rent would be handled if the building were not owned.

As brought out heretofore, all overhead must ultimately find its way to the production centers. Accordingly, depreciation charged to a general overhead center such as the planning department will be accumulated with other items belonging to that department and the total then will be distributed by some equitable plan to the service centers and the production centers. Finally the overhead accumulated in the service centers must find its way to the production centers.

To trace the procedure a little more definitely the planning of the work of the maintenance department, for example, may be a very

definite function of the planning department and it is but right that the service center set up for the maintenance department should bear its proportion of the overhead of the planning department—a general overhead center. The auditor of a large metal working plant in Cleveland has the following to say on this point:

“Mechanical and repair departments are, in a large institution, naturally operated with their own overhead.

“The overhead is made up, not only of the overhead of the department itself, but also of the overhead assigned to it from other departments from which it has in turn received service.

“It is in these departments that overhead can be, and usually is, distributed as a percentage of the direct labor dollar. Sometimes the ‘work hour’ is used, but it makes little difference as rates of pay do not vary to any great extent.”

By this he means that the overhead of, say, the repair department reaches the production centers for which the work is done by multiplying the wages of the repair crew chargeable to each production center by a percentage-of-labor-wages rates. Thus, in a sense, the repair department is a production center—doing work for the real production centers.

It is quite easy in reflection upon the theories involved to juggle overhead about from one center to another in endless rotation and from a practical point of view to defeat the purpose of a straightforward plan of overhead accounting. Here, for example, is one situation that not infrequently arises. The maintenance department has machinery under its control which requires power for operation. As a part of its work it engages in the making of repairs to power equipment. Theoretically the maintenance department should be charged for power and the power department charged for maintenance. This is all right as far as it goes but further reflection into the theory proves conclusively that the charge for power should include the proper amount for repairs and the charge for repairs an allowance for power used in making the repairs. But it is impossible to arrive at the theoretically exact charge to the maintenance department for power until the maintenance department has made its charge for services rendered which, of course, includes allowance for the use of its tools and the power required to run them. It is the old story of

the cat chasing its tail. It is futility rather than utility. Instead as one correspondent very well says:

“It is not necessary to ‘close’ the power department before making a power charge to Maintenance or Service Departments. The usual method is to make these charges at standard rates, letting the balance be distributed to production centers on a pro rata basis.”

It is impracticable to discuss all the numerous important details attending accounting for overhead. This discussion must concern itself with those things which are fundamental. In fact, in a general treatise such as this it is not wise to consider those details which may not apply universally. No two factories are exactly alike and each case must be considered by itself.

In conclusion then it may be stated that the objective is to accumulate the overhead first by the three general groups of overhead centers which, taking them in the reverse order of their description above, are:

The General Overhead Centers
The Service Centers, and
The Production Centers

Then the overhead of the first two named groups finds its way at the end of each accounting period, presumably a month, to the several production centers.

Nothing need be said probably of the desirability of clean-out accounting procedure. Generally, however, use will be made of overhead controlling accounts. There will be standard journal entries for the treatment of deferred items such as insurance and taxes and for the spreading of the overhead of the general-overhead centers and service centers to the production centers. This procedure, however, is covered in much of the literature now available and has no place in this pamphlet.

SELECTION OF OVERHEAD RATES

The next step in the development of overhead procedure is the selection of the types of rates to be used for the purpose of the distribution of the overhead accumulated in the production centers to the products passing through those centers. There is more difficulty attending the treatment of overhead due to the confusion of thought on the matter of overhead rates than from any other cause. This is due, as stated heretofore, because of popular misconception of the several types of the more commonly used rates.

PERCENTAGE-OF-LABOR-WAGES. This possibly is the oldest vehicle for the distribution of overhead to product, and because of its unscientific use in the early days it is frequently held in disrepute. Many people probably interpret the percentage-of-labor-wages plan as the obtaining of a single percentage for the entire plant. Where the procedure is thus no wonder results are inaccurate. Properly interpreted, however, overhead is accumulated by centers as described above and the vehicle for the distribution of the overhead for each center to the product passing through that center is a percentage of the direct labor wages of that center. It is important to keep this distinction in mind for where this vehicle is so employed it is not subject to some of the errors commonly attributed to it. For one thing the rates of pay in any center relatively are fixed, that is, the range of wages of the employees on a given type of machines is not wide. But whether or not the plan is sufficiently accurate is again a matter for individual consideration. The plan, however, is simple and the procedure straightforward.

EMPLOYEE HOUR RATES. The second most common typical vehicle for overhead distribution is the employee hour rate. Under this plan the number of hours required by a worker on a given operation is multiplied by the rate per hour to determine the overhead absorption by a particular lot of product. Employee hours are used in place of employee wages because in some cases it is found that hours are more stable and satisfactory than wages. But the use of the plan means some additional clerical effort.

MACHINE HOUR RATES. Under this plan overhead is distributed to product through a rate per hour for the use of the machinery. This often-times is a highly accurate and satisfactory method, for with proper operation of the machine the time required for the product to pass through the center is a good measure of the responsibility of that product for overhead incurrence.

The machine hour rate method is advantageously used, as one accountant points out:

“When the machine element is the governing factor in the cost of production in any department so that an overhead percentage on direct labor would run well over one hundred percent, sometimes three and four hundred percent. A good illustration of this is in the paper industry where a crew of six men operate a machine worth approximately a half million dollars and costing a considerable amount in maintenance and for power and supplies in its operation.

"A similar but not quite as pointed an illustration in the rubber industry occurs in connection with mixing and calendering where a machine hour rate is used, inasmuch as the percentage of overhead to direct labor runs as high as four hundred percent."

On the other hand the use of the machine hour rate method may be attended by difficulties, which together with the detailed records of machine activity that must be kept, make it unsatisfactory to some. For example, the comptroller of a large fire arms company says:

"There are only a comparatively few instances where the machine hour rate can be accurately applied in our business, for the reason that the overhead expenses which can be directly allocated to the machines are usually only a small part of the expenses of the department or production center. This means that the balance of the expenses must be prorated to the machines on some estimated or more or less arbitrary basis. The result is that the machine hour rate thus built up is probably no more accurate than the percentage of labor or the labor hour rate.

"It has been my observation that in very few instances can as much as 25% of the overhead expense be directly allocated to a machine or group of machines; the balance must be apportioned on some more or less arbitrary basis. In the few instances where there are only one or two machines in a department, such as a paper mill, it will be found that an accurate machine hour rate can be determined, but in the large majority of plants the use of the machine hour rate as a basis for distribution of overhead is probably no more accurate than the other methods mentioned. The expense of operating the machine hour method is certainly considerably in excess of either of the other methods."

GENERAL COMMENTS. There is little use arguing in an abstract way on the relative merits and demerits of various forms of rates. The discussion starts from nowhere and leads nowhere. The intelligent accountant will be able to figure out the matter for himself and he will not slavishly follow any one plan for it may well be that in certain centers one type of rate should be used and in others a different type. Substantial accuracy and simplification of accounting treatment are the ultimate aim. Judgment is required and with the application of that judgment good results are bound to follow.

RATES-DETERMINATION AND REVISION

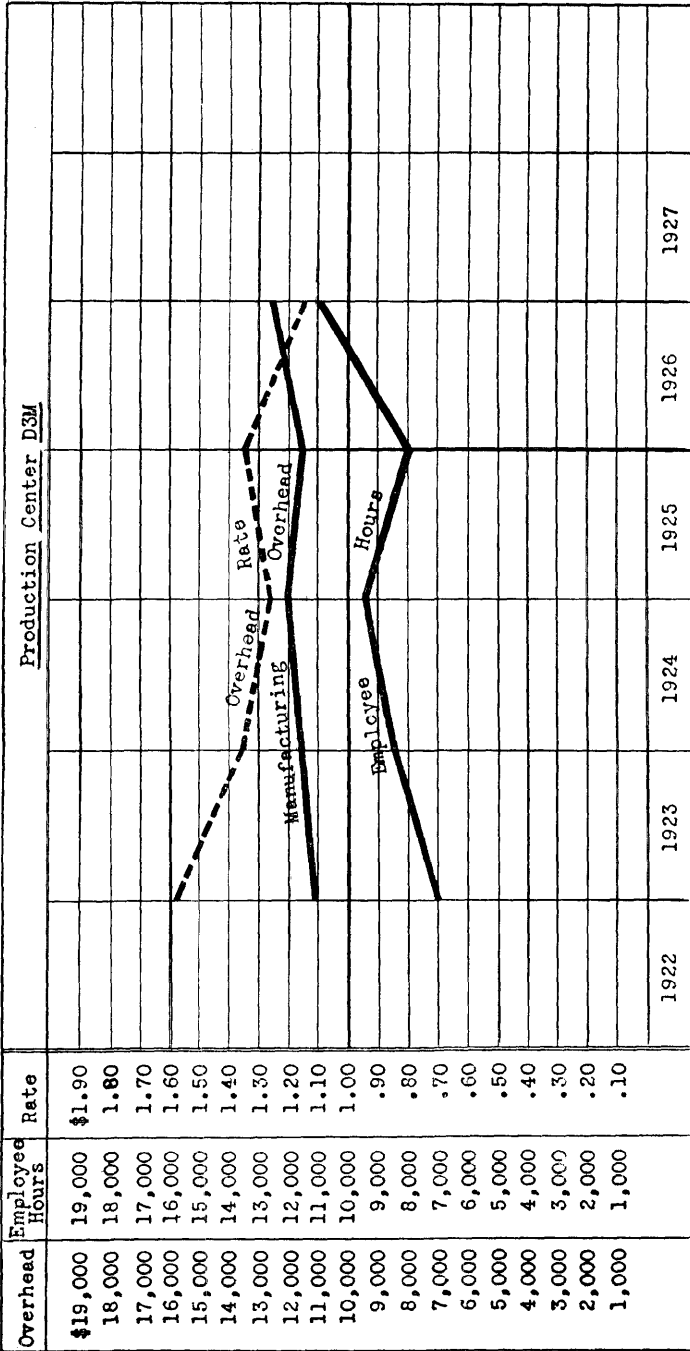
The next step in the development of the overhead accounting procedure has to do with the development of the rates themselves. The first thing that concerns us is the meaning that we attach to the term "normal" for we have decided that overhead shall be absorbed in costs on a normal basis.

It is logical and common practice to conduct our overhead accounting on the basis of the year, that is, the fiscal year of the company whether or not it be the calendar year. Naturally, and with good reason, we determine our profits on the basis of a year's operations and it is equally natural to establish our overhead accounting policies on the same basis. Why is it natural so to do? Because with most companies a year is a cycle of operations and this is particularly the case with those companies in lines of business that are at all seasonal in character.

What then is normal when considered from the point of view of overhead accounting? Is it, for example, capacity of the plant to produce? If this be the point of view, what is capacity? Is it the amount of work that may be expected if all of the machinery and equipment are productively employed every moment of the working hours, or if not is it an amount less than this by an allowance for unavoidable breakdowns and delays? Again, is it the average of the rates of production for the previous year or of several years? If this last mentioned plan is accepted shall we take into account the fact that business in all lines during the coming year is expected to be in a slump whereas last year or for several years past there was a boom? In other words, shall we take into account the trend of general business which inevitably sweeps our business along in its current?

How about seasonal aspects of our business? Shall we consider normal (leaving out of account other factors) to be at the peak of our expected operations during the year; at some point between minimum and maximum anticipated production; or again shall it be computed solely on the basis of the capacity of our plant to produce? The justification of this question lies in the fact that, regardless of our capacity to produce, the inevitable seasonal depression is going to cut down the amount that we can produce.

Again, how about the special machines that we have to provide, possibly at large outlay, that are used only occasionally? These are some of the questions that the designer of the overhead accounting system must answer.



THE THIRD FUNDAMENTAL

The third fundamental in the treatment of manufacturing overhead is the determination of "normal" conditions (a) with respect to production (here expressed in employee hours) and (b) with respect to overhead itself.

What rate of overhead should be used for 1927?

Further information than here given should be gathered - in fact the ascertainment of normal rates requires intelligent study, taking into account all the facts that can be gathered that bear upon the matter.

Fig. 3.

By way of illustration, the comptroller of one of the large electrical manufacturing companies has the following to say of the procedure employed by his company:

"The real progress which has been made in dealing with normal rates is that the latter are based on forecasts of business over a cycle of years, the number of years in the cycle depending upon the variations in volume occurring in the individual industries from one year to another. Thus, in our business we have established a cycle of five years for some lines of product, eight years for other lines of product, and two or three years in still other lines, and normal rates are determined on the basis of a forecast for the complete cycle, the results of previous years being used only as data helpful in arriving at a rate which over a cycle of good and bad years will liquidate the aggregate expense incurred. Normal rates so established should be reviewed annually or oftener and revised as important changes in operating conditions occur."

This is one method of handling the matter. There are other ways. This is no place for their discussion, nor is it particularly necessary that they be discussed, for so far accountants have been unable to compromise their various views and reach generally accepted principles of procedure. But the problem is a very real one and the thoughtful executive and his accountant will find some way out. Examination of the diagram on the opposite page, Figure 3, is suggested.

We have said that rates should be established on an annual basis and should be reviewed annually. Once set, however, for a year in advance experience indicates that it is not a good plan to change them. If they have to be changed because of faulty initial determination it is unfortunate; if there is pressure brought to bear to change them because actual conditions do not coincide with conditions established as normal it is unfortunate, for by making such changes we are violating the principle that we accepted, namely, that costs of products should not appear high when business is poor and low when business is good.

The description of the practice of one large company engaged in the manufacture of textile products on this matter of rate determ-

ination, as related by its vice president, will materially supplement the foregoing:

"This company operates 18 factories located in various states. As the product of these factories is very similar at all factories we have found it very helpful to prepare in advance standards costs,* using the same standard cost basis for all factories, which is based on the average cost of all.

"The standard costs are revised each fiscal year. Prior to the opening of the fiscal year a budget is prepared covering the estimated production and sales for the coming year. Also the direct labor, indirect labor, and overhead expenses. Each item of overhead expense is considered separately under the accounting divisions appearing on the factory ledgers.

"The estimated production and expense for the coming year being fixed, standard costs are then prepared for each kind of goods manufactured, and the standard cost of production spread on the factory ledgers each month. Against this is spread the actual cost of production, so that we can compare actual cost with the budget estimates for each item in the budget every thirty days and oftener should it be necessary.

To show that identical methods can be followed in quite dissimilar industries it is of interest to present the practice reported by the comptroller of a Pennsylvania metal working plant.

"Briefly, we segregate all our expenses by departments, and at the beginning of each fiscal year we figure a complete budget covering sales and all expenses, for the ensuing year. From the budget figures we establish a standard overhead rate for each production department, and use these standard rates in figuring our estimated costs, on which our selling prices for the ensuing year are based. These standard rates as fixed at the beginning of the year, have always stood for at least a year, and in some cases for two years, without change.

*For a discussion of the subject of standard costs see pamphlet of the Department of Manufacture entitled "Cost Accounting Through the Use of Standards."

"We also use these standard overhead rates in our general books, and charge or credit the unconsumed or over-consumed burden to the profit and loss account. The charge or credit is made at the end of the fiscal year.

"The expenses of non-productive departments are distributed on various bases to the productive departments, and are covered by the standard overhead rates of the productive departments. In this way our cost of shipments, as delivered to the warehouse, include all factory costs of every nature."

The practice of a third company, a very large one in the railway equipment line as related by a vice president, with particular reference to the development of machine hour rates, is as follows:

"Since May, 1922, we have been using the machine hour rate method for the distribution of our overhead charges on a machine group plan; that is, engine lathe group, turret lathe group, drill press group, milling machine group, etc., etc., with a bench or an assembly group for each of the twenty-nine (29) departments, a total of two hundred sixty-five (265) groups for the machine and forge shops. This apparently large number of groups is brought about by a very considerable number of special purpose machines, which, of course, must have a separate group number assigned to each.

"Since January 1, 1923, we have used as standard rates the actual rates arrived at during the last eight months of 1922, the difference between the actual expense for the month and that absorbed by the standard rates being charged against our monthly earnings.

"In arriving at the actual group hour expense, we include the following: depreciation, taxes and insurance, maintenance of floor space occupied by the productive machinery and the maintenance of same, tools, store supplies, power, general labor, spoiled work and supervision, together with any other miscellaneous charges that may be made from time to time. This gives us a departmental total to which is added the general factory expense, which includes the following departments: Construction, Purchasing, Transportation, Stores, Engineering, Accounting

and Works Manager's Office. The grand total is the rate per hour for each group per month.

"Monthly we prepare a statement which shows in detail the operating expenses for the month, the total productive hours worked and the composite rate per hour, and we are at the present time arranging to make a like statement for each department showing the composite rate per productive hour therein."

UNABSORBED OVERHEAD

The use of normal rates of overhead almost inevitably results in a deviation of overhead absorbed in costs from the overhead actually incurred. We cannot predict the course of business in advance with unfailing accuracy, nor can we keep the overhead amounts themselves exactly at the point that we would like them to be. Hence as we go through the year amounts of unabsorbed or over-absorbed overhead collect for the various production centers. What shall be done with these deviations? This subject is treated in the Department's pamphlet "Overhead Expenses—How to Distribute Them in Good and Bad Times," and briefly it is brought out therein that there are two schools of thought. One believes that a reserve for overhead deviation should be set up and this account should be the safety valve for the net amount of the under or over-absorption. In consequence, from its character as a reserve, it would appear on the company's balance sheet.

If financial statements are made up monthly, as most progressive concerns plan to do, this reserve for overhead deviation is carried along throughout the year, but at the close of the year presumably it would be written off against the profit and losses of that year. However, there are some who argue that it should be carried ahead from year to year but these seem to be in the minority.

How this plan works in the case of a large glass manufacturing company is interestingly revealed as follows:

"At the beginning of our fiscal year a budget for each department is established, covering controllable and pre-determined overhead. Our controllable items consist of labor, indirect material and other items of overhead for which the department head can be held responsible. Pre-determined overhead consists of all fixed charges such as

repairs, depreciation, taxes, and insurance. After the budget for each department has been established and service department charges pro-rated to operating departments, (production centers) the total is divided by the standard number of operating machine hours which gives us our rate.

“Standard machine hours are established by first determining the number of possible machine hours for a year and deducting from this the amount of lost time applicable to our process.

“The differences between standard and actual costs each month are analyzed as being due to Loss or Gain in Time and Expense and are carried to a reserve account, one for time and one for expense. This reserve equalizes our costs and provides in the time reserve an amount sufficient to cover losses during the period of sub-normal operations.

“The overhead reserve shows how well we are hitting the mark, as set up in the budget, if we are behind and a debit balance has resulted we can determine just where the costs have advanced and if such expenses are found to be necessary the standard overhead rates are revised.”

An interesting example of the practice of setting up and carrying forward a reserve for overhead variations from year to year is thus described by an executive of a large Illinois manufacturing company.

“Last year we opened our account for sub-normal production and credited it with \$400,000. We have no intention whatever of closing out this account, feeling that it will be depleted in times of depression to some extent, and our idea is that this fund should be built up to be equal to about two and one-half times our annual overhead. This would take care of the unabsorbed overhead on a fifty per cent production over a period of five years, which we think should put us in a very safe position.”

On the other side are those accountants who believe that overhead deviation is an item of profit and loss and should be so considered on the monthly statements. Where this is done profits are stated first on the basis of so-called normal costs and this profit is increased or decreased by the amount of the over or under-absorption.

The practical utility of an overhead accounting method which employs predetermined rates and thus sets up the under-absorbed or over-absorbed overhead as separate items is interestingly described by the president of a large farm machinery manufacturing company who writes:

“Of the three ways of arriving at overhead which you mention, we use the one based upon the direct labor dollar. The rates of pay here between the highest and the lowest mechanic differ but little. We use overhead figures derived from and applying to each department. We also use a pre-determined rate of overhead on shipments, a different rate applying to each class of production. The surplus overhead goes to a preliminary account which at the end of the year is charged into profit and loss. As we have been running under capacity for the last two or three years, there has generally been quite a heavy under-absorption and a correspondingly large debit balance in this account. It has been very interesting to keep it and analyze it month by month and at the end of the year by departments and by classes of product. It is certainly expensive, hardly an exaggeration to say frightfully expensive, to run under capacity; indeed our net margin of profit for the whole factory for the last two or three years has been small. This has been due practically altogether to the deduction of this excess overhead from the net manufacturing profit.”

CONCLUSION

Thus we come to the conclusion of this elementary discussion of present day trends in overhead accounting. It is in no wise a compendium of information but rather it is intended to be a guide to the executive and his accountant who, not being believers in cut and dried methods, wish to work out an intelligent plan of overhead procedure for themselves.

E. W. McCULLOUGH,

Department Manager.

THOMAS W. HOWARD,

Assistant Manager.

A list of the publications of the
Department of Manufacture on
accounting and other subjects will
be supplied on request.