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Cost Accounting

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COST ACCOUNTING

BY

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PREFACE

The motive which prompted the author to prepare and publish Cost Accounting, was the desire to supply a demand for a text book on the part of the students in New York University School of Commerce, Accounts and Finance. In presenting it for public consideration it is desired to have clearly understood the fact that it is intended as a text book especially adapted to the needs of students, and is not intended as a general reference work.

The supply of literature on the subject of cost accounting is increasing rapidly. The quality of such literature is of a high order. The fault to be found with it from the point of view of a teacher is that it is too highly specialized. The tendency on the part of authors on this subject is to select some particular industry or line of production and describe a particular system, attempting to make such typical of the entire subject.

Most systems are accompanied by elaborate forms. In fact it may be said that many systems are nothing more than a collection of forms. This practice has been carried to such an extent that it would not be extravagant to state that the average student looks upon the study of cost accounting as a matter of becoming familiar with certain specific forms comprising a particular system. In this maze of forms the student becomes lost and the principles underlying the forms are entirely overlooked.

During the first few years of the author's experience in accounting work he devoted a great deal of time to collecting forms of all kinds, especially those having to do with cost accounting.

Preface

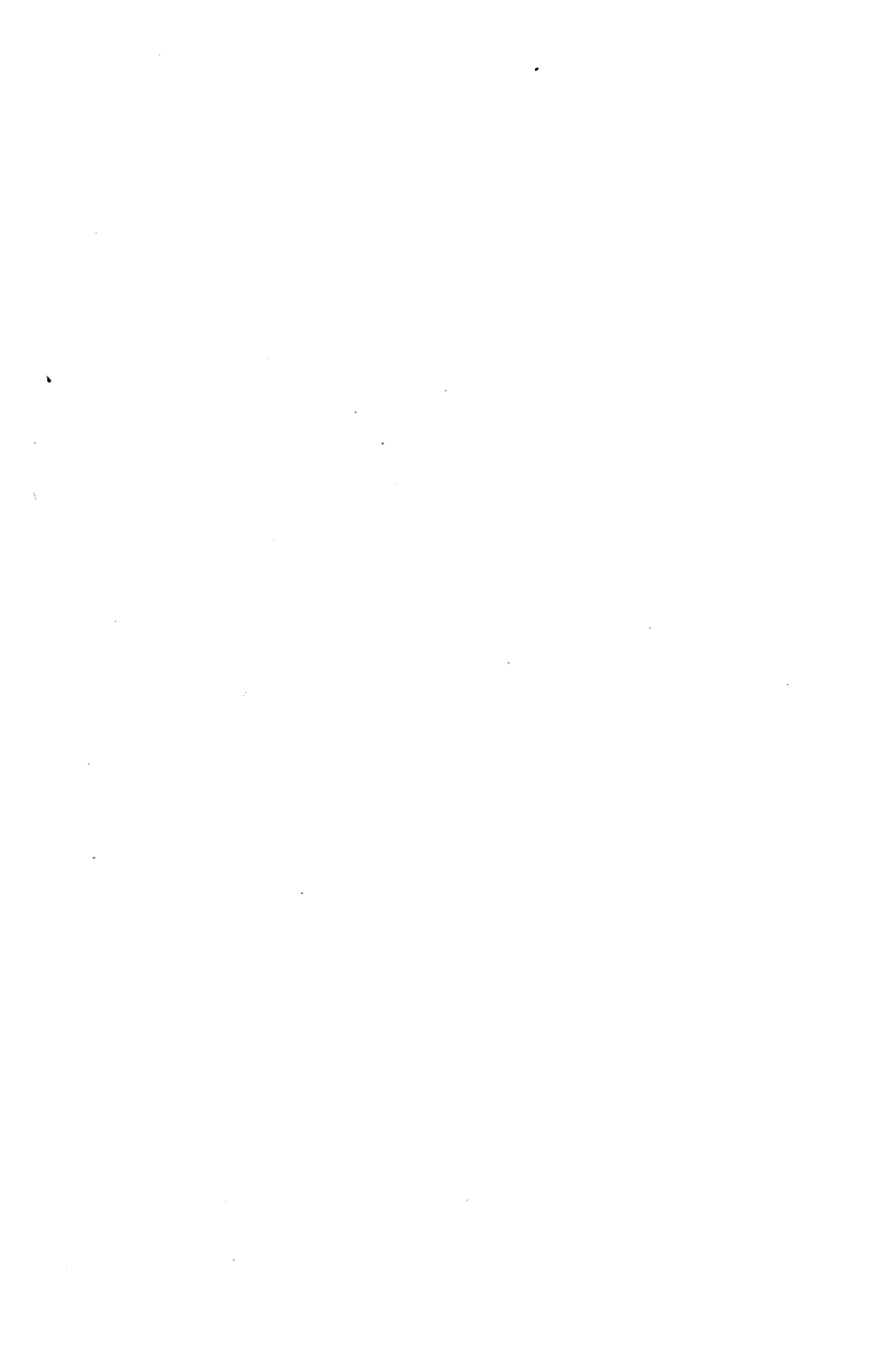
After having collected enough to half fill a medium sized steamer trunk he discontinued the practice. There were two reasons why. Being always so busy collecting them he never had time to refer to them. When he had occasion to devise and use a form he constructed it anew without reference to his collection. Having determined the subject for which the form was needed and considering the use to which it was to be put, it was only necessary to make the form through its construction and arrangement, call for the information desired. Experience taught him that a knowledge of what the form should recite was of vastly more value than familiarity with any particular form, or than to be able to refer to a splendid collection.

Such has been the theory under which this book has been constructed. It is essentially a book setting forth the principles of cost accounting rather than a treatment of the subject in all its refinements. To the experienced cost accountant it will be of little value. To the engineer dealing with cost accounting problems it will be of less value. To the student, whether in the technical school of some university, or in the works department of a plant in some small manufacturing town, it is hoped that this book may give a broader conception of the subject, impress the principles underlying it firmly upon his mind, and so prepare him that he may attack intelligently and successfully the problems which confront him and read and study to better advantage some of the more interesting literature now available and being prepared by specialists in this line of work.

JOHN R. WILDMAN.

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Cost Accounting

CHAPTER I

The Objects in Ascertaining Cost

A discussion of the subject of Cost Accounting involves the consideration of three topics :

- (1) The nature of the information being sought.
- (2) The means of obtaining the information.
- (3) The use to which the information is to be put, after it is obtained.

A consideration of the first topic requires an inquiry into the objects in ascertaining costs. Briefly stated they are as follows :

- (a) To ascertain whether or not a business undertaking is profitable.
- (b) To serve as a basis for fixing selling prices.
- (c) To furnish information to the proprietor or administrative officer which will guide him in forming his administrative judgment.

In the simplest of business transactions the interesting element is that of profit. A man who undertakes a business venture of any kind is primarily interested in knowing whether he is making or losing money. In either case, how much? He is secondarily interested in knowing whether his business is sufficiently profitable. By this is meant, whether or not the return on the

Cost Accounting

investment is up to the average for the line of business in which he is engaged.

If he is engaged in trading, his first or gross profit is from the sale of his merchandise. In order to ascertain his profit he must oppose against the proceeds of his sales the cost thereof. If his cost is incorrect, his profit is incorrect. Strangely enough, the error in such cases is usually against him rather than in his favor. Such errors frequently repeated are inclined to lead him suddenly, and often to his surprise, into a condition of insolvency. Hence the importance, even in the simplest transactions, of having information on the subject of cost which is correct and trustworthy.

Competition as it exists today calls for the greatest of care in fixing selling prices. The exercise of such care requires business experience, a knowledge of business conditions and reliable information concerning costs. The successful contractor is the man who not only gets the contract by virtue of having submitted the lowest reasonable bid, other things being equal, but the man who can get his profit out of the contract after he has succeeded in securing it.

If a loss results, or the margin of profit is too small, it means, upon repetition, one of two things must be done; either the selling price must be increased, or the cost must be decreased.

Of these two expedients, the first is usually inadvisable, if not impossible, without resulting in a loss of business, and the business man looks to the second means for relief. Can he use

The Objects in Ascertaining Cost

this means intelligently if he is not absolutely sure of his cost? Obviously, not!

Through the aid of accurate information concerning costs the proprietor or administrative officer is enabled to keep in close touch with conditions, shape the operating policy of the future and guide the operations as they mature.

He is enabled:

a. To determine which lines of production or merchandise are profitable and which are unprofitable; to institute methods for extending and increasing the sale of such lines as are profitable and to retard the sale of, or withdraw entirely from the manufacture, or sale of, such lines as are unprofitable; to decide intelligently the lines on which commissions may be allowed to salesmen and the extent of such commissions.

b. To reduce costs; either through a reduction of the elements composing costs, or through an increase in the production.

c. To allocate "leaks" and stop unnecessary waste or extravagance.

d. To develop the highest type of productive efficiency. To bolster up the weak points and harmonize the work of the different departments, or operating groups.

e. To gauge the efficiency of managers, relatively speaking, by comparing one manager with another. The manager, whose cost of producing soil pipe per ton is \$7.00, is obviously not as efficient or capable as the man who under precisely similar conditions can produce the same product at a cost of \$5.00 per ton.

Cost Accounting

f. To compare the work of similar foremen, departments, machines, operatives, or other centers of production.

g. To compare costs in general of one period with another.

h. To compare actual costs with estimated or predetermined costs. The tendency today is toward standardization. Generally speaking from the standpoint of costs, standards are unattainable. A comparison of actual costs with standard costs determines the percentage of inefficiency.

Modern business organization has become so complex as to have passed beyond the limits of individual observation, unless the individual has some artificial means of transcending these limits. The time has passed when the administrative officer can be in touch with all the details of the business. Cost statistics offer such a man a means of transcending his individual limits. They afford him an opportunity of having placed before him at stated intervals a picture, as it were, of his business operations. The administrative officer, or proprietor, draws his conclusions from the picture, and is afforded thereby a basis on which to found his judgment as to future operations and policies. It is said of the late Mr. Harriman, that he owed his success in a measure to his ability to interpret the operations of his many business enterprises from the statistical reports which he required of his representatives from time to time.

CHAPTER II

Classification of Costs

Costs are frequently referred to without distinction as to whether manufacturing or selling costs are meant. That such a distinction should be made is important. Manufacturing cost as will be seen in the classification appearing below, contemplates only such costs as arise, in the factory, in connection with the manufacture of the product. Selling cost has as its basis the manufacturing cost, to which is added the expense of selling the product, the expense of administration, and all other items of expense incident to the conduct of the business. The trader, who buys and sells merchandise, technically speaking, has no manufacturing cost. His is a selling cost, having as a basis, however, an item of cost of purchase, corresponding relatively to the cost of manufacture.

The details of each class of costs are as follows:

1. Manufacturing costs, composed of

Prime cost and

Manufacturing overhead, variously referred to as

Factory loading

“ burden

“ expense

“ indirect

Manufacturing expense

“ On cost.”

Cost Accounting

2. Selling costs, the elements of which are

- (a) Manufacturing cost
- (b) Selling expense
- (c) Administrative expense
- (d) Fixed or capital charges
- (e) Reserves
- (f) Deductions from sales.

A somewhat more detailed analysis of selling costs would include the following items:

A. Manufacturing cost

1. Prime cost

- (a) Materials and supplies, including inward freight and cartage, and duty
- (b) Labor—direct—such as “cutting out” and “stitching” in the manufacture of shoes.

2. Manufacturing overhead

- (a) Labor—indirect
 - Foremen
 - Helpers (not working on product)
 - Porters
 - Watchmen
 - Messengers
 - Teamsters

Classification of Costs

- (b) General factory expense
 - Heat, light and power
 - Shop supplies (so small as not to warrant charging to stock)
 - Repairs and renewals
 - Office supplies
 - Office expenses
- (c) Salaries
 - Manager or superintendent
 - Clerks—keeping factory records
- (d) Depreciation of machinery and tools, or other operating equipment

B. Selling expense

- (1) Salesmen
 - Salaries
 - Traveling expense
 - Commissions
- (2) Advertising

C. Administrative expense

- (1) Salaries
 - Officers
 - Clerks—keeping general records
- (2) Expense—general office
 - Printing and stationery
 - Postage

Cost Accounting

Telephone and telegraph
Traveling—officers and clerks
Legal
Miscellaneous

D. Fixed or capital charges—(subject to offset on account of other income)

- (1) Cash discount on sales
- (2) Rent
- (3) Taxes
- (4) Insurance
- (5) Interest

E. Reserves

- (1) Depreciation of plant
- (2) Doubtful accounts

F. Deductions from sales

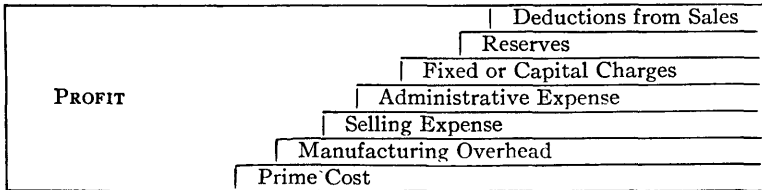
- (1) Allowances
 - (a) Loss
 - (b) Breakage
 - (c) Damage
- (2) Trade discounts
- (3) Rebates
- (4) Outward freight

The above outline is intended to be indicative rather than exhaustive.

Classification of Costs

The relation of selling cost to selling price, the elements of which are cost and profit, will be clearly defined by the following illustration :

SELLING PRICE



CHAPTER III

The Selection of a System

Having determined the nature and extent of the information sought, the question of how it is to be obtained arises. What kind of accounting mechanism, or system, shall be employed for this purpose?

In order to answer this question properly it will be necessary to consider the question of production with regard to the type of product. Production used in its relation to cost may be classified as:

- Single unit
- Multiple unit
- Miscellaneous

By single unit production is meant that class of production in which the units produced are all of the same nature; units which are identical with regard to the quantity and quality of material used, require the same operations of labor, and share equally in the distribution of overhead. Single unit production is attended by a uniform cost per unit.

Multiple unit production involves a dissimilarity either in the quantity or quality of material used in the article, the labor expended, or the overhead applied. Such circumstances usually give rise to a difference in type of the articles and a corresponding difference in the unit cost.

The Selection of a System

The term "miscellaneous" or "diversified production" is used to denote production in which it is difficult on account of the complexity of its nature, or inadvisable from the standpoint of the manufacturer, to classify the product and obtain a unit cost. A manufacturer engaged in producing several different kinds of articles, which permit of unit classification, might be entirely satisfied, although inadvisedly, with knowing the cost collectively of the various lines of output.

The successful cost accountant must learn sooner or later, that while he may often advise as to good practice he will at times be forced to accept a situation as he finds it and be governed in his work accordingly. Let it be remembered in passing from this topic, however, that miscellaneous production specifically denotes an absence of unit classification.

The selection of the system to be employed in securing the information desired will be seen from the above to depend upon the kind of production involved. Single unit and miscellaneous production, on account of their similarity, fall naturally into one class, while multiple unit production, on account of its complexity, is in a class by itself.

The systems available for use are two:

The accounting cost system, and

The manufacturing (or factory) cost system.

CHAPTER IV

The Accounting Cost System

The accounting cost system is the simpler of the two, in that it involves no books other than those usually embraced in the system of financial accounts. For this reason the accounting cost system is sometimes referred to as a "financial" cost system. It contemplates a complete and comprehensive classification of operating accounts in the general ledger such as were shown in the outline covering the elements of selling cost. The arrangement of the accounts is somewhat changed, however, in order that the financial operations may be clearly brought out and the source of profits allocated in preparing statements from the books. The asset and liability accounts also appear in the general ledger as usual and the trial balance of same furnishes the information necessary to prepare the balance sheet and statement of income and profit and loss. It is essential that the latter should be tied into the balance sheet as usual in order to prove its mathematical correctness, and it is the statement which becomes the basis of the cost sheet.

In addition to the work contemplated by the ordinary system of accounting it is necessary that a record should be kept of the units sold and the units returned in order that the net sales in units may be ascertained. If the cost of net sales is obtained and the number of net units sold is known, it is obvious that by dividing cost by units an average cost per unit may be obtained. It

The Accounting Cost System

is true of course that the cost may be slightly inaccurate on account of not selling in every case the physical units produced during the period, but if the units are of the same type the objection to the discrepancy will be so slight as to be almost nil when compared with the saving in time and expense which the use of the system accomplishes.

It will be seen from the following statement of income and profit and loss that the accounting cost system may be adapted to either single unit or miscellaneous production and affords to the administrative officer an excellent picture of the operation of the business and a basis for administrative judgment. General captions have been principally used here in order to condense the statement, but it should be understood that in practice the statement should embody all the detail accounts as set forth in the analysis of selling costs.

Cost Accounting

STATEMENT OF INCOME AND PROFIT AND LOSS FOR THE PERIOD ENDED _____

	Units	Money Values		Cost Statistics Average per Unit	
Gross sales					
Less returns					
Net sales					
Deduction from sales:					
Trade discounts					
Allowances:					
Breakage					
Damage					
Loss					
Outward freight and cartage					
Total					
Income from sales					
Cost of sales (deduct):					
Materials and supplies consumed					
Labor—Direct					
Manufacturing overhead					
Difference in inventory of goods in process					
Difference in inventory of finished goods					
Total					
Gross profit on sales					
Selling expense (deduct)					
Selling profit					
Administrative expense (deduct)					
Net profit on sales—Income from operation					
Other income (add)					
Total Income					

The Accounting Cost System

STATEMENT OF INCOME AND PROFIT AND LOSS FOR THE PERIOD ENDED _____

(Continued)

	Units	Money Values	Cost Statistics Average per Unit	
Deductions from income.....				
Net income—profit and loss.....				
Profit and loss credits (add).....				
Total.....				
Profit and loss charges (deduct)...				
Profit and loss surplus for the period				
Profit and loss surplus—beginning of period (add).....				
Profit and loss surplus (per balance sheet).....				

In connection with the preceding statement, a discussion may be had with advantage of the second section, or that dealing with the cost of sales. It is important that the relation between the items making up the cost of sales, as shown in the statement, and the same items, as they are found in the subsidiary records, should be clearly established. The materials and supplies shown in the statement, are the materials and supplies consumed in the manufacture of the product. The figure representing consumption is arrived at by taking as a start the inventory of materials and supplies on hand at the beginning of the period, adding thereto the purchases during the period, and deducting from the total of such amounts, the inventory on hand at the end of the period.

Cost Accounting

The consumption of materials and supplies, together with the direct labor and manufacturing overhead for the period, passes over theoretically into the account representing goods in process. The consumption might have been arrived at by applying to the purchases the difference between the inventory at the beginning, and the inventory at the end of the period. If the inventory at the end of the period is greater than at the beginning of the period, obviously, all materials and supplies purchased have not been consumed and the purchases are subject to a decrease on account of the increase in the inventory. Where conditions are the reverse, the purchases are subject to increase on account of the decrease in the inventories, for the reason that more materials and supplies have been consumed during the period than were purchased.

The cost of the goods in process which during the period have been completed and transferred to finished goods, is arrived at step by step, through the following accounting processes. To the value of the inventory of goods in process at the beginning of the period, there is added an amount combining the materials and supplies consumed, the direct labor expended, and the manufacturing overhead. From the total of these amounts there is deducted the value of the inventory of goods in process on hand at the end of the period. The result obtained by these processes gives the value of the goods which have been finished and transferred to stock during the period. The same result might have been obtained by applying to the combined values of materials

The Accounting Cost System

and supplies consumed, direct labor, and manufacturing overhead, collectively, the increase or decrease in the inventories of goods in process, at the beginning and at the end of the period, respectively.

The cost of the goods sold is obtained from the treatment of the finished goods account in a manner similar to the preceding; namely, adding to the inventory of finished goods on hand at the beginning of the period the value of the goods transferred to finished stock during the period, and deducting from the total of such values the inventory of finished goods on hand at the end of the period. The principle of applying to the value of the goods transferred during the period the increase or decrease in the inventories of finished goods may be carried out as well with this account as with the materials and supplies and the goods in process accounts.

From the foregoing, the attentive reader will doubtless have reached the conclusion that the same result may be arrived at, by treating the items involved in the cost of manufacture during the period with the increases and decreases in the inventories of both goods in process and finished goods. If to the purchases, after having been treated with the difference in inventories of materials and supplies, there is added the cost of direct labor and the manufacturing overhead and the total of such three items is then affected by the difference in inventories of the goods in process and the finished goods, the result will be precisely the same as that obtained by going through the accounts step by step

Cost Accounting

and following each operation. A careful study of the following tabulations will undoubtedly serve to bring out the thoughts which the above remarks intend to convey.

	Materials and Supplies.	Labor Direct.	Manufacturing Overhead.	Goods in Process.	Finished Goods.
Inventory at beginning of period.....	\$4,000			\$15,000	\$17,000
Purchases.....	10,000			16,000	19,000
Total.....	14,000			31,000	36,000
Inventory at end of period..	6,000			12,000	9,000
Consumption.....	\$8,000	\$6,000	\$2,000	\$19,000	\$27,000
		\$16,000			

Presented in the form of a statement the figures appear as follows:

Purchases.....	\$10,000
Deduct Increase in Inventory Materials and Supplies.....	2,000
Consumption.....	\$8,000
Labor—Direct.....	6,000
Manufacturing Overhead.....	2,000
Total.....	\$16,000
Add—Decrease in Inventory Goods in Process.....	3,000
Add—Decrease in Inventory Finished Goods.....	8,000
Cost of Goods Sold.....	\$27,000

CHAPTER V

The Manufacturing or Factory Cost System

Where multiple unit production is involved, the question of system becomes much more complex. More details are required, and consequently a more elaborate set of books. General books and general accounts are entirely adequate in the case of single unit and miscellaneous production, but it is impracticable, if not absolutely impossible, to obtain the necessary results in the case of multiple unit production. The accounting cost system answers the purpose so long as nothing beyond average costs is required, but it should be pointed out that the application of this system might result disastrously if the identity of the various units were overlooked and average costs obtained. An average cost would be entirely satisfactory if accompanied by average sales; that is to say, if an equal amount of sales in each of the lines was made. The average cost of three (3) lines of production at \$14, \$15, and \$16, respectively, might be \$15, and no damage could result if there were a corresponding average sale of the three (3) lines. An increase in the demand for goods costing \$16 and a decrease in the demand for those costing \$14 would materially alter the situation, and the manufacturer, having at his disposal only the information that the average cost of his three (3) lines of product was \$15, would be unable to account for the condition of insolvency which would very likely fall upon him.

In the use of the manufacturing cost system, it is necessary

Cost Accounting

to distribute or apply the material and supplies, labor, and overhead over the various grades or units of production, and keep special cost records. It is necessary to determine the cost of each grade, or quality of product. Each lot, or unit, or group of small units, must be identified, usually by number, and each traced through the process of manufacture, the items of cost accumulating as the work progresses.

The proprietor is primarily concerned with a cost upon which to base a selling price, but he may also desire information of a statistical nature, which will enable him to gauge or compare the efficiency of the management, or the operatives in some particular division of the work.

There are three (3) elements making up the cost:

- Materials and supplies;
- Labor;
- Overhead;
- Manufacturing,
- General.

The next question is, how to arrange the system so as to furnish the information as to how much of each element goes into the cost of the various units in process of manufacture?

It is usually conceded that a departmental organization furnishes the best form for accomplishing these results; not necessarily a physical division or department, but at least a division so far as the recording of the operations is concerned. By placing

The Manufacturing or Factory Cost System

each department under the charge of some employe, a distribution of the supervision of the work and records is accomplished without complicating the accounting mechanism and working a hardship upon one, or a small number of employes.

While the matter of classifying manufacturing cost systems, with regard to the various types involved, will be taken up later, the author desires to confine his remarks at the present time to a discussion of the simple type, wherein information having to do with materials and supplies, and labor, is obtained by the cost clerk direct from each department, instead of allowing the cost to accumulate on departmental records as the work progresses.

The work in process is identified by a system of numbers, under which each department reports the charges for material and supplies, and the labor which it has against these numbers. Where it can be avoided the overhead should not be allowed to become involved in departmental records. It is only necessary to complicate the work of the departments by loading them with overhead, where statistics for administrative purposes are required for the purpose of judging or comparing the efficiency of a supervising operative, or foreman, a group of operatives, or the work of a department, and such distribution is not contemplated in the simple type of system. If indicated by special circumstances the records covering such distribution should be made subsidiary to the general cost records, and no department burdened with any overhead, which does not originate there, or fall under

Cost Accounting

the responsibility or control of the head of the department. The value of statistics for administrative use is destroyed when, for example, an attempt is made to judge the efficiency of a manufacturing department by such items as salaries of officers, traveling expenses of officers, or any similar item not specifically affecting same.

Let it be remembered then, that the departments are to report the charges which they have against the work in process to the cost department, which should provide a book in which these reports may be summarized.

The stores department should be required to furnish a record of the materials and supplies issued, showing the number of the jobs or lots against which they are issued. This department should keep a detailed record of the cost of the materials and supplies, the receipts and issues of which should be summarized in the materials and supplies ledger.

Labor departments report to the cost department the charges for direct labor against the work in process, and these are summarized to show the distribution over the jobs in process, and ultimately the total direct labor charge against each job. The items of materials and supplies, and labor constitute the direct charges.

Overhead comes from the accounting department, and is allocated to the work in process through the medium of a distribution sheet, showing both the manufacturing and general overhead.

The Manufacturing or Factory Cost System

The results of the charges for

Materials and supplies;
Direct labor;
Overhead;
 Manufacturing;
 General,

are summarized and carried in the cost ledger until the job is completed. At such time they are transferred to a finished goods ledger.

From the above it will be seen that the books required in the manufacturing cost system are three (3), namely:

Materials and Supplies Ledger;
Cost Ledger;
Finished Goods Ledger.

With these there are also three (3) reports required, namely:

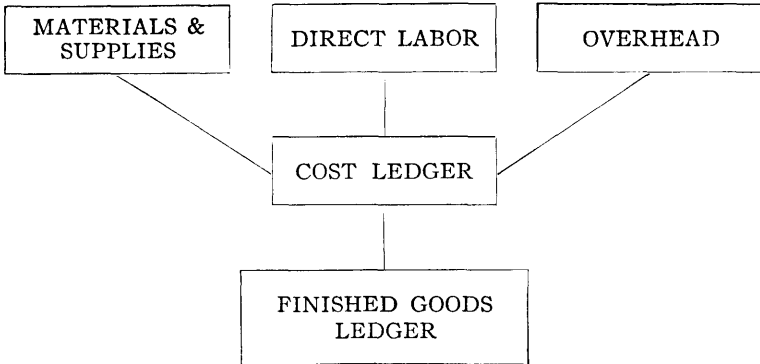
Materials and Supplies—from stores department.

Direct Labor—from operating departments.

Overhead—from accounting department.

It should be noted that the three books comprising a part of the manufacturing cost system are always controlled by accounts in the general ledger with which they should always be in agreement. The connection between the books, reports, and the work as it passes through the factory, may be made somewhat clearer by the following illustration:

Cost Accounting



CHAPTER VI

Orders

Before passing on to the detailed discussion of the elements comprising cost and the methods of handling same, some attention should be given to the system of orders which is used for controlling the operation of the plant and the goods in process.

It is customary to allow no material to be used and no labor to be expended without an order. These orders originate in the factory office, are prepared by the order clerk, or some of the office-help, and are always authorized by the manager or superintendent, or someone designated by the manager with the authority to give the order; never by the workmen.

Orders are divided into three classes, which, together with their uses, are shown by the following:

I. Plant:

- (a) Extensions.
- (b) Equipment.
- (c) Repairs and maintenance.

Cost Accounting

2. Production:

- (a) Stock, sometimes called standing orders.
- (b) Special, specifications accompanying.
- (c) Stock repair.
 - 1. Goods damaged before shipment.
 - 2. Goods returned by customers.
 - (a) Repaired at plant's expense.
 - (b) Repaired at customer's expense.

3. Shipping:

Orders

EMPIRE HAT MANUFACTURING COMPANY

PLANT ORDER: { Extensions.
Equipment. No.
Maintenance and repairs. Date

SUPERINTENDENT OR FOREMAN:

You are hereby instructed to proceed with the following described work; to draw on the stores department for the necessary materials and supplies and to charge all labor expended in connection with the work to the above order number.

DESCRIPTION OF WORK

Manager.

WORK TO BEGIN
WORK TO BE COMPLETED

ISSUED IN QUADRUPLICATE:

1. Office or order department.
2. Factory.
3. Stores department.
4. Cost department.

Cost Accounting

EMPIRE HAT MANUFACTURING COMPANY

PRODUCTION ORDER:..... { Stock. No.
Special. DATE.....
Stock repairs.

SUPERINTENDENT OR FOREMAN:

You are hereby instructed to proceed with the production of the following described articles; to draw on the stores department for the necessary materials and supplies and to charge all labor expended on same to the above order number.

WORK TO BEGIN.....
GIVE ORIGINAL ORDER NUMBER _____
IN CASE OF STOCK REPAIRS. *Manager.*

EMPIRE HAT MANUFACTURING COMPANY

SHIPPING ORDER No..... DATE.....
SHIP TO..... CHARGE TO.....
VIA..... MARK.....

Manager.

CHAPTER VII

Materials and Supplies

Under this heading four things should be considered :

First: A place to keep them.

Second: The records employed by the stores department.

Third: The system used by the stores department.

Fourth: Reports issued by the stores department.

With regard to their location and custody it is of course necessary that they shall be under the immediate supervision of some one individual who will be responsible for their safety and preservation. Such an individual should be provided with the proper means of safeguarding the materials and supplies as it is absolutely unjust to attempt to hold a man responsible for stores without providing him with adequate physical means of protecting them.

The materials and supplies of like nature should be together. They should be arranged in an orderly manner to the end that they may be easily located and the arrangement may adapt itself to the taking of the physical inventory. Generally speaking, they should be arranged in sections or classes, alphabetically, or in the order that the accounts appear in the material and supplies ledger and within the various sections they should be arranged in racks, tiers, bins, closets or drawers, depending upon their nature.

Cost Accounting

With regard to records, broadly speaking, it is desired to know—

What comes in,
What goes out,
What remains.

The record in each instance should show the name of the materials and supplies, the class, units, price per unit and cost. The original record of what comes in is the invoice. The original record of what goes out is the requisition. The ledger should show what remains.

The invoice is the basis for taking up the stock by the stores clerk and constitutes his authority for so doing. Invoices are usually entered in a book of record in order to prevent the receipt and issue of stores without any trace thereof being found. Such a book of original entry is also valuable in that a summary of the cost of the invoices obtained therefrom supplies a means of securing a general or balancing account in the materials and supplies ledger.

The requisition is the authority for the issue of materials and supplies. A knowledge of what it should recite is more essential than familiarity with some particular one of the various forms used. It should first of all receive a number; should recite the number of units required and give an accurate description of the materials and supplies to be issued; the lot, job or account number to be charged, and should bear the signature of some person

Materials and Supplies

in authority. It is not the practice to insert prices on requisitions until such time as the materials and supplies have been issued unless it is desired that specific materials at specific prices be issued. Ordinarily, they are issued in the order received, with accompanying prices. A summary of the requisitions in a book of record is desirable especially for the purpose of supplying totals for the general or balancing account in the materials and supplies ledger.

The ledger should contain an account with each class of materials and supplies and should be so arranged as to show the details of receipts and issues, setting forth in the case of receipts; the

Date
Number of invoice or number of summary
Units
Price per unit
Amount

and with regard to issues; the

Date
Number of requisition or number of summary
Units
Price per unit
Amount.

While the general or balancing account previously referred to is not absolutely necessary since the materials and supplies ledger

Cost Accounting

is controlled by the materials and supplies account in the general ledger, such an account facilitates the work of the stores department in that it is relieved of the necessity of constantly checking with the controlling account in order to ascertain if the ledger is in balance. The form of the ledger to be employed is largely a matter of choice. It matters little whether a bound book, loose leaf, or card system is used.

The operation of the system obtaining in the stores department requires that as to invoices they shall be numbered consecutively as received and the date of receipt noted thereon. Goods and prices should be checked and extensions verified, if same has not already been done. The invoice should be entered on the invoice record for summary purposes and the details of the invoice posted to the debit of the appropriate ledger accounts. Requisitions should have the number of units actually issued noted thereon, with prices of the units issued, should be extended and entered on the summary and the details posted to the credit of the appropriate ledger accounts.

A trial balance of the ledger should be taken monthly or oftener. The continuous posting of details of invoices and requisitions and the continuous balancing of the units of stock as well as the money values, proves valuable as a perpetual or running inventory. The balance of a given kind of stock as shown by the ledger may be verified by checking with the physical inventory, at regular periods or at such times as the stock is at a minimum.

One report only is necessary from the stores department so

Materials and Supplies

far as the cost clerk is concerned and this should take the form of a summary showing particularly the cost of the materials and supplies issued against the numbers of the various jobs in process. The report may be made monthly, bi-weekly, or as much oftener as judgment indicates or the cost department desires. A specimen report is given on page 34.

In connection with the general discussion of materials and supplies a few words should be said regarding inward freight and cartage and labor in the stores department. While they will be discussed here from a strictly technical standpoint and such items added to direct cost, experience teaches that while perhaps not so accurate it is more practicable to include them in the overhead.

Inward freight may be added to the price per unit on a percentage basis ascertained by finding the ratio which the freight on the invoices bears to the cost thereof. Cartage unless it can be applied to specific invoices is more difficult of distribution. It is possible, however, to ascertain the ratio of cartage to the total cost of goods and subsequently distribute same over the invoices. A similar ratio of the cartage to the cost of the individual invoices may be ascertained and the cartage then applied to the units. This method is largely based on theory and the work involved frequently precludes its adoption in practice.

Labor in the stores department is of two kinds:

Clerical.

Manual.

EMPIRE HAT MANUFACTURING COMPANY

REPORT OF MATERIALS AND SUPPLIES ISSUED—FOR THE WEEK ENDED DECEMBER 10, 1908

CLASSIFICATION.	Total.	DISTRIBUTION.			
		Manufac- turing Overhead.	Lot No. 278.	Lot No. 279.	Lot No. 280.
Fur—Double Ring.....	\$2,018 61			\$2,018 61	
Fur—Blue Sides.....	1,317 00				\$1,317 00
Fur—B. C. B. Unpulled.....	1,477 01		807 11	669 90	
Fur—Coney Sides, French.....	617 17			617 17	
Fur—Colored Seal.....	2,566 47		310 02	701 40	1,555 05
Fur—Coney Tails, English.....	160 09		160 69		
Shellac.....	1,271 08		333 13	506 55	431 40
Dye Mixture.....	339 12		83 76	137 88	117 48
Alcohol.....	603 14		153 56	246 20	205 38
Sand Paper.....	387 00		94 50	157 50	135 00
Ribbon—Band.....	2,801 96		528 16	1,533 28	740 52
Ribbon—Binding.....	2,549 72		506 30	1,333 52	709 90
Ribbon—Bow.....	69 59		12 22	40 23	17 14
Wires.....	636 12		157 14	258 66	220 32
Leathers.....	2,330 84		579 02	946 02	805 80
Labels.....	674 68		166 87	274 23	233 58
Needles.....	7 90	7 90			
Thread.....	18 79		4 70	7 38	6 71
Boxes and Cases.....	2,359 00		582 00	958 00	816 00
	\$22,204 89	\$7 90	\$4,479 18	\$10,406 53	\$7,311 28

Cost Clerk posts all except Manufacturing Overhead.

Materials and Supplies

Manual labor covers :

- (a) Receiving and putting goods in stock.
- (b) Taking goods out of stock and preparing them for issue.

It will be seen that from a theoretical standpoint the manual labor involved may be divided between the two processes just mentioned, and that it, along with clerical labor, may be distributed over the invoices. In such cases, however, the invoices would have to be held until the end of the week and the payroll ascertained, unless the labor were to be distributed daily. An arbitrary percentage is sometimes added to cover this and other factors but the objection to this plan is, that it involves an adjustment at the end of the week or month in order to bring the books into agreement with the actual figures which the payroll shows. The practice now commonly in use, is to throw this item, like inward freight and cartage, into the overhead for general distribution.

CHAPTER VIII

Labor

The subject of labor can best be discussed by looking at it from the standpoint of the foreman or head of a department and ascertaining the nature and extent of the information he requires.

Labor may be defined as services performed for which compensation is paid. The compensation may take the form either of wages or salary, and labor may be divided into two kinds, clerical and manual. Clerical, or administrative labor, is that performed with the head. Manual labor is that performed with the hands. Manual labor, in turn, so far as its application in manufacturing is concerned, may be divided into direct and indirect labor. The direct labor is frequently referred to as productive labor, and the indirect as non-productive labor. A choice of terms in this matter is of slight importance, except that the terms direct and indirect appear to be slightly more correct from a descriptive standpoint. It is usually easier to determine whether or not an operative is directly or indirectly engaged upon the product than whether or not he is producing anything. The direct labor may be applied either to the work performed at the hands of the operatives or through the medium of machines. Such labor is always expended in connection with, but not specifically applied upon, the product. It is reasonable to suppose, looking at the subject from the standpoint of the foreman, that

Labor

with regard to the work of the individual the information required would be something of the following nature :

1. What the operative does ; the nature of the work in which he is engaged, and the particular job upon which he is working ;
2. The unit of compensation, whether it be on a time or a piece or job basis ; if on the time basis, whether he is working by the hour, day, week or month ; if on a piece basis, the number of units produced ; if on a job basis, the amount of time employed on a job ;
3. The rate of compensation ;
4. The amount earned.

What applies to the individual applies to departments, and in order to obtain the same information with regard to the departments that has been obtained with regard to individuals it is only necessary to multiply the information per individual by the number of individuals in the department.

What applies to the departments applies to the plant as a whole, and in order to obtain this information with regard to the plant as a whole it is only necessary to multiply the departmental information by the number of departments. It is apparent from the above that it would be advisable to have a summary of the entire plant, showing

1. The amount earned by each individual ;
2. The amount of work of the operatives, taken collectively, which applies to each lot or job or class of work in process.
3. The total amount earned by all operatives.

Cost Accounting

As to the reasons for recording these three points of information, it may be said that with regard to the first it is necessary to ascertain the amount of the payroll liability at the end of each period, in order that the accounting department, or more properly speaking, the paymaster, may be informed as to the amount necessary to meet the payroll; second, the liability to each individual, or the amount which he is entitled to receive at the hands of the paymaster on pay day; third, for the purpose of distribution, in order that the amount applicable to each job or lot may be ascertained.

Having determined the information necessary, the matter of records may now be considered. These will, of course, comprise three kinds; those pertaining to the individual; those pertaining to the department; those pertaining to the plant as a whole. With regard to those of the department and plant as a whole, it is unnecessary to say scarcely anything more than that they are either partial or complete summaries of the individual's records. The record of the individual, as above indicated, should show—

1. His name or number;
2. The nature of the work upon which he is engaged;
3. The number of units produced, or amount of work performed;
4. The rate of compensation;
5. The amount earned.

Labor

The origin of the individual record will depend largely upon—

1. The nature of the work;
2. The intelligence of the operative;
3. The basis of compensation.

The members of a railroad construction gang would not, as a rule, keep their own records. Laborers in a foundry, on account of the low order of intelligence sometimes obtaining, would probably not keep their own records, whereas operatives on clothing, being of a higher grade and employed upon piece work, might, in some cases, record their own work.

The form to be employed in keeping such records would depend upon the type of production, whether single or multiple unit, or miscellaneous, and the basis of compensation, whether time or piece.

If the time basis were in use, a time book kept by the foreman or some delegated employe might be used for recording day labor.

If the hour were the unit of time, it is more probable that the time would be recorded upon a card, which might be kept by the operative or by some employe designated for this work.

In cases where the piece basis is employed for the recording of work, labor tickets are commonly used. These are either given out to employes upon the completion of work, or they may be in the form of coupons attached to an order, which are detached by the employe when the job is completed.

Cost Accounting

Labor tickets may also be arranged so that they may be punched by the foreman or some designated employe when occasion requires.

In the first of the two instances above cited, they are retained by the operatives until the end of the week or wage period, when they are turned in as vouchers and made the basis upon which the payroll is constructed. The labor attendant upon the counting of coupons is sometimes overcome by issuing them in strips or having them pasted in books something on the same order as those issued by several well-known concerns who give trading stamps with purchases. Rough outlines, indicating in a general way the scheme of time books, cards, and labor tickets follow.

TIME BOOK—SINGLE UNIT PRODUCTION AND DAY LABOR

Name	M.	T.	W.	T.	F.	S.	Total	Rate	Amount

Labor

TIME CARD—MULTIPLE UNIT
AND HOUR BASIS

TIME CLOCK _____ NAME OR No. _____ NATURE OF WORK _____

Job No.	In	Out	No. Hours	Rate	Amount

LABOR TICKET

Name or No. _____

Job No.									Total	Rate	Amount

Cost Accounting

In connection with the use of the above forms, and labor in general, calculating machines and mechanical devices of all kinds are invaluable in making extensions or in checking same where made by employes or foremen.

No matter what form of individual record is used, the information therefrom should always be summarized, on the labor reports, so as to show, first, by departments, and second, by a subsequent summary of these, for the entire plant—

1. The amount of the pay roll ;
2. The liability to each operative ;
3. The distribution of labor.

The latter information should be so arranged that the total amount applicable to each job may be seen at a glance.

The summary serves two purposes ; first, that of supplying the payroll figures to the accounting department ; second, the distribution of the labor to the cost department. A specimen labor report is given on page 41.

EMPIRE HAT MANUFACTURING COMPANY

DISTRIBUTION OF LABOR—FOR THE WEEK ENDED DECEMBER 10, 1908

DEPARTMENT.	Total.	DIRECT LABOR.						Lot No. 280.	
		Indirect Labor.	Lot No. 274.	Lot No. 275.	Lot No. 276.	Lot No. 277.	Lot No. 278.		Lot No. 279.
Blowing and Forming.....	\$238 68	\$36 00	.....	.....	.....	.....	\$55 22	\$96 99	\$48 47
Sizing.....	960 85	18 00	.....	.....	.....	.....	196 43	535 28	211 14
Pinning Out & Rounding.	17 60	.....	.....	.....	.....	.....	4 58	8 62	4 40
Shaving.....	38 05	.....	.....	.....	.....	.....	10 91	17 96	9 18
Stiffening.....	110 84	11 50	.....	.....	.....	.....	28 95	46 70	24 05
Coloring.....	52 51	.....	.....	.....	.....	.....	13 97	25 50	13 04
Blocking.....	136 99	.....	.....	.....	.....	.....	39 28	64 66	33 05
Squaring.....	24 12	.....	.....	.....	.....	.....	6 76	11 49	5 87
Pouncing.....	10 86	.....	.....	.....	.....	.....	3 27	5 02	2 57
Pressing.....	247 35	.....	.....	.....	.....	.....	70 93	116 75	59 67
Finishing.....	885 15	27 00	.....	.....	.....	.....	207 33	458 04	192 78
Rounding.....	23 58	.....	.....	.....	.....	.....	6 76	11 13	5 69
Curling.....	312 47	.....	.....	.....	.....	.....	88 82	148 01	75 64
Wiring.....	20 40	.....	.....	.....	.....	.....	5 45	8 98	4 59
Labeling.....	8 16	.....	.....	.....	.....	.....	2 18	3 59	1 84
Binding.....	489 47	.....	.....	.....	.....	.....	109 12	233 51	119 34
Trimming.....	497 69	48 00	.....	.....	.....	.....	109 12	200 82	91 80
Packing.....	112 45	.....	\$8 51	\$7 68	4 45	6 32	23 79	40 59	21 11
	\$4,185 22	\$140 50	\$8 51	\$7 68	\$24 90	\$63 25	\$982 51	\$2,033 64	\$924 23

Cost Clerk posts Direct Labor only.

CHAPTER IX

Overhead

In connection with this topic, the question may well be asked, what is meant by overhead?

The term in itself is somewhat difficult to define, but it should convey to the mind the idea of indirect expenses, or everything above prime cost; the expense of operating the business, not only of the plant, but the entire business; the expense, not only of manufacturing, but selling, administrating, and carrying on the business in general. It is variously called "Loading," "Burden," "Indirect Expense," and (especially by English authorities) "On Cost."

Overhead divides into:

Manufacturing;
General.

Manufacturing overhead begins with indirect labor and ends at the point of shipment from the factory. General overhead begins with the point of shipment and ends at Profit and Loss Surplus.

It should be borne in mind that manufacturing overhead includes not only the miscellaneous expenses of a general nature incidental to the manufacture, but in practice usually such items as indirect labor, inward freight and cartage, and minor merchandise and supplies which are inadaptable to direct distribution.

General overhead has nothing whatever to do with the manu-

Overhead

facturing. It covers the expenses incidental to the conduct of the business from the point where the goods have been finished and are ready to be shipped, and includes such items as selling expenses, administrative expenses, deductions from income, charges for reserves, and deductions from sales.

It has just been said of overhead that it was indirect expense. By that is meant expense which does not permit of direct distribution. It is impossible to measure the proportion of each class of expense which is applicable to each job or lot, and requires some kind of arbitrary division or basis of distribution.

In connection with a discussion of bases, the following questions are pertinent :

1. Which is the most equitable?
2. Which is the most exact?
3. Which is the most accurate?
4. Which is fairest?

It is necessary to choose some basis which deals fairly with all the work in process ; one which will distribute overhead to all jobs in actual process, and avoid loading jobs which are in the factory, but not in process. A variety of bases is available from which to choose. They divide generally into five classes, namely :

1. Time ;
2. Cost ;
3. Percentage ;
4. Production ;
5. Sales.

Cost Accounting

Under the time basis there is the labor hour, the machine hour, and the overhead day. Under the cost basis there is the wage hour and prime cost.

The labor hour may be defined as the unit of time whereby the work of one operative is measured; in other words, it is the labor of one operative one hour.

The machine hour is the unit of time whereby the work of one machine is measured; it is also the work of one machine one hour.

The overhead day is the unit of time whereby the amount of overhead applicable to each unit of production is measured; in other words, it is the basis for determining the average number of days each job is in process.

As a concrete example, let it be supposed that in job No. 1 there are 200 units and in job No. 2, 500 units. The amount of overhead for the period to be distributed is \$2,000. Let it be assumed that job No. 1 has been in process 10 days and that job No. 2 has been in process 4 days. It will be apparent that job No. 1, consisting of 200 units in process 10 days would be equivalent to 2,000 units in process one day, and that job No. 2, consisting of 500 units in process 4 days would be equivalent to 2,000 units in process one day, or taking the work collectively, the same as if 4,000 units had been in process one day. If the amount of overhead for the period is divided by 4,000, the average length of time the units collectively have been in process, a rate of 50 cents will be obtained, which may be made the basis for distributing the overhead as between the two jobs, in accordance with the number

Overhead

of overhead days involved, which in this particular example happens to be 2,000 in each case. Having allocated the overhead to jobs, it is a comparatively simple operation to re-apportion it to units by dividing the overhead on each job by the number of units involved, respectively.

As stated above, under the cost basis, there is the wage hour and prime cost from which to select. Prime cost needs no discussion, except to refresh the reader's memory that it includes but two items, materials and supplies, and direct labor.

The wage hour may be defined as the unit of cost, whereby the work of an operative is measured. It is the cost of the work of one operative for one hour.

Of the other bases of distribution little needs to be said. Students of the subject of cost accounting generally, are familiar with the percentage basis, and it is only necessary to make mention of the fact that the amount of overhead applicable to each job is that proportion which the number of units in the job bears to the total number of units involved.

In the case of the production basis the number of units involved would be the number produced, and in the case of sales the number sold.

The sales basis is not so frequently used in manufacturing concerns as it is in wholesale and retail concerns organized on a departmental basis, and where the distribution of general expense is thought to be more accurately made by using the volume of sales of the respective departments as a basis.

Cost Accounting

The bases in all cases depend upon circumstances. They will be governed many times by whether the employes are paid by the day or hour, or by the piece; they will be governed by the nature of the business. A time basis would not ordinarily be employed in cases where goods are required to be invoiced before the records are completed, or the end of the month is reached. A job printing establishment, for instance, usually does work on an estimated basis and bills the job as soon as completed, adding to the prime cost an arbitrary percentage to cover the overhead and profit.

The basis to be employed may also depend upon the facility or regularity with which the books can be closed.

While it is impossible to make any hard and fast rule as to the basis to be employed, such a division being entirely governed by circumstances, there is this to be said: the time basis is the ideal, and always preferable. No other basis should be considered if a time basis can be used. The argument in its favor is that practically all the items entering into the overhead are of such nature that they accrue over a period of time. Examples of these, which, upon analysis, will be found to bear out the above statement, are as follows:

Heat,	Traveling expenses,
Light,	Advertising,
Power,	Salaries of officers,
Direct labor,	Rent,

Overhead

Salaries, manager, and clerks,
Depreciation of equipment,
Salaries of salesmen,

Taxes,
Insurance,
Interest.

Having selected the time basis, there is the choice of the labor hour, the machine hour, and the overhead day, depending upon the payment of compensation, whether the unit be one of time or piece.

The arguments against the wage hour, prime cost and percentage bases are as follows:

It is claimed that where the wage hour is employed the burden falls on the high-priced labor, which is unjust. The skilled workman is usually more rapid, turns out more and better work, and requires less supervision. In the case of prime cost the burden falls upon the expensive material, while, as a matter of fact, the expensive product takes no longer to go through the factory than the inexpensive one. The objection to the percentage basis is that at best it is only an estimate based on past experience. It is constantly changing and should be constantly revised.

Irrespective of the basis selected, the overhead should be summarized on the overhead report in order that the cost department may make the distribution to the various jobs. A specimen report is given on page 50.

Cost Accounting

DISTRIBUTION OF MANUFACTURING AND GENERAL OVERHEAD—FOR THE MONTH ENDED DECEMBER 31, 1908

Lot No.	Days in Process.	Number of Dozens.	Overhead Days.	AVERAGE COST PER OVERHEAD DAY		Total Overhead.	Manufacturing.	General.
				Manufacturing Overhead.	General Overhead.			
274	2	.....	.....	.....	.....	.....	.....	.....
275	2	.....	.....	.....	.....	.....	.....	.....
276	2	.....	.....	.....	.....	.....	.....	.....
277	2	.....	.....	.....	.....	.....	.....	.....
278	5	.....	.....	.....	.....	.....	.....	.....
279	8	.....	.....	.....	.....	.....	.....	.....
280	7	.....	.....	.....	.....	.....	.....	.....
281	2	.....	.....	.....	.....	.....	.....	.....
TOTAL	.....	.....	.....	.....	.....	.....	.....	.....

	Total Overhead.		Total Overhead Days.	Average Cost per Overhead Day.
	Manufacturing Overhead.	General Overhead.		
Manufacturing Overhead.....
General Overhead.....
TOTAL.....

CHAPTER X

Types of Manufacturing Cost Systems

Multiple unit production calls specifically for the manufacturing cost system. Such systems may be classified by types as simple, compound and complex. The type depends upon whether the goods are produced on special or stock order and whether the work is performed by hand or machine.

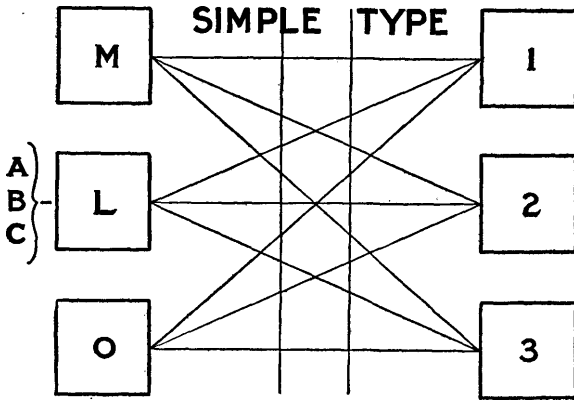
All types involve the same elements—materials and supplies, labor and overhead. The first two, in so far as their relation to the type of system is concerned, do not vary. The last named should be classified for the reason that it is comprised of items of two different kinds; those which permit of distribution to the operating departments and those which do not. A part of the overhead originates in the departments and must be applied to the product through such channels. Some of the overhead is foreign to the departments, both in its origin and application and while it must be applied to the product, it never reaches it by way of the operating departments. Overhead in its relation to the operating departments as affecting the different types of system is therefore classified as distributable and non-distributable.

In the simple type all of the three elements go through the factory, without combination, direct to the product. The word "combination" is used here as referring to the elements from an accounting standpoint rather than a physical standpoint. In the compound type, material goes direct, while the labor and dis-

Cost Accounting

tributable overhead become combined. In the complex type, material, labor and distributable overhead become combined, while the non-distributable goes direct.

These combinations may represent departments, processes, machines, or centers of production. There is no great distinction between "department" and "process" as used herein, except that more than one process may be included in one physical de-

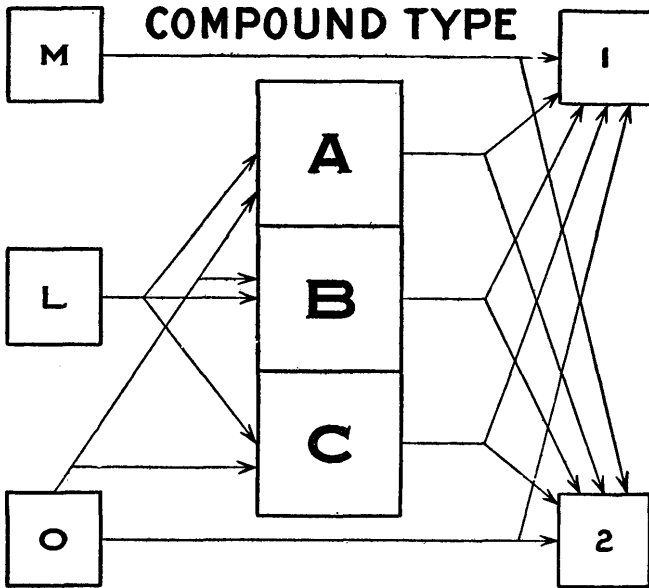


partment. In the accompanying illustrations, where an attempt is made to bring out more clearly the subject matter of the preceding paragraphs, departments are indicated by the letters—A—B—C; the elements of cost by the letters, M, L, O—D, and O, N—D; and the jobs by numbers.

Words and graphics almost fail when an attempt is made to describe briefly and clearly, or to illustrate, the complex cost

Types of Manufacturing Cost Systems

system. It may be referred to as a group of small cost systems wherein each operating department constitutes a member. It might aid in the illustration if, in the last diagram, one were able to imagine the departments "A—B—C" as containing within

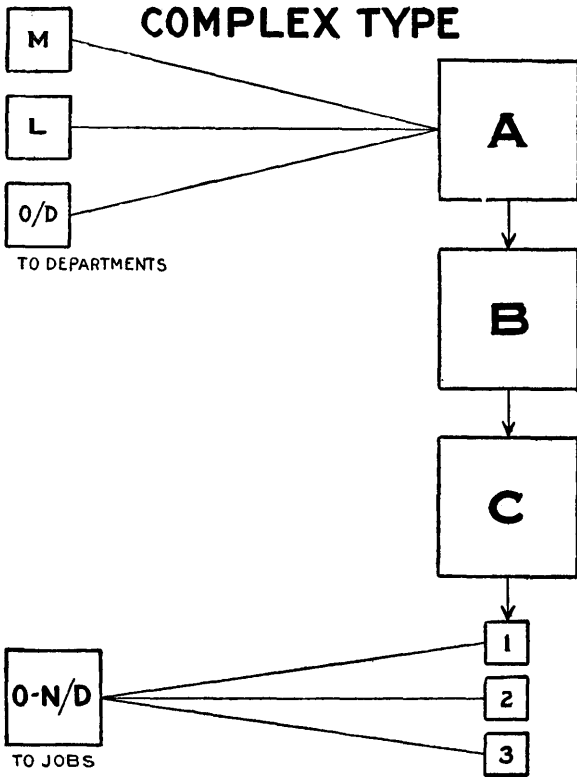


their respective limits, the diagram of the simple type sufficiently reduced in size to permit of such treatment.

In the operation of the complex system, materials and labor may be combined within a given department and carried forward,

Cost Accounting

or the combination may be extended to include all of the three elements and similar treatment follow. The last named proceed-



ure is difficult of accomplishment, except where conditions have been standardized and an overhead rate can be ascertained. The

Types of Manufacturing Cost Systems

difficulties in the way of success in the absence of such a rate are as follows:

1. The cost record must follow the product.
2. The distribution cannot be made until the end of the month or period.
3. The product must go forward when required for physical treatment, irrespective of the cost record.

Whether or not the rate is correct cannot be determined until the end of the period, when the actual amount of overhead for the period has been ascertained and the true rate found.

CHAPTER XI

When Departmental Distribution of Overhead is Indicated

Since the time when Adam Smith advanced and substantiated the theory that a division of labor increases production, the tendency on the part of the manufacturer toward a highly developed physical organization has been constantly increasing. Manufacturers have learned that by segregating and controlling their materials and supplies and dividing the operatives into departmental groups, increased production and greater efficiency result. Arranging the departments so that the course of the product is ever forward, results in a great saving of time and a corresponding increase in the amount of work of which the organization is capable. In the more modern plants special attention has been given to the physical arrangement of the various departments. The stores department where the incoming material is received is located as near as possible, not only to the department where the first operation of labor is performed, but to the means of transportation, whereby the material is delivered. The course of work is constantly forward, never doubling back or going twice over the same route, and finally reaching the shipping department which is located adjacent to the shipping facilities. The effect which such an organization has upon the elements of cost is decidedly simple except in the case of overhead. The materials and supplies present no particular problem, since in no matter which type of system is in-

When Departmental Distribution of Overhead is Indicated

volved, they emanate either from the main stores, or what might be termed branches of the main stores located in the departments and known as department stores. The direct labor originates in the various departments and causes no particular trouble in its handling. The treatment of the overhead is the problem which is hardest to deal with. While the statement has been made heretofore that it was inadvisable in the simple type of system to distribute the overhead to departments, and subsequently apply it to the product, it must be borne in mind that in the compound and complex type the situation is entirely different. These types frequently have to provide for complex and diversified product, and in such instances a departmental distribution of the overhead is not only desirable for a statistical purpose, but absolutely necessary in order to obtain results which most nearly approach correctness.

In the case of diversified product certain units go through all departments, certain units go through a part only of the departments, and in either instance certain units may go into departments where the overhead varies from heavy to light. It would be manifestly unfair to charge the product with overhead of departments through which it has not passed, or to burden product going through departments where the overhead is light with the overhead of departments wherein it is heavy. Where a variation of the overhead exists it is unquestionably more correct to localize and apply it to the product at points of contact. The justice of so doing is shown by the following

Cost Accounting

illustrations wherein the local and general methods are compared:

	Departments			
	Total	A	B	C
Light.....	\$24.00	\$10.00	\$8.00	\$6.00
Job No. 1.....	34 hours	8 hours	16 hours	10 hours
" " 2.....	11 " "	2 " "	4 " "	5 " "
	45 hours	10 hours	20 hours	15 hours

Departmental Distribution

	Job No. 1	Job No. 2
A.....	\$8.00	\$2.00
B.....	6.40	1.60
C.....	4.00	2.00
	\$18.40	\$5.60

General Distribution

	No. 1	No. 2
A.....		
B.....		
C.....		
	\$18.13	\$5.87
	45) \$24.00	.5333
	.5333	
	34	11
	21332	5333
	15999	5533
	\$18.1322	\$5.8663

When Departmental Distribution of Overhead is Indicated

In the above tabulation "light" is the item which has been selected for distribution. The total cost of the light for the period was \$24, used in the various departments, designated A, B, C as indicated. It is assumed that job No. 1 was 34 hours, and job No. 2, 11 hours in going through the three departments as indicated in the tabulation. By distributing the overhead to the respective jobs from departments, it is apparent that job No. 1 would bear \$18.40 and job No. 2, \$5.60; as against the respective amounts \$18.13 and \$5.87, were the overhead to be apportioned on the basis of total hours without regard to the amount of time spent in the respective departments.

It has been previously stated that one of the principal objects of departmental distribution was to secure statistical information. Such information is needed for administrative purposes and affords an opportunity for comparison which is invaluable. It may be made to serve as an index to efficiency. By distributing to the centers of production, such as departments, processes, or men, the items of expense or cost affecting such centers, and redistributing in turn to the units of product undergoing process the expense or cost thus connected, the establishment of a rate or amount per unit is made possible, which furnishes a ready means of comparison and indicates the capability of the operating center involved.

In like manner items of cost may be grouped around machines so as to produce similar results. The obtaining of rates has the effect of creating standards, while perhaps not standards

Cost Accounting

in the scientific sense, at least temporary standards which measure capacity and ability for work and answer that purpose until replaced. In this way they serve as an index to efficiency. Through the means of such statistics it may become evident that the increased cost of a certain process is due to the idle time or inefficiency on the part of the operatives. This may have occurred on account of a falling off in the amount of work, some fault in the method of distributing work, or delay on the part of the foreman in so doing. Proper statistics can be made to indicate such conditions promptly, thus paving the way to the application of remedies. Such remedies may be brought about, first, on the part of the foreman, by laying off a part of the force, or improving the method of distributing work; second, on the part of the superintendent in causing the foreman to become more efficient, either through the aid of advice, or such other measures as may suggest themselves in view of the circumstances surrounding the case.

CHAPTER XII

Defective Goods and Idle Time

In order to accomplish a full discussion of the subject of departmental distribution it will be necessary to consider two of the elements of cost, namely, materials and direct labor, in certain special phases which they present. These are defective goods and idle time. The question with regard to material here is, the way in which defective work shall be handled. In this respect any remarks must be qualified as has frequently been necessary, by stating that the ways of treating defective work depend upon the line of production.

There are three methods commonly used. The first is to divide the cost of the job or lot by the number of perfect units, thereby burying in the cost of the perfect units the cost of the defective work. The second way is to divide the cost of the entire lot or job by the number of the perfect units, after deducting the cost or scrap value of the defective work. The third way is to set up the defective work at its actual cost and carry it through as defective work, adding to the first cost any subsequent cost applicable thereto. As an illustration of the first methods, assuming the cost of producing 100 perfect units to be \$500—it is evident that if only 98 perfect units result the cost will be \$5.10 per unit. In the case of the second method, the cost will be \$5.06, if it is assumed that \$4, being the scrap value of the imperfect units, has been deducted from the cost of the

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lot, and the balance of \$496 divided by 98 perfect units. In the case of the third method, the cost per unit will be \$5,—98 being perfect and 2 imperfect. The second method is probably the most common. One of the collaborators on "a uniform method of cost-finding for steel foundries," has, in effect, this to say on the subject:

"Defective costings fall naturally into two divisions. First, those discarded at the foundry as imperfect, and second, those returned by customers. The reason for discard at the foundry may be either on account of construction, due to the complication of pattern or thinness of section, or imperfect practice. In such cases the job should be charged with the material, and labor credited with metal at scrap value, and the balance divided by the number of good castings. As a prevention against the return of defective castings by customers, the cost should be loaded with an arbitrary percentage based on the cost less the scrap value which should be credited to the proper reserve."

In the manufacture of hats, for example, the third method, while perhaps not most commonly used, is the most scientific. Defective hats are known as "knock-downs." The cost of "knock-downs" is of considerable importance. The question presented is, whether or not it pays to finish up for sale, hats which are imperfect when formed. Is it good practice to load the cost of "knock-downs" up to the point of "stock bodies," on perfect hats, and finish up for sale a hat, the proceeds from the sale of which, is considered as so much "velvet?" As a

Defective Goods and Idle Time

result of such practice "knock-downs" might very easily be sold at a considerable loss, whereas, if the proper information were available, the superintendent would be enabled to decide whether or not imperfect bodies might be profitably completed.

Labor needs no distribution to departments, since it arises there. The question with regard to labor is, what shall be done with the idle time? Theoretically speaking, idle time becomes in effect a supplementary labor cost, which, in practice, should be distributed over the jobs in process, in proportion to the time actually expended on each job. The subject of "idle time" will be treated more at length under "machine rates."

CHAPTER XIII

Distributable Overhead and the Bases of Distribution

In making the distribution of such overhead as permits of distribution to the various departments, care should be taken that only such overhead be distributed to the respective departments as distinctly applies to them. Such overhead as applies must be analyzed and some consideration given to the departments as to their physical characteristics, the capacity of their contents, and frequently the value of same. In this connection there must be considered the floor space, cubic contents, value of the machinery and the horse-power of same.

It is probable that before proceeding to the discussion of the items to be distributed some thought should be given to certain of these items as to the economic and other theories concerning them. Reference is made especially to rent, taxes, insurance, and interest on capital invested in machinery and tools.

Under the economic theory, these items are not considered as a part of the manufacturing overhead. Under certain popular theories advanced by engineers and accountants, these items play a most important part. The economist, and the accountant who endeavors to base his accounting on a substantial economic foundation, argues that rent plays no part in the manufacturing cost. It is an item of general overhead, to be taken into consideration in fixing the selling price, but from the standpoint of the business, taken as a whole, is a deduction from income, and no

Distributable Overhead and the Bases of Distribution

part of manufacturing costs. It is probable that before this question can be satisfactorily settled, considerable research on the part of men possessing the necessary qualifications will be necessary. It has in its favor, that its exclusion from manufacturing cost facilitates comparison where some concerns own their buildings, while others are obliged from their lack of capital to share a portion of their income with the landlord.

It will be pointed out by the opposers of this theory that a concern purporting to own its plant may be, in fact, paying interest on capital borrowed for the purpose. It will further be pointed out by such persons that even though this were an investment of owned capital, taxes are paid on the property in lieu of rent and interest. This contention may be met by the supporters of the economic theory with the statement that there is not a sufficient similarity in amount as among these three items to permit of their being included in the manufacturing overhead and thus tend to obscure the true cost of manufacture and interfere with a comparison of costs composed of like items.

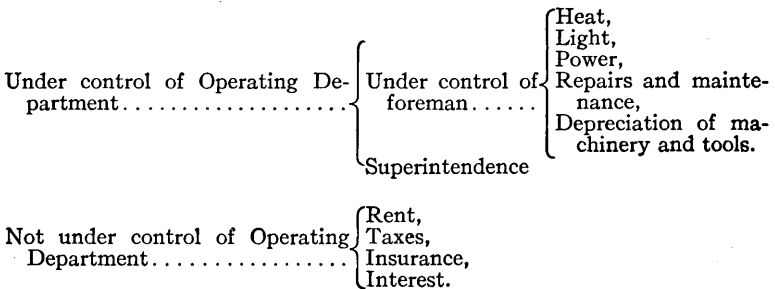
There would appear to be no more reason for including interest on capital and taxes, than rent, in manufacturing costs, as on account of being similar to rent, they are more properly chargeable against income.

The item of insurance also permits of some discussion. It is argued by the economists that insurance is not a true item of manufacturing cost. Insurance is a premium paid for the protection of capital and being an expense of capital, considered

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from the standpoint of the business as a whole, is a deduction from income. Advancement of this theory is usually confronted with the query as to why the salary of the watchman at the factory, who is engaged in protecting the capital of his employer, is not treated as a deduction from income rather than a part of manufacturing expense.

Having disposed rather indefinitely of the various theories covering certain of the items making up the overhead, they may now be considered with regard to those which fall within the control of the operating department, and with regard to certain of these, those which may be said to fall specifically within the control of the foreman, as well as those which do not fall within the control of the operating department. They may be listed and grouped as follows:



It will now be necessary to consider with regard to the above items their distribution to the departments and the various bases upon which they may be distributed. There may be eliminated

Distributable Overhead and the Bases of Distribution

from this class, repairs and maintenance, and depreciation of machinery and tools, since such items are local in their origin and do not require distribution.

Heat may be distributed on a basis of cubic yards, after first obtaining the cubic contents of all departments receiving heat. The cost of heat for all departments is divided by the number of cubic yards contained in same, and multiplying the rate thus obtained by the number of cubic yards in each department, to ascertain the cost of heat applicable to each.

The distribution of light depends upon whether or not facilities for measuring same by meter are available. Where electricity is used, and meters are found, the unit of measurement is the kilowatt hour. Where gas is measured by meter, the unit of measurement is the cubic foot. Where meters are not available light is distributed on the basis of square feet of floor space.

Power is apportioned on a basis of horsepower hours. This unit is obtained by multiplying the horsepower of the machines by the number of hours in operation.

Superintendence may be distributed on a basis of direct labor hours; rent on a basis of square feet; taxes on a percentage basis, the percentage being computed on the value which the contents of any given department bears to the total assessed value of all departments.

Insurance may or may not permit of localization. It should be localized, if possible; if impossible, it should be distributed on the basis of value. Interest should likewise be apportioned

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on the basis of value. It has not been thought necessary to repeat in each instance the formula for distribution, on account of its being practically the same in each instance and having been once given in connection with the distribution of heat.

CHAPTER XIV

Machine Rates

Distribution may not cease with departments. Having allocated the items of expense thus, we may go on further and redistribute within departments to processes, to individuals, or to machines. The theory being in each case the same, but as applied to machines slightly more interesting, we may proceed with its application thereto, and to discuss the question of machine rates.

The subject matter for distribution will depend upon the type of system, and may embody overhead alone, a combination of labor and overhead, or a still further combination of material, labor and overhead. The rates are of two kinds—the departmental, sometimes referred to as the “old” machine rate, and the allocated rate, sometimes known as the “new” machine rate.

The allocated rate may be either the fixed rate, involving one supplementary, or the scientific rate, involving two supplementaries. In order to find the departmental rate, it is necessary to divide the actual overhead of the department by the number of actual machine hours for the entire department. A rate is thus obtained which furnishes a basis for distributing the overhead to the jobs, in accordance with the number of machine hours shown by the respective jobs. This method is satisfactory, in case there is no bench work and the machines are of the same type, of the same value, occupy the same amount of floor space, and use the same amount of power.

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It should be noted that this method pro-rates the overhead. Objection to it is found in that it does not sufficiently localize the overhead, and the objection gives rise to a demand for a method which will permit of as much direct distribution as is possible. To supply this demand, the allocated machine rate, covering labor and overhead, was evolved. The rate here is obtained by dividing the total cost of labor and overhead as allocated to individual machines by the number of hours the corresponding machines are in operation. The cost applicable to the jobs in question is obtained by multiplying the rate by the number of machine hours on the respective jobs. This method may be used to advantage where the majority of processes are machine. Bench work, of course, complicates matters, and attention to the physical arrangement should be given in order that machines of the same type may be in the same group.

The fixed rate contemplates the use of one determined upon the basis of actual running time during the next preceding month or period. The charge to the jobs is obtained by multiplying the number of operating hours per job by the rate and crediting to the overhead a corresponding amount. The amount so credited, which, it will be noted, is an estimate based on past experience, will be offset at the end of the current month or period by the actual cost during the period, and as usually happens a difference will result.

This difference may mean that the fixed rate upon which the charges to jobs have been made was either too high or too low,

Machine Rates

and the difference must be distributed either as a debit or a credit to the cost of the jobs, in accordance with whether the fixed rate was too high or too low. It gives rise to what is known as a supplementary rate, and is obtained by dividing the "difference" by the actual number of operating hours. The redistribution is brought about by multiplying this supplementary rate by the number of actual operating hours shown by the respective jobs.

The scientific rate is the most complicated, but produces the most satisfactory results. It contemplates the estimating, or predetermining, of certain items of overhead for the year or period. Among these are:

Superintendence,	Depreciation,
Heat,	Taxes,
Light,	Insurance,
Power,	Interest.

The scientific rate also contemplates operation on the basis of maximum running time for each machine during the entire year or period. Items of overhead are first distributed to departments and subsequently to machines. The machine cost is then divided by the maximum operating hours in order to get a rate per hour. The charge to jobs is obtained by multiplying the number of actual operating hours devoted to the job, by the rate, and the crediting of a corresponding amount to the overhead.

Idle time, as in the case of the fixed rate, gives rise to the

Cost Accounting

necessity for further distribution and the obtaining of what is known as the first supplementary rate. This is ascertained by dividing the cost of the idle time by the total number of actual operating hours, and the distribution by multiplying the first supplementary by the number of hours on each job. As jobs are charged a corresponding credit is made to the overhead. It will be remembered that there are now two credits to the overhead, one arising at the time of applying the machine rate, and one at the time of applying the first supplementary. The process from this point is precisely the same as in the case of the fixed rate. Actual overhead for the month or period is now ascertained and charged to the overhead, thereby offsetting the credits just previously mentioned and usually resulting in a difference between the actual overhead and the predetermined overhead, plus the first supplementary rate. The manner of disposing of this difference gives rise to the second supplementary rate, which is obtained by dividing this difference by the actual operating hours on all jobs and distributing to the jobs in accordance with the number of hours each shows. As this last supplementary is charged, overhead is credited, thus actually balancing the overhead account. In order to bring this out, reference to the following ledger account, as well as the succeeding illustration, may be found helpful:

Machine Rates

OVERHEAD ACCOUNT

Actual.....	\$3,000.00	Machine rate.....	\$2,000.00
		1st Supplementary.....	400.00
		2d ".....	600.00
	<u>\$3,000.00</u>		<u>\$3,000.00</u>

ILLUSTRATION

	Full Time	Estimated Overhead Machine Rate	
	2,400 hours	\$2,400.00	\$1.00
Actual time.....	2,000 "		
	400 hours	Idle hours × \$1.00 = \$400.00.	
	2,000 hours)	<u>\$400.00</u>	

.20 = 1st Supplementary.

\$3,000.00 = Actual overhead.

2,400.00 = Estimated overhead.

2,000) 600.00 = Excess to be distributed

.30 = 2d Supplementary.

<u>575 Hours</u>	<u>720 Hours</u>	<u>705 Hours</u>
<u>Job No. 1</u>	<u>Job No. 2</u>	<u>Job No. 3</u>
575 × \$1.00 = \$575.00	720 × \$1.00 = \$720.00	705 × \$1.00 = \$705.00
575 × .20 = 115.00	720 × .20 = 144.00	705 × .20 = 141.00
575 × .30 = 172.50	720 × .30 = 216.00	705 × .30 = 211.50
<u>\$862.50</u>	<u>\$1,080.00</u>	<u>\$1,057.50</u>
	\$862.50	
	1,080.00	
	1,057.50	
	<u>\$3,000.00</u>	

CHAPTER XV

Wage Systems

Before getting into a discussion of this subject a few words should be said as to the relation of Wage Systems to Cost Accounting.

The success of a professional accountant depends in a large measure upon his value to the client. His value is demonstrated by his ability to save the client money. One of the principal ways of saving money is reducing cost. An accountant should therefore be in a position to indicate to the client, the manner in which costs may be reduced. Wage systems undoubtedly lower costs and the accountant in order to act intelligently and be of most value to his client, should be familiar with the subject and the relative advantages and disadvantages of the various systems. The constant struggle of to-day is to effect the reduction of costs. Why? It may be that competition requires it, or it may be due to a desire on the part of the manufacturer for increased profits.

While it is quite evident that costs may be reduced by the reduction of any of the three elements composing same, it is probable that the item of labor presents greater possibilities of successful reduction than either of the two other elements.

There are two ways in which labor cost may be reduced. The first is through the reduction of wages. The second is through an increase in the production. The first method produces a

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strenuous objection on the part of the laboring man; a complaint that he is being ill-treated, or perhaps his refusal absolutely to continue at reduced rates. The second method is the more scientific and satisfactory to the wage earner and given the demand for unlimited production, is to be preferred by the manufacturer.

As an illustration, whereby the same result is accomplished, reference may be had for a moment to the tabulation which appears below and shows the application of the two methods, to the casting of pin trays.

	Workman I	Wage \$2.40	Production Trays 120	Cost Per Unit .02
(1).....	I	\$1.80	120	.015
(2).....	I	2.40	160	.015

Considering \$2.40 per day as the normal wage of a man who produces 120 trays, it is evident that the cost per unit will be .02. If the manufacturer desires to reduce the cost to .015, he may accomplish this result by decreasing the wage to \$1.80, assuming that the production remains constant, or he may allow the wage to remain at \$2.40 and insist that the operative shall increase the production to 160 trays.

The reduction of the wage to \$1.80 brings a storm of protest from the operative. Insistence that he shall increase his production causes him to become sullen, and perhaps complain that the employer is a slave driver. In the instance where his wage is reduced, if the workman continues, it is probable that he will "soldier," with the result perhaps, that the production per day

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will fall from 120 to 90, thus, based on the wage of \$1.80, restoring the cost to .02.

It becomes quite evident then, that a reduction of the wage is practically out of the question, and that in order that the cost may be reduced, the production must be increased, and the question before us now, is how this increase shall be accomplished.

The small boy who is paid for doing chores, does them more cheerfully than if he is compelled to do them without compensation. The school-boy who receives a quarter from his father every time his report card shows 100% in arithmetic, usually does better work in arithmetic on account of the quarter awaiting him. The quarter acts as an incentive. Laboring men are not unlike school-boys in this respect. They will do more work per day and they will do better work per day, if some incentive is offered, than if driven to the same result. Let us assume that the incentive offered to the operative is one-half of the saving brought about through a reduction of the costs. It is not unusual to find that men, if offered the proper incentive, are capable, with ease, of doubling the production. Under such a condition, with a normal daily wage of \$2.40 it is evident that the cost per unit would be .01. The saving per unit will be .01 which if equally divided with the workman, on a basis of 240 units produced, will give as the workman's share \$1.20. The workman's daily wage will then be \$3.60, while the net cost of production per unit to the employer will be .015.

The conclusion to be drawn from the above is that the wage

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system which has as its basis, the sharing of savings with the employes, has accomplished the desired result of reducing costs, increased the wage of the employe, and thereby proved entirely satisfactory to all concerned.

The following tabulation may bring out more graphically the preceding statement:

	Wage	Production	Cost
Normal	<u>\$2.40</u>	<u>120</u>	<u>.02</u>
Increased Production	\$2.40	240	.01
½ Saving to work- man	<u>1.20</u>	<u>240</u>	<u>.005</u>
Workman	\$3.60	240	.015

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In discussing the above, the question is often asked, Why not as an alternative, introduce piece rates? Here is an incentive indeed. The benefit, however, accrues largely to the workman. It is true of course, that there will be a certain amount of saving in the overhead, due to increased production, but that no saving will be effected so far as the labor is concerned.

One hundred and twenty units at .02 will cost \$2.40, and 240 units at .02 will cost \$4.80. To use an expression popular in

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connection with the discussion of piece rates, operatives "work their heads off."

Piece rates ultimately prove unsatisfactory to the workman, because of the fact that as soon as the wage becomes excessive it is sure to result in a cut. The workman thus becomes dissatisfied and unconsciously adopts a standard.

Mr. George Frederick Stratton writing on the subject in the March, 1910, number of "System," relates the following incident:

"A young man secured a job in the brass finishing department. He was a green man and started at day rates to learn polishing. Specializing on such work, he advanced sufficiently in three weeks to go on to piece work. In two months he jubilantly exhibited a pay check calling for \$14.00 and was applauded by his family. 'It's pretty good now! but it's as much as I'll get if I work there ten years.' 'How's that?' inquired his father? 'You're on piece work and you'll surely get more expert as the time goes on.' 'Sure thing,' retorted the young man, 'but \$14.00 is the limit. If any man runs over that in our room, he'll get his head punched—and he'll get the rates cut, too.'"

Piece rates may be effectively employed, provided the incentive is restricted. That is to say, an incentive may be offered to increase production, if the rate is reduced on the surplus; for example:

120 at .02—	\$2.40
120 at .01—	1.20
<hr/>	<hr/>
240)\$3.60(.015

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It will be noted from the foregoing, that the same thing has been accomplished in the application of piece rates to the problem that resulted previously where the daily wage basis was in effect.

The application of the broad principle in the first instance is frequently seen in connection with machine work. Here the reduction in cost is effected through a saving in time, rather than an increase in production. If the average or normal time required for the accomplishment of a certain task is eight hours and the rate of compensation, or machine cost is .60 an hour, the cost of the job will be \$4.80.

If by close attention to his work, and the intelligent application of all his faculties, a workman is able to reduce the time of operation to six hours, it is quite apparent that at the same rate per hour, or machine cost of .60, he has effected a saving of \$1.20. Even viewed from the standpoint of equity, there would appear no reason why in the natural order of things, the workman should not receive some benefit accruing through the saving of \$1.20 at his hands; why he should not receive some premium or bonus for having accomplished this saving.

Whether or not he is entitled to it from an equitable standpoint, it is certainly good business on the part of the employer to share the saving with him, to the end that he may have some incentive for continuing his efforts to lower the cost. If he receives half the saving, in the above mentioned instances it will amount to .60. It will be seen that his day's pay, assuming that he does no further work after accomplishing the task set, will be

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made up of two elements; one being the regular wage at a fixed sum per hour, and the other the premium or bonus for the saving in time, amounting respectively to—\$3.60 and .60 or a total of \$4.20 for the day, as illustrated herewith:

	8 hours at .60	=\$4.80
	6 " " .60	= 3.60
	<hr/>	<hr/>
saving)	2	2)\$1.20
	<hr/>	<hr/>
premium)	1	.60
	<hr/>	<hr/>
cost	7	.60 = \$4.20

This work taken in connection with an eight hour day, leaves the operative still two hours in which to work on another task and thereby further increase his daily wage.

It should be borne in mind that increased speed and increased production give rise to an increase in the amount of defective work and a corresponding need for the establishment of an inspection department.

Most wage systems are constructed on the principles outlined above, and while some are known as premium systems and some as bonus systems, there is only a very slight technical difference between these two terms. The word "premium" is usually employed to indicate a division in the saving in time, whereas, the term "bonus" implies an increased rate offered for speed and skill.

Up to this point, the discussion has been confined entirely to

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the reduction of cost based on the saving of labor. We shall also have to consider a similar saving with regard to overhead, or to overhead in conjunction with labor. The most common type of system which takes into account both labor and overhead, has for its basis what is known as the differential rate. The rate per hour is arranged on a sliding scale which increases in proportion as the number of units produced increases. The workman who produces 12 units receives a proportionately higher rate per hour than the workman who produces only 10 units. The system operates to the advantage of the efficient workman and to the disadvantage of the inefficient workman. It is said to "differentiate" between the good workman and the poor workman. On this account the rate is known as the "differential."

While it will be seen from the tabulation herewith submitted that the increase in the number of units produced carries with it an increase in the rate, and a consequent increase in the wage of the operative, a consideration of the units taken in connection with the overhead will show that as the units of production increase, the overhead decreases.

DIFFERENTIAL RATE

Labor Cost	Overhead Cost	Cost per Unit
10 units at .30 = \$3.00	\$1.32	\$1.62
11 " " .32 = 3.52	1.20	1.52
12 " " .34 = 4.08	1.10	1.44
8 units at .26 = \$2.08	\$1.65	\$1.91

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The advantages of the differential rate are, that it offers an incentive to the workman and increases his wage if he takes advantage of it.

From the standpoint of the employer it is equally advantageous, in that it decreases cost by increasing production, and in general raises the standard, by enabling the employer to distinguish between the efficient and inefficient workman.

CHAPTER XVI

The Fixing of Wage Rates

The success of all wage systems depends upon the fixing of rates. Before a rate may be fixed it is necessary to determine,

1. Which are the best methods and tools to use.
2. What length of time is required by the workman of average capacity to perform a task without undue exertion?

The necessity for this sort of thing was first seen about thirty years ago, by Mr. Frederick W. Taylor, who was at that time connected with the Midvale Steel Co. Mr. Taylor went about the task of gathering statistics and classifying them in a scientific manner, so as to permit of their use in determining the best methods and tools to use, and the time required for the performance of specific tasks. In a paper on the subject of Shop Management, Mr. Taylor makes the statement that the two facts which appear most noteworthy in connection with the method of Shop Management, are,

“*First*—What may be called the great unevenness or lack of uniformity shown even in our best run works, in the development of the several elements which together constitute what is called the management.”

“*Second*—The lack of apparent relation between good shop management and the payment of dividends.”

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“The art of management has been defined as knowing exactly what you want men to do and then seeing that they do it in the best and cheapest way. What the workmen want from their employers beyond anything else, is high wages, and what employers want from their workmen most of all, is a low cost of manufacture. The possibility of coupling high wages with a low labor cost, rests mainly upon the enormous difference between the amount of work which a first-class workman can do under favorable circumstances, and the work which is actually done by the average man. First-class men are not only willing, but glad to work at their maximum speed, provided that they are paid from 30% to 100% more than the average of their trade.” Having in mind the above facts, Mr. Taylor made a careful study of the best methods and tools to use, and evolved a system for standardizing the time of operations which may be best described in the authors own words, as follows:

“In 1883 while foreman of the machine shop of the Midvale Steel Company of Philadelphia, it occurred to the writer that it was simpler to time with a stop-watch each of the elements of the various kinds of work done in the place, and then find the quickest time in which each job could be done, by summing up the total times of its component parts, than it was to search through the time records of former jobs and guess at the proper time and price. After practicing this method of time study improvements for about a year, as well as the circumstances would permit, it became evident that the system was a success. The

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writer then established a time study and rate fixing department, which has given out piece work prices in the place ever since."

The Taylor system while it imposes upon the management the burden of seeing that the work is done in the time and manner specified, also provides a higher rate for increased efficiency.

In 1886 Mr. Henry Towne originated a wage system which was improved and made practical by Mr. F. A. Halsey, who in 1891 described the system in a paper before the American Society of Mechanical Engineers. The Towne-Halsey system contemplates as a standard, the quickest time in which a job has been done. The workman who does it in a shorter time receives the same wage per hour for the time he is engaged upon the job, and in addition a premium for having worked faster, which ranges from one-quarter to one-half of the saving in time.

It may be stated here, that no system has yet been evolved to which there was no objection. An objection was raised to the Halsey system in that the rate became excessive after 50% had been saved.

In 1901 Mr. James Rowan read a paper before the mechanical section of the International Engineering Congress, in which he advocated the allowance of a bonus based on such a percentage of the regular wage as the time saved bears to the standard time. For example, if the standard time for the operation were one hour, and the standard wage .30, a saving of six minutes would be equivalent to 10%, and 10% of .30 or .03 added to the standard wage, would give as the wage per hour .33. Objection

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was found to this system, that the bonus was too great in proportion to the saving during the first hours saved.

Among other systems which have gained both notoriety and popularity are:

Cardullo,
Searle & Nicholson,
Gantt,
Emerson.

Under the Cardullo system the wage is arranged on a sliding scale based on the percentage of time saved, but is limited by the maximum, no matter how much time is saved.

Searle & Nicholson advocate a system whereby the workman receives one-half the time saved until the saving reaches 50%, thereafter a percentage based on the ratio which the time saved bears to standard time. This is a combination of the Halsey & Rowan methods and would seem to overcome the objections found to both.

The Gantt system does not differ materially in principle from the other systems, except that in addition to the reward for efficiency offered to the operative, and which Mr. Gantt specifies shall be liberal, the reward shall be extended to those who supply the operative with materials and appliances to enable him to maintain the efficiency specified.

Before discussing the Emerson system, which serves as an introduction to the next topic, a few words may be said con-

The Fixing of Wage Rates

cerning the various profit-sharing and stock-distributing systems, which are becoming largely in vogue. Rewards of this description are intended to promote co-operation and act as an incentive to the workman; to decrease cost by increasing production. They are not as a rule successful. They fail usually, so far as the workmen are concerned, because of the fact that the profits do not depend entirely upon the workman. A saving may be made by the manufacturing department through a reduction of cost whereby profits are insured, only to have such profits dwindle on account of the shortsightedness on the part of the selling organization, or through poor judgment on the part of an administrative officer. This objection may be overcome, however, by fixing a standard cost at which the product is credited to the manufacturing department; any reduction in this cost being considered as a saving attributed to the manufacturing department and a part thereof set aside and distributed among the men as profits. Notwithstanding the fact that the general objection has been overcome, these systems are usually deemed to be unfair and inequitable, since it usually occurs that the men who contribute most to the profit get the smallest share thereof. Workmen as a rule prefer individual return for individual effort, which the wage system accomplishes.

Mr. Harrington Emerson recognized this tendency of human nature when he originated the Individual Effort System.

The Emerson System became famous in connection with its adoption and use in the shops of the Santa Fe Railroad, to the

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extent that it is popularly known as the Santa Fe System. The essentials of the Emerson Systems are:

- A. Standard time, or time in which the work should be done;
- B. A premium for efficiency.

The premium begins at 66 $\frac{2}{3}$ % efficiency and gradually increases until 100% efficiency is reached, in which case, the premium equals 20%. Above 100% efficiency the premium increases rapidly constituting an increase of 1% premium for each increase of 1% in the efficiency.

CHAPTER XVII

The Efficiency Department

One of the most striking innovations of recent times is that of the so-called efficiency department. It is mentioned here, on account of the close relation which it bears to Cost Accounting. It is presided over by the efficiency engineer, whose duty it is to determine the measure of return which the employer shall receive for the money which he employs in manufacturing operations.

The house-wife who purchases in the market a bushel of potatoes for one dollar, expects to receive in return the standard of quantity as well as the standard of quality. It is considered equally appropriate that the entrepreneur who invests a dollar in manufacturing operations should expect to receive a standard return of quantity and quality.

It is the duty of the efficiency engineer to endeavor to bring this about. His function is to fix standards of quantity and quality through the aid of time studies. Just as the mining engineer makes an assay of ore, so the efficiency engineer tests the quantity and quality of the material used as well as the quantity and quality of workmanship. He must have a broad knowledge of the four requisites of organization, namely:

- Machinery,
- Men,
- Materials,
- Methods.

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He is the chief of staff, whose assistants are specialists in the above mentioned lines. The staff determines what shall be done and prescribes the methods for accomplishing the work.

The line organization performs the work in accordance with the methods prescribed, and has always at its command highly specialized staff knowledge upon which it may call for assistance.

Under such an organization, each branch of the work is in charge of one of the assistants.

The man in charge of machinery has as his duty the standardization of all machinery and equipment. To him is assigned the task of securing the proper types of machines and tools which are the most efficient. He advises as to their care and decides upon the location of each, with a view to securing the most effectual progress of the work through the plant. One case is reported where a 40% increase in the output was secured by a rearrangement of machines.

Another assistant chief of staff looks after men and conditions, which is one of the most interesting as well as the most difficult branches of the work. He supervises the standardizing of conditions and requirements that fall within the scope of his duties. He should plan, direct and advise as to the welfare of the employes. He should see to it that before an employe is engaged, he submits to examination as to his moral, physical and professional qualifications. Emerson goes to the extent of saying that "it ought to be as difficult to enter the services of a great

The Efficiency Department

corporation, as to pass the entrance examination to West Point; but once in, it ought to be a catastrophe for a man to be forced to leave; because the company provides so much that he cannot provide himself, for his physical, financial and professional welfare and because it rewards individual efficiency."

Great attention is being paid in these days to the welfare of employes. Great corporations as well as individual employers are giving more attention to providing better light and better air. Many manufacturing plants are equipped with automatic exhausts for the removal of dangerous particles of dust, which heretofore have been allowed to fill the atmosphere in which the employes worked. Over-crowding of work rooms is being avoided and operatives are provided with a place to wash and bathe, and in many instances comfortable dining rooms in which to eat. Medical attention is furnished and ample means of escape from the buildings in case of fire provided. In order that ample opportunity for recreation may be had, club rooms and club houses, with billiards, pool, bowling and all other appurtenances thereto, are provided by the company free of charge. In some cases the club house contains an auditorium where entertainments are held and lectures are given. One Western company went so far as to provide and equip a first-class bar, on the theory that the men would have liquor and the company preferred that they should have good liquor rather than poor.

Materials are looked after by another assistant chief of staff, who controls both the purchasing agent and the stores depart-

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ment. He standardizes the material to be used and specifies the kind and quality to be purchased. He prescribes the methods necessary for its care, to the end that it may not deteriorate, be wasted or be used extravagantly.

The man in charge of methods, prescribes the methods whereby standards may be attained. It is his duty to advise workmen as to the most efficient use of equipment, machines and tools. In short, he is called upon to provide methods which will result in doing the most work in the shortest time and better work with less effort.

The efficiency organization, of course, requires records and accounting. Records are needed of machines, as to their installation, operation and maintenance. It is especially necessary that breakdowns and repairs shall be recorded. With regard to materials, a record of the purchases, issues and amounts consumed; as to work performed, both the quantity and quality.

An authority on this subject states that it is impossible to maintain either standards or records, unless they are tied into the cost accounting.

Standards serve to develop a predetermined cost. Taking into consideration the cost of material as determined by the standards of quantity and quality, the cost of labor as determined by the standard time of operation, the cost of the overhead as determined by the standard of the various elements composing it, it is possible to predetermine or obtain an estimated cost which may be used as a standard or basic cost and which provides for 100% efficiency.

CHAPTER XVIII

Reconciling Predetermined and Estimated Costs With Actual Costs

As a matter of fact, experience shows that there is frequently a wide difference between the ideal or standard and the actual. What should be is one thing, and what has been is another. Broadly speaking, it may be said that standards cannot be maintained. Failure to maintain them is due to

1. Inefficient material—material which is below the standard of quality and requires more than standard of quantity.
2. Inefficient labor, due to inefficient workmen, methods or conditions.

Cost Accounting is required because of inefficiency. It is the duty of the efficiency engineer to say what the cost *should be*. It is the duty of the cost accountant to say what the cost *has been*.

At this point a solution of the problem as to how a reconciliation may be effected between predetermined costs or estimated costs on the one hand and actual costs on the other, presents itself.

Predetermined costs should be technically distinguished from estimated costs, in that they are constructed from predetermined standards scientifically obtained, whereas, estimated costs are purely hypothetical and are founded on the assumption that the

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costs for the current period will be the same as those of the next preceding period.

As an illustration of the reconciliation between estimated cost and actual cost, attention is invited to the facts contained in the following tabulation:

	Total	Material	Labor	Overhead
Job No. 1.....	\$3,080	\$1,200	\$1,600	\$280
“ “ 2.....	2,200	1,000	1,000	200
	\$5,280	\$2,200	\$2,600	\$480

The application of the principle to contract work, with which everyone is more or less familiar, will perhaps serve to make the illustration more striking. It should be noted that the accounts which we are about to reconcile are those contained in the general ledger, and the question before us is,—how we may carry in the general ledger estimated or predetermined costs, without interfering with the actual costs as developed by the financial accounts, and at the same time bring them into agreement at the end of the period. This is accomplished, so far as the estimated costs are concerned, through the medium of two (2) accounts, namely:

- Cost of contracts;
- Reserve for cost of contracts.

It is usually possible to obtain from a contract book, wherein the estimates of the jobs are listed, a total of the entire estimated

Reconciling Predetermined with Actual Costs

cost for all jobs during the period. From these figures, which, in the case of the above tabulation, amount to \$5,280, the following journal entry may be framed:

Cost of contracts.....\$5,280
 To Reserve for cost of contracts.... \$5,280

Let us assume that at the end of the period the actual cost of the two contracts above mentioned is \$5,780. This amount will have been charged to "Reserve for cost of contracts" concurrently with the credits to material, labor and overhead. By reference to the following ledger accounts it will be seen that the account "Reserve for cost of contracts" would at this point show a debit of \$5,780 and a credit of \$5,280, and the difference between the two sides of the account would indicate the extent to which the estimate was incorrect.

DR.	Cost of Contracts	CR.	Reserve for Cost of Contracts .	
Estimated... \$5,280			\$5,780	\$5,280
Reserve..... 500				500

In order to effect the reconciliation, which will close out the "Reserve for cost of contracts" and make the "Cost of contracts account" show the actual cost, a second journal entry in the amount of \$500 is necessary.

Cost of contracts.....\$500
 To Reserve for cost of contracts..... \$500

The question of reconciliation would be comparatively simple if the question of uncompleted contracts were not involved. This

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difficulty may be overcome by treating the uncompleted contracts as inventories in the case of both accounts involved, and proceeding as before. The above method of handling these accounts becomes more valuable when the principles applied to the cost in total are applied to the elements making up the cost. Under such circumstances the journal entry for placing the estimated cost on the books would be as follows:

Estimated cost of uncompleted contracts.....	\$5,280
To Reserve for material, uncompleted contracts.....	2,200
" " " labor, " " ".....	2,000
" " " overhead, " " ".....	480

Assuming that at the end of the period job No. 1 is completed and job No. 2 uncompleted, the proper steps are, first, to deduct the items involved in the above journal entry affecting job No. 2 and bring them down as inventories. Assuming further that the total actual cost of job No. 1 is \$3,280, distributed as follows:

Material.....	\$1,200
Labor.....	1,600
Overhead.....	480

the proper journal entry would be:

Reserve for material, uncompleted contracts.....	\$1,200
" " labor, " " ".....	1,600
" " overhead, " " ".....	480
To Material, labor overhead.....	\$3,280

It will then be apparent that by posting the above journal entries to the proper ledger accounts that, as to the material and

Reconciling Predetermined with Actual Costs

labor in job No. 1, both have been correctly estimated, but that the overhead has been under-estimated in the amount of \$200. The proper journal entry for effecting the reconciliation is as follows :

Cost of contracts	\$3,280
To Estimated cost of uncompleted contracts	\$3,080
Reserve for overhead, uncompleted contracts	200

A further illustration of the application of these principles will be found in the following tabulations and journal entries. The journal entries may be used in cases where, in the absence of a cost system, it is desired to point out to a client engaged in contracting, the measure of inaccuracy on the part of his estimating department.

No. 1	\$10,000	}	Estimated cost of various contracts.
" 2	20,000		
" 3	25,125		
	\$55,125		

FIGURES SHOWN BY GENERAL BOOKS

	12/31/08	Purchases	12/31/09	Cost
Inventory, material	\$3,000	\$25,000	\$2,000	\$26,000
" uncompleted jobs	15,000	. . . . .	14,000	1,000
Labor . . . . .	. . . . .	18,000	. . . . .	18,000
				\$45,000
Overhead, various items . . . . .	. . . . .	. . . . .	. . . . .	13,500
		Actual cost		\$58,500
Cost of contracts (estimated)			\$55,125	
To Reserve for cost of contracts				\$55,125
Reserve for cost of contracts			58,500	
To Material, labor, etc.				58,500
Cost of contracts			3,375	
To Reserve for cost of contracts				3,375

CHAPTER XIX

The Report of the Cost Department

It will be remembered that at the beginning of the first chapter it was proposed to discuss three topics. These topics embraced, the nature of the information being sought, the means of obtaining the information, and the use to which the information is to be put after it has been obtained. The first topic was covered by an inquiry into the objects in ascertaining costs and which, briefly summarized are, to make them serve as a basis for fixing selling prices and to furnish information to the proprietor or administrative officer which will be of help to him in deciding upon administrative policies. Such policies may include determining which lines of production or merchandise are profitable, and which are unprofitable, and instituting methods which will reduce costs. A discussion of the means of obtaining the information would appear to have been covered by reference to the system employed for gathering the information, and there remains to be explained the use to which the information is to be put after it has been obtained.

Obviously, the party in interest is the proprietor or administrative officer. The information which he seeks is that which will enable him to draw quickly a conclusion from certain facts presented to him concerning the costs. As a rule he is not a man whose time and patience will permit of delving through

The Report of the Cost Department

voluminous books and records for this information. It must be summarized and placed before him so that its full significance will be evident at a glance. The medium for presenting the information in such summary form is the cost sheet, or the report of the cost department. The construction of the cost sheet will depend largely upon the nature of the information desired by the proprietor.

Regardless, however, of circumstances, it is always essentially a statistical report and is based on unit costs. The units will vary, in some cases dozens, in others tons, in others single units, and in still others the unit may be the contract or job. Depending upon the use to which the information is to be put, the cost sheet may be compiled on a production or on a sales basis. The amount of detail which it carries will depend upon the extent to which the administrative officer uses it as an index to operating efficiency. Generally speaking, the cost sheet must show distinctly with regard to unit costs the material, labor, and the overhead. In order to show the relation of the various elements of the material cost to the total material cost, it may sometimes be necessary to present in classified form all the materials involved. Such an arrangement is admirably adapted to comparison. At times it may be interesting for administrative and comparative purposes to show the various labor departments separately. The proprietor may also be interested in knowing all the items which make up the overhead.

For the purpose of fixing a selling price and the supervision

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of operations, a cost sheet on a production basis, that is to say, one showing the unit cost of finished goods orders, is usually sufficient. If it is the desire of the management to ascertain the profit on various contracts, or various orders, a cost sheet showing this information is very much more difficult of accomplishment and much more complex. The difficulty lies, in that a shipping order may comprise various qualities, or classes, of goods coming from various production or finished goods orders wherein the cost varies, and it becomes necessary to assemble the unit cost of the various finished goods orders in order that the total cost of the shipping order may be ascertained for comparison with the sales price to show the profit on the order in question.

The general arrangement of the cost sheet is illustrated in a form to be found on page 101. It is presented in the simplest possible form in order that the principles underlying its construction may be readily seen.

The Report of the Cost Department

OUTLINE FOR COST SHEET
Form No. 12

	FINISHED GOODS ORDER NUMBER			
	1	2	3	4
MATERIAL (ITEMIZED).....				
LABOR DEPTS.....				
OVERHEAD.....				
TOTAL.....				

[THE END]

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