

1-1920

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Recommended Citation

Hilditch, F. W. (1920) "Cost Accounting in the Chain Industry," *Journal of Accountancy*. Vol. 29: Iss. 1, Article 2.

Available at: <https://egrove.olemiss.edu/jofa/vol29/iss1/2>

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Cost Accounting in the Chain Industry*

BY F. W. HILDITCH

Owing to the various operations employed in the manufacture of chain as distinct from jewelry chain and the variations in the processes themselves resulting from the numerous sizes and different kinds of chain manufactured, the cost accounting methods of the chain industry comprise many interesting and unique features.

The manufacture of chain demands no new principles of cost accounting, but, as hereinafter shown, some of the methods of application are the outgrowth of manufacturing conditions peculiar to this particular industry.

At the present time there are four distinct processes for the manufacture of the various grades and sizes, and the adoption of any of these by a manufacturer is governed to a great extent by the kind and size of product required and the amount of capital available for investment in the necessary equipment.

OPERATIONS

The four operations are as follows:

1. The stamped link
2. The weldless wire link
3. The electric weld
4. The fire weld

In the first process, suitable for small sizes only, flat links are stamped out of band or hoop steel, which are then bent and assembled into chain by automatic machinery. This product is plated and is then sold as coil chain, or, after the chain has been fitted with certain attachments (some of which are purchased and some fabricated by the chain manufacturer), complete articles are produced, such as halters, cow ties, kennel chains, etc.

The weldless wire link process also is used for the manufacture

* A thesis presented at the November, 1919, examinations of the American Institute of Accountants.

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of the smaller sizes of chain, but through this process wire is converted into short or continuous lengths of chain in one operation, the several links of which are so formed that they will withstand a fixed tensile strain without pulling apart. Various machine methods of forming these links are used by different manufacturers and sometimes by the same manufacturer, with the result that there are several styles of this chain on the market, each having its own advantages. This product is finished in a similar manner and is sold for much the same purposes as the stamped link chain.

Electric welded chain is confined to small sizes, although covering a somewhat wider range than the chain manufactured by the first two processes. Two distinct operations (*viz.*: forming and welding) are required to complete the chain to the point where it can be converted into commercial articles. The material used is wire or rods up to about one-half inch in diameter and is formed on specially designed machines into various styles of links which are made singly or in continuous lengths, according to the product desired and the method to be used in welding. The welding is done by electricity on machines, some of which are practically automatic, while others are only semi-automatic, requiring more attention and greater skill on the part of the operator. This chain is frequently sold in continuous lengths with no finish, or with a bright finish obtained by "tumbling," and a considerable portion is fitted with special attachments and thus converted into articles similar to those produced from stamped link or weldless link chain.

Fire weld chain can be made in almost any size, but this process is not practicable for the very small sizes because of the excessive labor cost as compared with chain made by any of the other processes. The links are made in various styles, according to trade requirements. For the smaller sizes they are formed by cold winding rods into spirals which are cut into links, and for the larger sizes by heating short bars and shaping them into links by hand or machine. These links are then heated in coke, gas or oil fires and welded wholly by hand hammers or in part by hand and in part by power-operated hammers. This chain is usually sold in specified lengths fitted with special end links or attachments, and frequently with both.

Chain made by any of the four processes described requires a certain amount of inspection, which, in the case of electric welded chain, is a very rigid one. Much of the electric welded chain and practically all fire welded chain must also be subjected to a strength test according to standard specifications.

Chain plant cost accounting is somewhat complicated because some manufacturers use more than one of the processes heretofore described and frequently adopt varying methods of operating each process. Furthermore, in the case of welded chain the same styles and sizes, within a certain limit, may be made by either of the two welding processes, and some manufacturers fabricate or assemble many of the attachments used on the chain, necessitating forming and assembling operations, which are sometimes more complicated than those involved in the manufacture of chain.

STOCK RECORDS

For a modern chain plant properly controlled stock departments and the maintenance of accurate records of incoming and outgoing material are vitally important features of a trustworthy cost accounting system. Contracts for raw material must be made far in advance of consumption dates. The tonnage turnover is unusually large, and, while the supply of raw material must be continuously replenished by an inflow of new material, the accumulation of surplus stocks should be avoided—otherwise an excessive amount of working capital would be employed unnecessarily. Moreover, the demand for many of the chain products is seasonal, especially those for agricultural and lumber purposes, which necessitates the carrying of a very large stock of finished and partly finished material at certain periods of the year, when it would be found impracticable to take a physical inventory.

Material forms the major element of the manufacturing cost of chain, and therefore accurate costs are largely dependent upon accurate material consumption records.

Hence it is absolutely essential that continuous stock records be maintained of raw materials and manufactured products by sizes and kind which should show at all time quantities on hand, quantities consumed or shipped during a given period and quantities on order. These records must be compiled from receiving reports for all incoming goods, from requisitions for all materials

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consumed, from daily production reports for all product stored and from shipping reports for all product shipped. From the summaries of these reports (the details having been posted to the numerous commodity accounts maintained in the stock ledgers) the money values are entered in the factory ledger, in which classified material accounts are maintained as controlling accounts for stock ledgers similarly classified.

To keep the stock records thoroughly revised as to quantities actually on hand, it is necessary to take frequent physical inventories of various items of stock, so that the book records may be compared with physical conditions several times within a fiscal period. Any quantity adjustments necessary in the stock records must be made in the material controlling accounts on the factory ledger at money values.

In a well-organized plant it is the custom for the storekeeper, when placing a requisition on the purchasing agent for a replenishment of stock, to take a physical inventory of the material being requisitioned, as the stock on hand at that time should have reached its minimum; consequently, the task becomes less onerous and lends itself to greater accuracy. These inventory reports are compared with the purchasing agent's record of maximum and minimum quantities to be carried of each commodity—and therefore largely prevent the purchasing of material when not really needed—and are afterwards forwarded to the stock ledger clerks for comparison with their records, which are adjusted to the physical conditions after proper inquiries have been made as to the discrepancies in quantities of any moment.

SCRAP

Scrap is an important element affecting the cost of chain, and therefore adequate records of scrap produced are necessary in order that credit can be given, at scrap value, to the product in the manufacture of which the scrap was made. These records also are important for the determining of the efficiency of machines and operators and the quality of the material used.

It may here be stated that the majority of manufacturers in any line of business where scrap is produced set its value at the current market price or at an arbitrary figure which reduces the production cost of the main product accordingly. In the case of

salable scrap the writer has always advised that its value should be the current market price, less an estimated amount to provide for the labor cost of picking up and loading the scrap on cars and also for a selling cost. Unless this method is adopted, the scrap is being carried in the inventory at selling value; and, moreover, the cost of the main product is understated by the amount of expense incurred in handling and selling the scrap.

PAYROLL

The payroll of a chain plant presents some complicated conditions, as it covers a wide range of labor classes, including the unskilled laborer, the semi-skilled operator working on automatic machinery, the highly skilled operator performing largely hand operations, machinists, diemakers, millwrights, etc. In order to stimulate production and to provide for local labor conditions, various methods of payment for labor are used in the same plant, including the weekly wage, hour rate, day rate, piece rate, production premium plan, overtime bonus, attendance bonus, etc. It has been found more satisfactory to compute the payroll daily from time slips covering the total hours worked by each man, segregated to show the time spent upon each different product in case of producers and upon each class of expense or shop construction orders in case of non-producers. A clock system must also be used in conjunction with the time slips, in order that by ringing in and out at the beginning and end of a working shift a weekly check can be obtained on the accuracy of the hours reported on time slips, upon the basis of which bonuses are calculated. The use of a clock by each employee is essential, even though he may be working on a piece-work basis, as it furnishes a check on his attendance, which, to ensure efficient production, should be regular.

OVERHEAD EXPENSE

Owing to the diversity of methods used in the manufacture of chain, the different degrees of machine and hand work required to complete the various operations, the fabrication of chain attachments and the variety of commodities produced, it has been established that the best method of distributing factory overhead, for the purpose of obtaining an accurate unit cost of each commodity, is to segregate the expense to the various departments af-

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fect, and thence spread it on the product upon which the department performs an operation.

An account must be kept for each operating department, to which all department expense is charged and, in addition thereto, a proportion of fixed factory charges. This expense cannot be applied to the cost of a product by any uniform method. Each department must be considered independently, and, in the end, bases for distribution will include the percentage of labor, man hour, machine hour, links and pounds plans. The methods which furnish the most constant unit and the unit connected most closely with the product at that particular stage of manufacture should be employed.

The segregation of expense to departments is facilitated by the adoption of an expense distribution report, through which non-productive labor, as determined from time slips, is credited to the departments performing the work and charged to departments benefitted thereby.

Costs

Requisitions and time slips used respectively with stock records and payrolls and the application of overhead expense, as previously mentioned, furnish the information necessary to compute the manufacturing cost of the various products fabricated.

A strict use of the individual job method has not been found practicable in certain chain manufacturing operations. The most satisfactory method is a combination of the individual job cost and the monthly operation cost methods. Under this plan the labor cost of an operation—for example, "forming"—is computed for the period of a month for each size and kind of chain formed, or in case of sizes and kinds which experience shows are uniform as to labor cost and output the computation will cover all of such a group.

For a monthly operating labor cost computed for a group of sizes it is necessary to show on the production cost summary the quantities of each size and kind of chain, grouped as to each specific operation, and to apportion the labor thereto by segregating time slips for each operation. Thus the labor cost is obtained of one operation for a number of sizes, and the material cost, by size and kind, is readily obtained from the material requisitions,

as the raw material used is governed by the size and kind of chain to be produced.

The product at this stage is reported into stores in a semi-finished condition and carried on the stock records until subsequently withdrawn against assembling job numbers to be converted into various products on which the completed cost is obtained by the individual job method. Costs computed in this manner are made a part of the financial records through the production cost summary, which is so arranged that stores and department accounts can be credited therefrom with the total value of material and partly finished stores consumed in manufacture and with the labor and overhead applicable to cost of production respectively, and stores accounts are charged with the value of semi-finished and finished products reported into stock and the cost of sales with the finished product shipped.

In the cost of fire welded chain, fuel is an important element and is applied as a direct cost to the product. To obtain a proper distribution thereof, as between different sizes, it is necessary to know the daily fuel capacity of each furnace and apportion the actual fuel consumed on that basis in conjunction with the number of hours operated.

In the case of manufactured goods, the unit prices shown on the stock records, at which they are drawn out of stock, are the previous month's costs and may differ from those of the current month when obtained. To pick up any difference, without the detail involved in a consideration of each job cost, all actual costs of a month's output are adjusted to the values at which the stocks were drawn from stores during the month. The balances on hand at the end of the month in the stock records are then adjusted to the actual costs, if the difference between the actual costs and book costs warrants the adjustment.

WORK-IN-PROCESS

On account of the speed with which chain passes through the different operations it has been found extremely difficult to keep an adequate check upon work-in-process between the points at which it is reported into stores.

It has been found advisable, therefore, to take monthly physical inventories in certain departments or groups of departments in

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order to check the work-in-process record on the production cost summary. This is not a difficult task, as it is necessary only in those departments covered by the monthly operation cost method, where the accumulation of work-in-process is always small. For departments working upon the job cost basis, the work-in-process is checked whenever a job is closed, which is sufficiently accurate for monthly financial statements.

OPERATING STATEMENTS

An important feature of chain plant cost accounting is the monthly operating statement which is compiled from the department charges in the factory ledger. It shows for each department the productive labor and the cost of operating, divided into various classes of expense. The total figures are summarized to show the total operating cost for the month divided into the same classes of expense. These figures totalled for the period of a calendar year will furnish the necessary details (except for the item "material purchases") required in the income tax returns in support of the total cost of sales.

The actual monthly overhead rate determined for each department and the rate used are also recorded on these statements, thus furnishing in condensed form, for the use of the production superintendent, a complete history of the month's operations by departments and in total.

* * * *

The methods above outlined result in obtaining manufacturing costs which, together with the selling and administrative cost, are used as a basis for selling values.

In a manufacturing concern the aggregate value of the inventory usually represents the largest item of quick assets, and it is therefore of the utmost importance that the amount should be correctly and conservatively stated. The safeguards adopted, in addition to the frequent taking of physical inventories of commodities to serve as a check upon the accuracy of quantities carried on the stock records, previously mentioned, are:

- (a) A periodic scrutiny of stock records for the purpose of ascertaining the inactivities of any stocks carried;
- (b) The adjustment of values of inactive stock;
- (c) Provision for obsolescent material.

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Any obsolete material discovered should be scrapped or sold, as the use of the money realized and the gain in storage space will usually more than offset any loss sustained by the difference between the book value and the amount realized on its sale.

Except for work-in-process, it therefore becomes necessary to take a physical inventory at the close of a fiscal period, but it is customary at that time to transcribe from the stock records the entire inventory, showing the quantity and description of each commodity, its unit price and value.

In conclusion, it may be stated that, for a corporation operating several factories, it has generally been found practical for each plant to carry on its own records the construction accounts and depreciation reserve accounts. The authorizations for construction are first approved by the management at headquarters and the various depreciation rates are also established there, to become operative at the beginning of each fiscal period. Uniformity in accounting is adopted at each plant, with the result that the trial balances, combined with that of the head office, can be readily converted into a consolidated statement of assets and liabilities at the close of any month.