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Accounts of a Paper Box Factory

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The particular business I have in mind is that which has for its raw material waste paper, which it buys, collects, sorts into different grades, manufactures into various kinds of paper and cardboard and finally ships to the purchaser in the form of a carton or container.

Among the various accounting necessities of this industry there is one essential, on which I propose to base this paper, bringing out, incidentally, many of the peculiar accounting problems associated with it. This necessity is a cost accounting system. In addition to the several reasons why every manufacturer should have a cost system, there is in this industry one reason which of itself alone would be sufficient to justify any expenses incurred therefor. That is the need of an accurate basis on which to estimate competitive bids, because by far the greater part of the contracts received are for large quantities, often running up into the millions, on which, almost without exception, several manufacturers are asked to submit figures. Therefore, to secure the business the price must be reasonable, and if there is not an accurate cost system on which to base estimates the chances of error are altogether too great—and errors, if repeated, would result in serious financial loss, if not in bankruptcy.

What sort of cost system is required? This can be answered in one word: it must be "accurate," because on account of the infinite variety of the finished product no system of averaging will give anything resembling correct cost or be better than an estimate.

One of the peculiarities of this business is that sales of stock occur when, ordinarily, the stock would be treated as goods in process. For example, the paper stock department may accumulate a surplus of some particular grade of paper which there is no prospect that the mill department will be able to handle for some time, and it is deemed advisable to dispose of it; or orders

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may be received for paper as it is turned out of the paper machine; also, sales of blank cardboard to small box manufacturers are common. It is therefore advisable to divide the factory into three major sections, which we will call

The paper stock department,
The paper mill department,
The box factory.

These, of course, may be further subdivided into as many departments as necessary.

Costs in the paper stock department are quite simple. The raw material is the paper stock as it is collected. Productive labor is that of sorting and baling. Overhead is distributed according to the number of tons sorted and baled during the month. This method gives an average cost per ton of stock sorted and baled. In the case of paper stock of a uniform character, which has to be neither sorted nor baled, the cost is the purchase price plus the hauling charge and an addition for overhead determined by the percentage which the amount so purchased is of the total paper purchased, hauled, sorted and baled during the period. This method gives an accurate cost per ton of paper purchased not sorted. In the case of stock sorted and baled, the best we can do is an average cost per ton, which for the purpose of establishing the selling price is practically useless, because all grades have the same average cost and there is a wide variation between the market values of the different grades, some grades being worth two or three times the value of the cheaper varieties.

Thus, if a true cost of the product manufactured by the mill is to be determined, the paper stock department should be treated as a separate unit and the stock transferred to the mill at the market price. This method will show whether it is more economical to buy sorted stock on the open market or to continue operating the paper stock department.

The paper mill is a manufacturing department, and here costs are more involved.

Raw material is the sorted waste paper, as it comes from the paper stock department, and pulp, sulphite, colors and chemicals. To ascertain the material cost of each order is not a difficult matter, and most concerns of this kind find that averages work very well; but an accurate cost per order can be obtained through the

formula required by the grade of paper on the order, because every grade of paper and cardboard has its own particular formula, which should be rigidly observed if the strength, bending qualities and other essentials are expected. Therefore, each order must be taken separately, and the formula furnishes an excellent short cut in ascertaining the material cost.

The first operation in the manufacture of paper or cardboard occurs when the paper stock is put in the beaters and ground up. To mix his stock intelligently the beater-room foreman must know the amount and grade of paper required. From experience he knows the number of beaters he must mix for that amount, and, as the custom of the business allows a 5 per cent overrun or underrun on an order, if he uses ordinary care he cannot go far wrong. The dry stock capacity of every beater is known, and all that is necessary is for the foreman to report the number of beaters he mixed on each order, which, when multiplied by the capacity of the beaters gives the total weight of stock used. To this figure is applied the formula; and the amount of each kind of raw material for that order is determined.

The accuracy of this method can be tested by the perpetual inventory records, and should be checked every month if a material discrepancy occurs in any kind of stock. The orders manufactured during the month calling for that particular grade should be reviewed and the accuracy of the formula figures verified, though the error will probably be found in the inventory records.

In the manufacture of paper the machine is the governing factor. In distributing overhead the machine rate should be used and great care exercised to determine it as accurately as possible.

Labor should be analyzed by jobs and charged thereto. If sales of blank cardboard or fibre board are made, any additional labor, such as weighing, bundling, trimming or wrapping, should also be charged directly to the job benefited.

As the sales at this stage are often considerable, it simplifies the accounting to regard all the product as sold, including the transfers to the box division. As with the paper stock division, transfers should be made at market price.

The last division, the box factory, is by far the most important. Here averaging has no place and costs must be accurate, because on their accuracy depends the success or failure of the

business. An error of two or three cents on the estimated cost of a hundred cartons when multiplied by a hundred thousand may, if too high, mean the loss of the order, and if too low will undoubtedly mean its receipt and a financial loss to the company. One of the most fruitful sources of unfair competition is an erroneous idea as to what constitutes costs. Systems of calculating costs may vary and give several different results, all of which cannot be right—though they all may be wrong. As the cost of an article cannot be changed after it has been produced the thing to do is to change the method of calculating until the correct cost is determined.

On account of the great variety of the product manufactured, a cost by orders is the only practical method for a box factory.

The direct materials in box factory are more valuable and varied than in either of the other departments, and a complete system of storekeeping and perpetual inventories should be maintained. Everything used in the manufacture for an order which can possibly be charged directly to the job should be so treated—even such things as ink, tape, glue, wire for stitching, etc. As it is not possible to determine the amount of ink or bronze required on an order, a liberal quantity of each color necessary should be withdrawn from storeroom and weighed before being put into the printing press, and when the press has completed the order the amount remaining should be removed, weighed again and returned to storeroom, the difference being the amount used on the order. The amount of tape used can be determined by measuring the depth of the box and multiplying by the number in the order. Wire for stitching can be measured in a similar manner, by determining the feet, or weight, of wire used by a machine per thousand stitches, and, as each box requires the same number of stitches, it is a simple matter to determine the number of stitches in the order. Such accuracy may seem extreme and unnecessary to the uninitiated, but it is only by such methods that trustworthy costs can be secured.

In the manufacture of paper boxes, on account of the endless variety and size of the product, it has not been found practicable to pay piece-work rates to any great extent. In almost all factories workmen are paid an hourly or weekly rate; therefore, to arrive at the labor chargeable to any order every employee whose

labor is expended on a particular order should be instructed to charge the time so spent to that order, regardless of whether the form of product was changed when passing through his hands or not. If the work is essential, it should be charged directly to the order benefited, as that is always the most equitable manner of charging expenses, if at all possible. The best method of accomplishing this is to furnish every employee each morning with a list on which is printed the name and number of each machine in the department in which he is employed and also a list of the operations not performed on a machine, which are directly connected with a particular order. He should be instructed to show his time on this card by orders—hours and minutes on each—which should be checked by his department foreman each evening and compared with the employee's time as shown by clock cards. If this procedure is carefully followed and all employees are cautioned to fill in the actual time engaged on each job before starting another, it furnishes a good control of the labor and gives excellent results.

The distribution of the overhead still remains, and it is here that the accountant must exercise all his ingenuity that the distribution may be the best and most equitable possible and based on sound theory.

After a little consideration we discard as unsuitable several of the more common methods:

> Percentage of material method, because of the wide variation between the value of the materials used on different orders.
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> Percentage of labor cost, not only because of the difference in the rates of wages but because all the product, even in the same department, does not utilize the same facilities to the same extent.
>
> The prime cost method, because it has all the defects of the two foregoing methods and does not provide a distinction between product manufactured by high-class expensive machinery and by less efficient and cheaper equipment.
>
> Percentage of labor hours, because it makes no distinction between the facilities employed and would result in overcharging the product of cheap hand labor and undercharging the output of expensive automatic or semi-automatic machines.

About all that is left is the machine-rate method. This system

gives the most satisfactory results, because it recognizes the difference in overhead expenses arising from the operation of different classes of machinery and absorbs as direct charges all overhead expense that can be associated directly or indirectly with the operation of any machine or particular area of the plant.

To get the best results from this system the factory should be highly departmentalized, each department comprising, if possible, only similar machines and processes. In addition to this, each machine in the department should be charged directly with all the expenses which can possibly be associated with it.

The best basis on which to apportion certain expenses is sometimes a problem, but as a general rule the following methods for the ordinary expenses can be followed with good results, provided that the figures from which the percentages chargeable to each production centre have been determined are correct:

Expenses	*Base of Distribution*
Rent	Area of space occupied
Depreciation on buildings	" "
Insurance on buildings	" "
Taxes on buildings	" "
Heat	" "
Janitor service	" "
Building repairs	" "
Depreciation on equipment	Value of equipment
Insurance on equipment	" "
Taxes on equipment	" "
Power equipment expense	Horsepower hours determined by test of load carried
Power equipment depreciation	" " " "
Current purchased	" " " "
Power department	" " " "
Current for light	Payroll hours
Lighting supplies	" "
Superintendent's salary	Chargeable hours
Superintendent's office force	" "
Superintendent's office supplies	" "
Factory telephone	" "
Elevator expense	" "
Foremen's wages	Payroll hours of department supervised
Foremen's clerks	" " " "
Overtime	Direct to job benefited

The hourly charge for each machine can be obtained by divid-

ing the total expenses charged to it by the number of productive hours worked during the period; or, if the expense applicable to the idle time of the machine is desired, we may divide by the number of productive hours in the period, assuming that each machine worked full time. The difference between the productive hours in the period and the productive hours worked multiplied by the normal rate gives the overhead applicable to idle time, which may be regarded as a department expense and be pro-rated over product of that department.

In a well-balanced box factory the item of idle time should not be an important figure. Many orders for large quantities are received which may require delivery of certain amounts each month for a period of six or eight months, so that at almost every season there are many unfilled orders, and if a dull period occurs employees and machines are put to work on them until current business becomes normal. This takes the place of what is known as manufacturing for stock in an industry where the product is more or less standardized, except in this case the product has been sold but must be stored for a period before being delivered. In the paper box and carton industry every purchaser has his own specific requirements—consequently nothing of a standard nature is used and manufacturing for stock is unknown.

In closing the books for the fiscal period these unfinished orders are in all sorts of condition. Often part of one order has been delivered, another part has been completed and is in the finished storeroom, a third part is uncompleted and in all stages of manufacture, and on still another part nothing has been done at all. If the finished and undelivered items are substantial the problem arises as to whether or not a profit should be taken on them. The general procedure is to inventory them at cost and allow the period in which they are delivered to have the profit; but if deliveries were made shortly after closing I cannot see why the period producing these articles should not get the credit. Of course, if the procedure were to be changed, the orders finished during a prior period and delivered in the current period would have to receive consideration.

Many of the large paper box manufacturing concerns are at present making extensive experiments with a view to expanding their rapidly increasing usefulness, and patented articles are quite

common. The accounting for this experimental work does not differ from that in any other manufacturing concern. The expense of each experiment is segregated, and if a patent is secured the amount is used as the base of the book valuation of that patent.

The future of the paper box and container is assured. Demand for these articles is constantly growing, and industries which formerly used wooden boxes exclusively have now discarded them entirely in favor of the more economical paper product. Serious inroads are also being made on other types of container, and in the near future it is quite possible that much of the food product now canned will be put up in some form of paper box or carton.

The industry offers an interesting field to the cost accountant, and to one who is so fortunate as to be connected with progressive concerns of this type the future offers unlimited possibilities.