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## Chocolate and cocoa costs

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**NATIONAL ASSOCIATION**  
of  
**COST ACCOUNTANTS**

Affiliated with The Canadian Society  
of Cost Accountants



**Official Publications**

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Vol. III

JULY 15, 1922

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**Chocolate and Cocoa  
Costs**

**BUSH TERMINAL BUILDING**  
130 WEST 42nd STREET, NEW YORK

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GEORGE REA,  
Touche, Niven & Co.,  
New York, N. Y.

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BUSH TERMINAL BUILDING  
130 WEST 42nd STREET, NEW YORK CITY

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# National Association of Cost Accountants

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## CHOCOLATE AND COCOA COSTS<sup>1</sup>

The manufacture of chocolate and of its by-product, cocoa, is often combined with candy-making in one establishment. Whether thus combined or not, the chocolate industry requires special machinery, has its own manufacturing processes and meets with cost problems peculiar to itself. The problems of the candy-maker and confectioner are different and are not discussed in this article.

### RAW MATERIALS

Chocolate is made from cocoa beans which are imported from Mexico, Central America, Brazil and the northern countries of South America, the West African tropical coast, Ceylon and the Dutch Indies.

The food value of the cocoa-bean was well known to the Indians in the 15th century. At the time of the conquest of Mexico by Cortez, chocolate (or chocolatl as it was termed by the natives, the word meaning "water of cocoa") was the principal drink. The cocoa-bean constituted a part of the currency of the Aztecs, being circulated in small bags, each containing a specified number of beans.

The food value of chocolate or cocoa is much more widely recognized in Europe, where practically the entire population drinks the beverage, than in the United States where only 15% drink it. This disproportion will be referred to again in connection with the determination of by-product costs.

The words "chocolate" and "cocoa" are applied indiscriminately to all cocoa products. However, manufacturers are beginning to restrict the application of the word cocoa to the fibrous matter of the bean from which a large part of the natural vegetable oil has been extracted and which is steeped in water to make a beverage; and the application of the word chocolate to the edible combination of the bean with materials which improve its flavor and palatability. This distinction is observed in this article.

The cocoa bean of commerce is the seed of the cocoa or cacao tree, removed from the fruit, cleaned, dried and sweated. In its natural state it has a bitter, astringent taste. In the sweating process the beans are piled in heaps and covered with green leaves, or enclosed in a receptacle and buried for a few days. The fermentation which is induced by sweating develops the natural vege-

<sup>1</sup>This article is based upon a paper read before the New York Chapter.

table oil content and reduces the bitterness and astringency. In this condition it is imported into the United States where it undergoes manufacturing processes which further improve its flavor.

If cocoa beans are bought from brokers or importers, the accounting methods and records are those ordinarily employed for domestic purchases. If the manufacturer buys from the foreign producer or broker, he must arrange for letters of credit and the financing of foreign drafts. To the purchase price, the cost accountant must add the expense of handling at port of shipment, freight and duty, domestic port charges, hauling, etc., unless under the terms of the purchase contract any of these expenses are to be borne by the seller.

Cocoa beans which are procured from different countries and even from different districts in a country vary in flavor and in the percentage of waste in manufacture. The name of the country or district of origin describes to the trade the quality of the bean. The quality of the finished product depends to a large degree upon the respective proportion of the several kinds of beans taken into the mixture. Perpetual inventories and frequent verifications are accordingly necessary to assure the management that the production records are correct and that the high quality of the finished product is being maintained.

Since prices fluctuate sharply, the stock records show not only the quantities of the various grades but the prices at which the several lots were acquired. These prices of course, include all charges up to the time the lot is delivered to the storeroom or warehouse. Warehousing, hauling from warehouse to factory and price fluctuations are elements which make a standard cost system essential in order to be able to measure the efficiency of the purchasing department.

Sugar is such an important material in chocolate manufacture that the limited supply and high prices in the post-war period restricted the output of chocolate to such an extent that American manufacturers found it necessary to arrange for direct importations at the time when sugar prices reached their highest level.

Sugar is ordinarily bought from the American refiner and presents no special problem in purchase and stores accounting. The chocolate manufacturer can keep his sugar stores record in the same form as that for his cocoa beans.

Other materials used in lesser quantities will be mentioned again in connection with their processing. It might be stated here, however, that aside from stores control in order to assure accurate production records, they have no special importance in costing.

#### PREPARATORY PROCESSES

The manufacturing processes are of two general kinds, the first, the preparation of the raw materials, and the second, the blending into finished or semi-finished food products.

The preparatory processes are cleaning, roasting, cooling and cracking the cocoa beans, and pulverizing the sugar. All of these operations are done by machinery with a minimum of labor.

The cleaning machine removes sticks, stones, dust and other dirt. Records of the quantity of refuse removed, which are not always kept, however, are valuable guides to the purchasing department. The cleaner and roaster are usually connected, the cleaned beans being automatically conveyed from one machine to the other. The roaster contains a revolving cylinder suspended over a fire, in which the beans are heated to a temperature of 260° to 280° Fahrenheit to drive off the moisture and accentuate the natural flavor. To impart the darker color found in the so-called Dutch cocoa and in chocolate syrups, an alkali, commonly potash, is put into the roaster with the beans. Authorities disagree as to the possible harmful effects of this treatment.

The roasted beans are removed from the roaster into broad, shallow pans with perforated bottoms where they are cooled, the process being hastened by an induced draft. The cooled beans are shoveled into the hoppers of a machine which cracks them between steel rollers and separates the hulls and cocoa dust from the nibs. The nibs are the broken pieces of the body of the bean containing the essential food elements. The hulls are the thin shells of the bean having no value in the industry but having been used to good account as fertilizer and as cattle food when pulverized; in Europe they are sometimes used as a coffee-substitute under the name "Miserable," which may indicate that it has not met with great favor. Cocoa dust is the fine particle of the body of the bean containing only 18% of vegetable oil which is less than the government standard. If there were a greater demand for cocoa, the dust probably could be made marketable by increasing slightly its oil content. It is sometimes added to an equal weight of nibs in order to make a low-grade chocolate product. In the cost accounts it is given no value as a by-product, nor is it taken up as of any value if added to the low grade mixtures, since it only contributes to the loss in process.

As the preparatory processes are practically continuous operations, and the labor expense is small, process costs are practicable. Yet the beans are put through in lots, so lot costs can be obtained as readily if desired.

In a small factory handling seven or eight tons of beans a day, the total manufacturing expense in the roasting department (which is the name sometimes given to the preparatory processes) will be less than 50c. per hundred pounds of nibs produced. The same equipment and labor can easily handle up to ten tons of beans per day, with a consequent reduction in department cost to approximately 30c. per hundred pounds of nibs. This condition suggests the advantages of standards which show the excess cost of sub-normal production.

The standard rate is stated in cents per hundred pounds for



labor, for machine expense, for supplies including fuel for the roaster, and for fixed charges, respectively. The total amount earned by the department in any period, which is ascertained by applying these rates to the number of pounds of nibs produced, is taken up in the cost of the product, and the balance of the cost of operation is charged to burden variance and to unearned burden. No adjustment need be made either with standard or with process costs for possible differences in time required to roast and crack the different grades, since these differences are negligible.

The loss of 20% in moisture, shells and dust in the preparatory processes must be taken up in the material cost by adding 25% to the standard cost of the bean. Any variation from this percentage, which is accepted as standard by the trade in predetermining selling prices, is carried to a fluctuation account.

Theoretically, the weights should be checked after each operation. But every practical purpose is served by comparing the weight of the nibs with that of the beans put into process. A reasonable approximation of the loss with that of previous runs of the same grade of bean is an assurance of proper handling and accurate accounting.

#### PULVERIZING SUGAR

In order to make a smooth chocolate, the sugar which constitutes from one-third to one-half of the mixture must be pulverized. Granulated sugar is bought from the refinery and reduced to powder in a mill. Its cost in the mixture is the cost of the granulated sugar plus the labor, expense and burden of the sugar mill.

In the small factory with a single mill where the operator can spend a part of his time on other work, the expense of pulverizing is not important enough to warrant a special segregation, and therefore it is included with that of the roasting department. For process costs, the total expense of the department divided by the weight of nibs and pulverized sugar produced is the unit cost to be applied to both nibs and sugar. If standard costs are used, one standard may be set for the department, or a special rate may be determined for pulverizing, based upon time studies made in the sugar mill.

#### GRINDING

In the first process after the preparatory processes described, the nibs are pulverized in a grinder, which melts the vegetable oil content by the heat engendered by friction. There is about 55% of vegetable oil in the nibs which is enough to carry the fibrous matter and ash in suspension and to make the product of the mill a smooth liquid of the consistency of molasses. The trade name of this product is liquor, and of the grinder, liquor mill.

Liquor is the basic ingredient of all chocolate and cocoa products. The various grades of liquor bear the names of the

kind of beans from which they are made. They are mixed in proportions according to their quality and flavor to produce different grades of chocolates and chocolate products.

The liquor flows from the mills into one-hundred pound cans. The number of cans of liquor is a ready check on the product from a given quantity of nibs. Greater accuracy by weighing is impracticable except in a very large factory because of the liquor adhering to the can, the cost of scraping out the contents in order to get an exact weight offsetting any possible inaccuracy from under-filling. A good foreman can estimate the production of liquor very closely.

A more important problem is the careful handling of liquor. In order to have it available for mixing, it must be made in excess of immediate requirements, the surplus being left in the cans and set aside until required in the mixing department. Careless workmen will not keep the grades apart. No direct loss results therefrom, but the mixing reports of liquor used do not agree with production and inventories. The quality of the chocolate product may be affected by mixing liquor not called for by the formula. If such a condition develops or is suspected, a daily count of the cans of liquor of each grade on hand and a reconciliation with the liquor-mill and mixing reports should be made until the quality of the chocolate reaches the standard again.

The liquor is also an article of commerce, being sold to confectioners who make mixtures according to their own formulæ but who do not have the equipment for roasting, cracking and grinding the beans. For this trade the liquor is drawn into shallow pans, each holding ten pounds and carried to a cooling chamber (called the ice box) where at a temperature of 40° Fahrenheit it hardens and is readily wrapped and packed.

For the trade a mixed liquor is occasionally made by mixing nibs of two or more grades before they are ground.

The cost of liquor is the cost of the nibs plus the liquor mill expense, including fixed charges and labor, and if it is sold plus also the cost of wrappers and packing. In this case standard costs can be used to advantage, only production statistics being required, thus eliminating the volume of lot cost computations.

The liquor mill is not infrequently considered a part of the roasting or preparatory department of the small factory, in which case its costs are included in the standards previously mentioned for that department.

## COCOA BUTTER AND COCOA

The materials, the preparation of which has been described, namely, liquor and pulverized sugar, are mixed with milk and flavoring extracts to make chocolate. Before taking up the mixing operations, however, another process must be described. This is the production of cocoa butter which is added to many chocolate mixtures to give them an easy working consistency and a balanced food value. Cocoa butter is the natural vegetable oil extracted

from liquor, the process leaving a by-product, cocoa powder. These products are more conveniently termed butter and powder respectively.

The liquor, having been left at or brought to a temperature above its melting point, 90° Fahrenheit, is pumped under high pressure into a filter press which extracts nearly 75% of the vegetable oil (butter) content. The butter as it comes from the press is ready for the chocolate mixture, but the powder, which is the fiber base of the bean now containing about 22% to 24% of vegetable oil, is subject to additional processing before it is ready as a beverage for the market.

Cocoa-butter is also separated from the nibs by crushing in a series of horizontal millstones, each succeeding pair being closer set than its predecessor, at a temperature of 200° Fahrenheit.

The fibrous matter left after the butter is extracted is not soluble in water. Accordingly, notwithstanding that it was finely reduced in the liquor mills, it must be yet more finely pulverized in order that it may be readily taken up by the water in which it is steeped. The hard cakes of powder (so-called) taken from the filter press are first broken up in a roll-crusher. A pulverizing mill directly connected to a fine wire mesh sifter completes the reduction, the coarser particles retained by the sifter being returned to the pulverizer for further processing.

The powdered cocoa is packed either by hand or by machinery in containers of from  $\frac{1}{4}$  lb. to 100 lbs. each. Accurate weight and a low packing cost are desirable, which primarily are problems of management, but accounting records must supplement the vigilance of the foreman and superintendent. The weight of the powder (in cake form) taken from the filter press, must be accurately reported as a check on the packing room reports. To maintain efficiency, low costs and reliable stores records, the quantity packed and time consumed may be ascertained by the method described in the section of this article, "Packing Chocolate Bars" on page 14.

Two distinct problems arise in costing cocoa. The first one is to apportion the cost of the liquor between the butter and powder extracted therefrom. The second one is the costing of the processes by which the powder is prepared for the trade. The latter is simple, involving no unusual procedure, and it may be done either by the lot or the process method, the latter giving as equally reliable results as the former and with much less expense. Standards can also be used to advantage for both the manufacturing and packing operations.

The problem of by-product costs arises in ascertaining the respective costs of butter and powder at the press. It may be of interest to note that it is solved in this industry by applying the market value or sale price to the main product, butter, and the balance of the cost of manufacture to the by-product, powder.

The explanation of this method of by-product accounting lies

in the small domestic demand for cocoa and high protective tariffs abroad which practically close the European markets to the overproduction of American cocoa, in the competition of foreign cocoa-butter and in the close association of the chocolate and confectionery industries.

Our large per capita consumption of candies demands a large production of butter with a corresponding production of powder which is greater than the country will absorb at a price which will return a profit except to the large manufacturer with an established name and trade.

In Europe the condition is reversed because the manufacturer finds a ready market for his powder at a profitable price, and the industry is encouraged by high tariffs which effectually shut out the competition of American overproduction. Confectionery not being so generally in demand, the butter commands a relatively lower price without finding a home market for the entire product. The surplus is shipped to America and except during the war it has practically established the market price here.

The American candy manufacturer takes the butter into his costs at its purchase price. The chocolate manufacturer who is also a confectioner follows the same practice in order to meet competitive costs because he often finds the European butter selling below his cost of manufacture. The manufacturer of chocolate coverings for candies is compelled to adopt the practice, so it becomes general. As the market quotations vary from day to day, the average for the month is the price at which butter is charged into the mixture. A standard cost for butter prevents the fluctuation in cocoa costs which attend the use of market price for the butter. If one were inclined to criticize this method of accounting for a by-product, it might be justified in principle by the relative sale values of the two articles. The butter commands the higher price and therefore should bear the larger part of the cost.

It would be impracticable to apportion the total cost of manufacture upon the basis of the respective volumes of the products because of their gross disproportion to selling prices in both high priced and low priced markets. Under such a procedure, both butter and powder would have the same cost per pound, which would be the cost of liquor plus the cost of pressing. Such a method of costing at the recent extremes of high and low prices would have given the following results:

	<i>High- priced Market</i>	<i>Low- priced Market</i>
Cost of beans, per pound .....	14.0¢	7 ½¢
Cost of liquor, per pound .....	19.4¢	10.24¢
Cost of pressing, per pound .....	.5¢	.40¢
Cost of butter and of powder at the press, per pound	19.9¢	10.64¢
Add cost of pulverizing the powder, packing, con- tainers, etc. ....	1.6¢	1.30¢
Total factory cost of powder .....	21.5¢	11.94¢
Selling price .....	14.0¢	3.00¢
Loss on powder, not including selling and general expenses .....	7.5¢	8.94¢
Cost of butter at press, as above.....	19.9¢	10.64¢
Selling price .....	39.0¢	27.00¢
Gain on butter .....	19.1¢	16.34¢

It is admitted that the practice of allowing the powder to carry only the excess of manufacturing cost over the market value gives costs to both powder and butter which are equally out of proportion to their market values. With the prices in the foregoing comparison in effect, the respective costs of the powder were obtained as follows:

	<i>High- priced Market</i>	<i>Low- priced Market.</i>
Cost of products of the press, per pound as above .....	\$ .199	\$ .1064
From a press holding 271 lbs. of liquor, the combined values of the butter and powder were .....	\$53.93	\$28.83
There were produced 113 lbs. of butter— at market price, 39¢ per lb.....	44.07	30.51
at market price, 27¢ per lb.....		
Leaving as the value of 158 lbs. of powder.....	\$ 9.86	
Profit to be offset against subsequent cost of processing 158 lbs. of powder.....		\$ 1.88
Cost of pulverizing, packing, etc.....	2.51	2.05
Factory cost of 158 lbs. of powder.....	\$12.37	\$ 0.17
Factory cost of powder, per lb.....	.0783	
Selling price, per lb.....	.1400	.0300
Profit (including selling and general expenses) ...	\$ .0617	\$ .0300

Some manufacturers have worked out a ratio of the market price of butter to that of cocoa beans over a period of years and take up the butter at that ratio to their beans cost. This is just another method of applying the same principle. It has the advan-

tage of yielding uniform costs for both products and of keeping the value of butter below that of the liquor when the butter market may be exceptionally high with respect to the price of beans. But it shows a profit on powder only to the manufacturer whose trade name enables him to market his product at a premium. Other manufacturers must offset their loss on powder against their profits on chocolate, which has the same effect as charging the butter into the chocolate mixture at the cost of the liquor at the press less the sale value of the powder, just the reverse of the existing practice.

Either of these two methods, which are the same in principle, are suitable to those industries the main product of which is cocoa-powder. But on the part of producers of cocoa-butter and of chocolate and chocolate products, the practice of taking up the butter at market price and leaving a balance of manufacturing cost to be carried by a by-product for which there is a precarious market is highly speculative. They should adopt the opposite course of crediting the powder at the sale price (or the current market price in the case of makers who have an established trade) and loading the balance of the manufacturing cost on the butter. The small manufacturer would even be justified in charging the entire cost to the butter, the powder carrying only the cost of the processes through which it passes after leaving the press.

## MIXING

Let us consider again the main product, having arrived at the process where the raw and prepared materials are mixed in kneading machines according to formulæ.

The finished product is of two general classes, coverings or coatings and confections. There are many grades of each. Coverings are sold to candy-makers and confectioners who make chocolate-covered candies or candies with a chocolate base. Confections, for the purpose of this article, comprise only the well known chocolate bars and nut bars, as it is not desired to discuss the more complex candy products. Both coverings and confections pass through the same processes in the mixing department.

The materials employed, it will be remembered, are liquor, pulverized sugar, cocoa-butter, milk and flavoring extracts. The lot of materials placed in the kneading machine is called a batch. The quantity in a batch varies with the formula, from 450 lbs. to 600 lbs. The mixer reports daily the number of batches mixed to each formula. In the cost department the batch totals are converted into quantities of materials which are checked against stores withdrawals and against production reports of liquor and pulverized sugar adjusted for inventories. When there is doubt of the accuracy of the mixtures, as for example when the finished product is not up to standard, a daily check is made until normal conditions are restored.

In the kneading machines the materials are thoroughly blended. The mixture is then delivered to the finishing machines

where it passes around and between rapidly revolving, smooth steel cylinders which incorporate the ingredients and give the compound a smooth finish. The highest grades are worked about five times as long as the cheapest, and other grades for relatively shorter periods.

If process costs are obtained on a per pound basis, the time required to finish the several grades must be taken into consideration. From time studies a series of decimal equivalents of the respective finishing times is computed. The total process cost is apportioned to the several grades produced during the month upon the basis of the quantity of each multiplied by its decimal time-factor. The cost thus apportioned to any grade divided by the weight of the product of that grade gives the cost of finishing per pound.

For cost purposes the mixing and finishing processes may be combined into one if desired, a decimal equivalent being obtained for the total mixing and finishing time, and the total department cost apportioned by the method just described.

The mixture comes out of the finishing machines as a smooth paste and it is immediately placed in mixing tanks, where it is raised to a temperature of 110° Fahrenheit and more cocoa-butter is added according to prescribed formulae. At this stage broken chocolate from the packing room is put back into process, care being taken of course to combine paste and broken chocolate of the same formula. The quantity of butter and broken chocolate added in the mixing kettles is reported daily. Slowly revolving paddles blend the ingredients into a thick liquid. If the paste is a covering mixture the contents of the tank are drawn through a spout at the bottom, fitted with a valve, into shallow pans containing one, five or ten pounds each and carried into the ice box, which is a large room kept at a low temperature by refrigerating apparatus. At 40° the contents of a ten-pound can will become solid in about forty-five minutes after which it is broken out by laborers striking the upturned pan smartly on a table. The cakes are loosely covered with paper and packed in cases containing 100 pounds. Cakes broken in handling either in breaking out or packing, are returned to the mixing department and put back into process as previously described.

Process costing can be employed to much better advantage than to attempt to follow a batch or series of batches through the department. The time element is unimportant and need not be considered except in the finishing process as previously described. In the smaller factories, mixing, finishing, ice box and packing are considered as a continuous process. As relatively more laborers are employed in the ice box and in packing, though the total number employed in the small factory (of six to eight tons daily production) is small, mixing and finishing may be taken as one process and ice box and packing as another. In large factories, more subdivisions will be found necessary.

A monthly recapitulation of daily reports of chocolate packed and of broken chocolate adjusted by inventories, compared with the mixing reports, assures the accuracy of the production records on which costs are based. If discrepancies cannot be accounted for a daily accumulation by grades provides data from which test comparisons may be made at frequent intervals, either at the end of a run on a particular grade or by the aid of in-process inventories.

Broken chocolate is valued at the cost of finished chocolate less packing expense. It is charged back into process at the cost of the materials in the mixture to which it is added. The difference between its finished cost and the in-process value is the loss resulting from breakage. Periodical reports of quantities and resultant losses by grades should be submitted to the management.

### MOLDING

The mixtures from which chocolate bars and nut bars are made pass through the same operations as those described for coverings up to the point where the liquid paste is ready to be drawn from the mixing tank. Instead of being drawn into pans, the paste is conveyed to molding machines. These machines automatically and rapidly place the molds in position, fill them with the paste, remove the surplus paste and eject them on to a conveyer which carries them to the ice box. The mold is a flat metal plate,  $\frac{3}{4}$ " or more in thickness, with recesses the size and shape of the desired chocolate bar. The number of recesses in a mold depends upon the size of the bar. A mold may hold up to five pounds of paste.

To mold nut bars, a machine has been devised with an additional hopper to contain nuts. The machine feeds both paste and nuts to the mold. In a factory not equipped with this special machine the nuts are mixed by hand in a container into which the paste is drawn from the mixing tank.

Besides the operator, the machine requires an attendant to keep it supplied with molds and paste. In the small factory, it is the only machine which requires the constant attention of the operator. In this case, therefore, the labor cost is of relatively greater importance. If desired, time records can be kept of the run on each grade and on each size and style of bar. Process costs can be obtained as readily, however, by the method described for the finishing machines, because the molding machines fill the molds at the same rate for all sizes and styles of bars. The weight of the chocolate in each mold multiplied by the number of molds filled per hour or minute gives the quantity molded. It is a simple matter then to apportion the cost for the period upon the basis of the quantity of each style of mold and the hourly rate of molding. Or, standard costs may be set which when applied to the product will give the standard cost of operating the department for the period. The excess of actual over the standard cost of operation



is the cost of lost time and inefficiency which unless controlled may easily become excessive.

The bars harden in the ice box, and are then readily broken out of the molds, and placed loosely in tote boxes in layers with oiled paper between the layers and carried to the packing room.

### PACKING CHOCOLATE BARS

In the packing department the bars are wrapped and packed in cartons. Both operations can be done either by machinery or by hand. Machines are more generally used in the larger factories. The time which the small factory loses in making the many changes required to adapt the machines to a different style of bar absorbs a large part of the labor saving which otherwise would justify the investment. If machines are used, time records can be made, or process or standard costs can be computed with the weight of the bar and the number wrapped or packed per hour as the basis, as described for molding costs.

Hand packing, though done by cheap labor, may easily become expensive. The foreman must be alert to see that the girls are constantly supplied with bars and with packing material so that idle time expense may not be incurred. But dependence must be placed upon reliable cost data to insure a fair day's work from the girl if she is paid by the hour or day, to insure just and reasonable piece-work rates if they are in effect; or to insure adequate production records for bonus, premium or differential rate wage systems.

It is more difficult to secure adequate production data in the small factory because the girls are changed frequently from one class of work to another. When a girl may complete her job within an hour, it is almost impossible to compile exact cost data that will justify the expense. Excessive variations between employees on the same class of work are the rule, yet the excess costs thus incurred are too small because of the low wage rates to warrant the expense of other than the most simple cost system.

If either lot or class costs are to be obtained for day-rate workers, a simple method is to collect the wrapped or packed product at regular intervals, and record on each girl's card the quantity taken away, class of work done and time to the nearest quarter hour. To prevent alterations, the amount is also punched from a series of numbers printed on the margin of the card. A new card is issued daily.

In the cost department the elapsed time on each class of work is entered and the total time on the card is compared with the clock record. Then the rate of pay is entered and the costs extended. The number of pieces wrapped or packed and the cost for each class of work are posted to summary sheets and weekly or monthly totals accumulated. This affords a ready comparison of the quantities reported daily as wrapped and as packed, which

of course should agree. The quantity packed can also be compared with the deliveries to the storeroom. Thus reasonable accuracy may be insured. The month's totals must be adjusted to the quantities taken into stores which of course must be reconciled with the weight of material put in process less broken chocolate. This method insures a reasonable distribution of the packer's time, and may be employed to very good advantage, when only the total cost of wrapping and packing each style of bar is wanted. For the small factory, it could hardly be recommended as a reliable record of individual efficiency or a basis for piece-rate or a bonus or premium plan, but the larger factory which can afford the expense of a higher-priced employee to collect the production data, would find this method satisfactory.

Excellent results are obtained by setting standards for wrapping and packing. From a comparison of the total cost of each class of work with the standards, the small factory can determine whether it is advisable or necessary to make a more detailed comparison or whether to apply pressure through the superintendent and foreman to increase efficiency. The larger factory can supplement the comparison of totals by a comparison of individual production.

Packing materials are an important element of cost because of excessive waste unless closely controlled. These materials are tin-foil wrappers, oil-paper wrappers, print-paper wrappers, labels, cartons, carton liners and cardboard fillers and interliners. These vary with the style of the bar, but the quantity of each per bar or carton is always the same for any style. From the production records, therefore, the cost of wrapping and packing materials used is readily computed. The excess of the cost of materials drawn over the material used is the loss by waste. As comparison is made for each item, continued loss in any article will be noted and investigations disclose whether the fault is owing to the employee or the quality of the material.

### THE COST SYSTEM

Of the total manufacturing cost, only 10% to 12% is labor and 12% to 15% is burden, as compared with 70% to 75% for materials. The possible saving to be effected by the use of an intricate system making exhaustive analyses of manufacturing expense is relatively so small as to render such a system impracticable except for the largest establishments. Accordingly, process costs are to be preferred to lot costs because they require less detail and fewer computations.

The foundation for a process cost system will be found in nearly every factory in the daily material reports which are essential not only to insure proper accounting for materials but also to control the quality of the finished product. These reports can be readily adapted to the requirements of a process cost system.

A survey of the establishment should be made to ascertain what operations can be combined into one process, to the best advantage, for cost purposes. More combinations can be made in the smaller plants, but the division of the factory into departments and the combination of operations into processes for cost purposes will be determined largely by the facilities for reporting production and weighing the materials at points where they may be diverted into more than one operation or grade of product.

Simple forms for daily reports must be used, for the factory personnel is not of a high order. Equally simple columnar forms to accumulate the production data and to distribute expenses to departments and processes, and a concise yet comprehensive form of monthly report of operations showing results in pounds and values complete the accounting records.

The cost accountant must not be content to deal only with monthly totals. The responsibility for the accuracy of the records and costs rests upon him alone. Therefore he must assure himself that the daily reports which he receives are correct. He can easily follow in his records a run on any grade of beans, even of several days' duration, through the cleaner, roaster, cracker and liquor mills and see that the quantity of liquor made bears a reasonable relation to the weight of beans drawn from stores. The number of batches can be readily converted into liquor put into mixtures, which deducted from the inventory at the first of the month plus production leaves the quantity that should be on hand. Test inventories of finished product may be made as readily. To the conscientious cost accountant with a lively interest in his responsibilities, his cost work will be as satisfying as the product of the factory.

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