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Accounting for a Cast Iron Pipe Foundry*

BY A. KARL FISCHER

THE SITUATION TO-DAY

Before going into a discussion of the pipe industry in normal times, I shall discuss some of the problems brought about by the war which the accountant is sure to have to face. There are few industries that war conditions have not changed. Not only have prices been entirely upset, but in many instances the industries themselves have been revolutionized. The iron and steel industries in this country had flourished prior to the war, and the heavy burdens placed on manufacturers meant merely elaboration and extension.

In the cases of the individual concerns, however, many can scarcely be recognized as the manufacturers of a product once uniform in character and quality. Almost any concern working in metal was able by employing initiative to obtain profitable orders, the need for which was created directly or indirectly by the war. In many cases the manufacture of the new product was quite different from any previously undertaken. This expansion was often necessary for existence, for the demand for some products diminished during the war.

Almost all pipe manufacturers make as auxiliary products some other machinery which may be used by gas and water companies. These include such items as fire hydrants, valves, gas-producers, gas-holders, pumps, etc. Because construction of pipe lines by gas and water companies was generally postponed after the beginning of the war on account of the prohibitive prices, it was quite necessary to seek contracts of a new and different character as well as to take war contracts. The construction of machines to be used in ammunition plants was one thing undertaken. This necessitated the installation of much new machinery—some being well adapted to the manufacture of gas-holders, gas-producers and other machinery where the casting process is not involved. The installation of such ma-

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chinery increased the capacity of the plant for the making of auxiliaries.

While conservatism might prompt charging as much as possible of such additions to operations, correct principles require that all machinery which will have a usefulness in the normal industry shall remain in the plant account. The company will be able to sell many machines which are made of wrought iron or of steel and may have established itself very firmly in this business which before the war was a minor consideration.

The methods of handling and machining pipe and heavy machines undergo a gradual but constant change, and the opportunity may have been taken to replace some antiquated equipment with that of a greater capacity. Here if depreciation charges have been insufficient, in view of the large profits which were earned the splendid opportunity of writing off the values of old machines replaced or abandoned should be pointed out. It may be unnecessary to state that the federal income tax will be an excellent aid in such an effort.

The making of pipe often having been entirely discontinued the foundries were allowed to stand idle. The manufacture of pipe is still not very active. Consideration must be given to the effect which this will have on depreciation and on possible obsolescence.

One company had to put up new buildings for the sole purpose of storing patterns and flasks—one building particularly well protected against fire for the storing of wooden patterns and flasks. I might add that this was done after a rather disastrous fire. While foundry work was going on, this equipment had been kept in convenient places in the foundries and yards. The cost of such new buildings should be liberally charged off, for they may have little usefulness when casting is actively resumed. Here the charging off of the entire amount is excusable.

In the case of another company the production of gas and water machinery, other than castings, has been so increased that the possibility of the complete discontinuance of the production of pipe and castings should be considered.

In another case the erection of parts of gas and water plants has been undertaken by the manufacturer. Here the accountant should insist on proper accounting in regard to the contracts.

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He will probably find the management somewhat at a loss to know how to handle the accounts with these contracts and he will have to explain the best practice. While a conservative estimate of the profit actually earned may be taken if desired, the dangers of anticipation of profits should be carefully avoided. In one case I have in mind, the management has adopted the commendable policy of taking no profit until a contract is complete.

The details of the pipe and foundry industry in normal times will be taken up under the following headings.

- Balance-sheet,
- Revenue and expense accounts,
- Production and cost finding.

BALANCE-SHEET

Property: The storing of pipe requires extensive yards and one of the chief requisites of the location for a pipe foundry is that land shall be cheap. The result is that foundries have usually been built in localities not previously settled. The mill usually owns much of the surrounding land, on which employees' houses are built and where farms will occasionally be in operation. The cost of the land should appear in separate property accounts according to its use.

There are no abnormal conditions affecting the depreciation of buildings, but some consideration must be given to obsolescence. Many old-style foundries are still in operation, but they do not permit the production that can be obtained from the modern pipe foundry. The old-style foundry had several pits, while the modern pipe foundry has only one pit and a much greater capacity. The old-style foundry employs hand-operated chain hoists for removing patterns from the molds and cores from the castings. The new foundry does all this work with cranes. Usually, one size of pipe is made in the new foundry at each heat, and the manufacture of the entire capacity of the foundry can be completed in 24 hours. These improvements merely illustrate the advantage of new buildings over the old.

The machinery and equipment, such as cranes, ladles, locomotives, cars, etc., have a comparatively long life, but improved machinery is constantly being installed. Much of the work on

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pipe can be done almost entirely by machinery, but in some plants labor is still employed where machines could do the work more cheaply.

Cupolas must be frequently relined. The experience of a company will determine the life of the lining and the cost should be written off on a tonnage basis.

The life of machines in the machine shop, such as lathes, boring mills, planers and multiple drills, will probably be shorter than in the foundry, where methods change less frequently.

All pipe manufacturers must make some castings on special designs and on special orders. The cost finding will be discussed under a subsequent heading. The patterns and flasks must, however, be handled differently for pipe which is a standard pattern and for any special casting. Even the head patterns for flanges and bells, which are part of the pipe, are often molded on special patterns.

The steel patterns used in molding pipe have practically the same status as machinery. Their cost can, however, be charged directly to the sizes of pipe on which used. The cost of all patterns for special castings—which besides head patterns will include T's, elbows and other special work necessary in the laying of pipe lines—should be charged against the individual orders. Some T's and elbows are carried in stock, and the cost of patterns for these may be distributed over their life. Wooden patterns should be depreciated more heavily, but follow the same general principles as the steel patterns. The wooden patterns, however, will be found to have been constructed mostly for special work. The cost of patterns used in making "barrels" (the trade name for the flasks used in making pipe) should be charged to the first flasks constructed. Having acquired a stock of standard patterns there will be frequent replacements, and these should be charged against reserves.

The cost of flasks will be distributed over the product in the same manner as that of patterns. The cost accounting will be a little more difficult, as one flask may be used on two or three different sizes of pipe. Iron flasks in property accounts will be treated the same way as patterns. Wooden flasks have often comparatively small value and may usually be charged to produc-

tion the first month, even though their life will be considerably longer.

Companies frequently owns employees' houses. Depreciation is seldom considered, and the argument about the appreciation of land value will usually be encountered.

Inventories: Perpetual inventories of stores must be maintained. Purchases will be charged to the several stores accounts and when requisitioned will be credited thereto and charged to the various departments. The principal accounts which will be maintained are: pig iron, scrap iron, cupola coke, coke (for drying castings), cupola coal, power coal, sand, hay (for use in making hay rope), hay rope (for use in making cores), wood (for use in making patterns and flasks), limestone (used in the cupola), core compound, oil (for use in making cores), blacking, coating, paint and stores accounts for foundry, pattern shop, machine shop and power house.

Reserve for depreciation: I have discussed depreciation for the various classes of properties under their respective heads. The reserve as thus determined will, of course, appear on the balance-sheet. It is preferable to show this as a deduction from the combined property account, especially if computed on the basis of actual life of the various classes of property.

Accounts receivable: There should be very few losses on bad accounts, as most sales are made to municipalities after ordinances have been passed authorizing construction. There may, however, be some claims for damaged pipe. Some losses may be recovered from railroads, but any damage claims, if carried at all, should be valued very conservatively. The claims for defective pipe will not be large, for most pipe is proved at the foundry by a representative of the municipality or other consumer, and either accepted or rejected there.

Miscellaneous: It is usual to enclose a cheque with bids for contracts. These are invariably returned when a bid is accepted or rejected. There is therefore very little question about their value as assets.

The other balance-sheet accounts present no features not encountered in other industries.

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REVENUE AND EXPENSE ACCOUNTS

Before discussing revenue and expense accounts themselves something should be said about marketing. A market for gas and water pipe can only be created by the growth of communities and their gradual education up to their needs. The important part for the manufacturer is to learn where municipalities or occasionally corporations are contemplating new construction or extension. Bids are submitted for the work, but high-class pipe men will be needed to close contracts. A large pipe manufacturer must sell pipe in all parts of the United States and will be compelled to have variable prices to compete with mills close to the consumer. Contracts are usually made f. o. b. destination, and prices are made to include the freight. The keeping of trustworthy costs is essential, for bids on large contracts must occasionally be made at short notice, and an unfavorable contract might prove disastrous.

Sales: Sales will include a large amount of freight, and the freight and expressage accounts should be separated into the same classifications in which it is desired to keep the sales accounts. A suitable classification has been found to be bell and spigot pipe, flange pipe, bell and spigot fittings, flange fittings and miscellaneous castings. Returns and allowances will be separated in the same way; but these should be very small as explained above, for defective pipe will be rejected at the foundry. For the general books, cost of sales will be divided in the same way.

Miscellaneous: There is nothing to indicate that selling expenses and administrative and general expenses apply against any particular class of product. There is, therefore, no purpose in trying to distribute them over types or sizes. The same expenses as are found in other businesses will appear here and it is unnecessary to list them.

Rent and maintenance of company houses should have appropriate accounts. Here, as usual, the system of accounting for rents must be investigated. A plan of properties owned should be on hand, but, strange to say, a complete plan is seldom to be found.

If it is desired to show the cost of sales under general ledger captions, the following accounts will usually be maintained:

labor, pig iron, coal, coke, sand, straw, facing, oil, miscellaneous supplies and expenses, taxes, insurance (fire), employers' liability insurance and superintendence.

PRODUCTION

Peculiarities of production: While sales of pipe and other castings are not constant, even in normal times, their production may be made more or less so. Here the foresight of the management is a necessary asset. Great quantities of pipe may be made and stored in the yards. Advantage should be taken of the fluctuations in the cost of pig iron. There is as much danger of overstocking of pig iron as there is of pipe.

When sales of pipe fell off during the war many mills found themselves with a large stock of pipe on hand which had no ready sale. The manufacture was cut down and the stock eventually sold, but at a price, warranted by the high price of pig iron, which yielded a handsome profit.

Processes: Before going into the methods of cost finding the various processes and departments should be understood. A brief outline of manufacture is given.

Pipe may be completely manufactured to the entire capacity of the pit every 24 hours. The cupola is charged during the afternoon, draught turned on at about four o'clock in the morning and the molten iron poured at about ten o'clock in the morning. A charge includes pig iron, coal, coke, lime-stone and possibly some chemicals.

After removing finished pipe the barrels are again set up for the next day's heat. The sand is poured and rammed and the pattern is pulled through the sand, making the mold. The molds are dried by stoves, arranged in the pit, on which barrels are set. These stoves are fired by coke. The cores, the making of which is a separate operation, are inserted in the mold. The head pattern (the mold for the bell or flange) is then placed on top of the barrel and the complete mold is ready to be poured.

After the pipe has sufficiently cooled it is placed on skids, and goes from one skid to another through the processes of cleaning, coating and the various tests necessary in the proving.

Making of cores is a separate operation. One man usually works upon the same size cores continuously. The core-bar is

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placed in a lathe and receives a coating of mud and hay rope, until it reaches the thickness of the inside circumference of the pipe. The hay rope burns when the casting is made and loosens the sand and enables the core to be easily pulled out of the pipe. These cores must be baked in an oven for the purpose.

The mud to be used in cores is prepared by the mud mill. It includes mud, oil and core compound.

The making of hay rope is another distinct process and the completed product is turned over to the core rooms on spools.

Yardage expense includes storing and loading charges.

Pipe is usually tested by an inspector from the consumer, but all pipe must be proved and tested by the manufacturer.

The making of special castings will go through the same general processes, but the uniformity of method will not be possible.

In the modern foundry the placing of the barrels, ramming of molds and inserting of the cores are done by one electric crane. In a more antiquated foundry chain hoists, cars, etc., may be found doing this work.

Some pipe, especially flange pipe, will have to be machined (bored, drilled, planed etc.). There will be a machine shop for this purpose.

Both wooden patterns and wooden flasks will be constructed in the pattern shop. The building of patterns requires high-class carpentry work as well as designing. Flasks are usually no more than boxes without bottoms.

Power production is another process.

The making of brass castings for fittings for special castings may be done by contract, and the keeping of costs or accounts will depend upon the conditions.

Cost finding: For many years it was considered sufficient to distribute costs of various sizes by production weights. In some mills most of the costs are still so distributed. But it has been found possible and practicable to allocate all costs to sizes on a more scientific basis, and such methods as are hereafter outlined are actually in use to-day.

Overhead will have to be charged to the departments. Superintendence must be distributed on an arbitrary basis. Taxes and fire insurance can be distributed to various departments on the

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appraisal basis; employers' liability insurance on a labor cost basis. Power and light may be metered to departments. If not metered they can be estimated fairly accurately. Very little power except on cranes will be used in the foundry. Power is used for most operations in the machine shop; for some in the pattern shop; for practically all in the pipe core rooms; and for all the making of hay rope.

Depreciation has not been included with these overhead expenses, because it may be treated as a direct cost. The experience in each department will determine the best basis for allocation to various types and sizes.

The making of hay rope is one simple operation, and the labor, hay and overhead costs for the entire month divided by the production weight represent the cost per pound of production. This is the cost at which the hay rope is charged to the pipe core rooms.

The cost of mixing mud for cores is obtained in the same way as that of hay rope and charged to core room in the same way.

In the core room the same men work on the same size cores all the time and they report the materials used when reporting their time. It will be found in any foundry that there is some one, usually the superintendent, who has a very good idea of the principles affecting the distribution of the overhead to various types and sizes. Baking and power as well as general overhead expenses do not necessarily vary with the sizes of pipe by weights or by measurements, and labor cost or labor hours may be used as well for the distribution of expenses. The power consumed in turning cores of different sizes, for instance, will be practically the same—as will the cost of baking.

In the pipe foundry all labor can be charged direct to each size and type of pipe. Likewise all materials can be so charged, excepting iron. The vats where pipes are dipped for coating or blacking are filled from time to time and the cost is distributed to the sizes and types on a tonnage basis.

All expenses of the cupola—labor, "the charges," a provision for relining—are charged to cupola cost account. The hot metal cannot be weighed conveniently and the cost of iron as shown by the cupola cost account is charged to the various types and sizes on the basis of tons produced.

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A fixed rate for each size and type of pipe should be established for depreciation of patterns. Another fixed rate should be established for depreciation of flasks for the several sizes and types. These two kinds of rates must be calculated somewhat differently because one pattern makes only one size of pipe, but one flask may make two or three sizes. At the end of any annual or other convenient period an adjustment of these rates may be necessary to bring the costs into agreement with the annual estimate.

Experience will have to determine what basis for the distribution of several other overhead expenses should be employed. It should be noted that the coke used in drying molds can be charged direct to the various sizes and types.

Storing and loading should be distributed to all castings on a tonnage basis.

Only a part of the product, whether special castings or pipe, will need to be machined. There is seldom any machining necessary on bell and spigot pipe, but always on flange pipe. Here labor cannot be charged direct to the types and sizes, for one man can work on more than one machine at a time.

There will be few materials in the machine shop. It is not easy to keep a record of machine hours, nor is it considered that this basis properly takes care of each of the overhead expenses. The most practicable plan has been found to be to distribute the entire cost of the department to each type and size in the proportion that the time of each in the shop multiplied by the weight bears to the whole production calculated on this basis.

With modern manufacturing methods defective work is not a considerable item. The pipe is proved the same day it is manufactured and if defective is immediately broken up and scrapped. This scrapped pipe is kept in one place and eventually returned to the cupola. At the end of each month an inventory of this scrap pipe is taken and the cupola cost account is credited with the manufacture of that amount of scrap iron before costs are distributed to the sizes and types. It is charged with the value of scrap pipe on hand at the beginning of the month. This makes the entire production of each type or size of pipe bear the cost of defective work over and above the iron cost.

In the case of some of the old-style foundries defective work

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may be a considerable item and the cost of production should not be made to bear this expense. The entire cost of the pipe after deducting the scrap value should be charged to a defective work account, and may then be distributed as overhead to the entire product or, preferably, be considered a profit and loss item.

Work in progress: In the hay rope building we have either hay or hay rope. In the mud mill the quantity of mud ready for use in making cores at any time is inconsiderable. In the core rooms the cores made the last day of the month constitute work in progress, for the cores are made up each day to fill the requirements in foundry the next day. In the foundry the entire cost for the month up to about one or two o'clock in the afternoon of the last day will be represented by pipe. The cost of setting up the barrels, of ramming, etc., for the next day's heat will represent work in progress.