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FROM LOSSES TO PROFITS ON THE SAME VOLUME

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By overhauling its manufacturing methods, this company turned a losing business into a paying one. Accurate cost records, expert control of chemical processes, rearrangement of shop layouts, automatic machinery, time study, better planning and control, centralization of power plants—these are some of the steps—at hand to every manufacturer—which enabled the company to stop losses and start profits once more, despite the fact that the volume did not increase

TWENTY-ONE years ago when this company was formed—in the organizing days of 1901—it authorized a bond issue of $600,000 and sold all of them. The other day those bonds became due and we paid them off at par. We did not have to pay them; indeed overtures were made to us to refund. Ten minutes' conversation and a stroke of the pen would have refunded them. We paid them because of a policy that we inaugurated nine years ago. This was to keep well within ourselves and to finance not through banks and borrowed money, but by so improving our processes and so coordinating our manufacturing that one dollar did the work of two. We were able to withdraw the amount of that bond issue out of our cash surplus without in the least pinching ourselves. That is perhaps remarkable—at a time when money is none too easy to get.

To me it is not remarkable. It seems to me only the inevitable result of changing from haphazard to reasoned methods of production and distribution. We have had no windfalls; the progression has been through work. We are doing little more business than the old company—but we are doing it better.

Now to get the background. In 1873 the Vulcanized Fibre Company came into being. It was, I think, the first concern in this country to make vulcanized fibre. Certainly it was the first to go into the business on any scale—although nowadays we should not consider the scale a large one. The company had about $150,000 as an investment. It employed 50 men and did a gross business of around $200,000 a year in fibre for mechanical purposes, mostly for washers. That was before the electrical industry amounted to anything and before fibre was generally used. The company had very little competition and it made a satisfactory profit. In 1901, when consolidations were so popular, the American Vulcanized Fibre Company was formed by the consolidation of the Vulcanized Fibre Company and the other three companies in the country who were in the same business. One of these was in Boston, another in Newark, Delaware, and a third in Wilmington. The new company, as was the fashion, issued securities with some abandon. The promoters put out $700,000 in preferred stock, $2,000,000 in common stock and the bonds that I have spoken of. The bond issue probably represented the fair value of the physical assets of the constituent companies. The organizers valued the good-will at $1,825,000. They closed the plant at Boston, one of the plants in Wilmington, and proceeded to operate practically on the basis of a monopoly, for, with the four companies under one head, the outside competition for the time being was negligible. It was possible to sell at high prices.

If we should set the total mental energy of the corporation at 100 then the managers gave 75 points to finance and the maintenance of high prices and 25 points to manufacturing.

The making of fibre is a specialized business. No other business is entirely like it. But it so happens that our particular problems—although having to do with fibre—have been quite on a par with the problems of any manufacturing business of moderate size. I went into the business without any previous experience in fibre making and simply applied to fibre the general knowledge of manufacturing and accounting that I had learned elsewhere. So while I must talk in terms of fibre just change the terms and the application will fit nearly any business.

Our company through the years considerably extended its field of operations and eventually made most of the articles that the present organization makes—with the exception of one highly important line. They made fibre sheets, rods and tubes, which were sold practically on the raw material basis; they also made up fibre into special articles on order—electrical goods, and the thousand and one specialties for which fibre gradually came to be used. Some of the articles were trade goods sufficiently standard to be carried in stock. The business as a whole might roughly be considered one that dealt principally in raw material, considering finished fibre as raw material. Possibly two-thirds of the output was of this character

and one-third finished goods. Fibre is machined into articles much as is wood or metal and thus, for the specialty division the company had a considerable equipment of lathes, drill-presses, and the like.

Fibre is made by a technical process that up to a stage follows the making of paper. The rag stock is mixed and cooked and beaten in paper machines and eventually comes out as paper. This paper is not unlike blotting paper in appearance. The exact technical process is not important. This paper is the starting point in the making of fibre. It is then immersed in a chemical solution which loads it to several times its original weight. The period of immersion varies with the thickness of the fibre that is being made. After the loaded fibre comes out of the bath it must be dried until all of the loading material has evaporated. This is a process running from only a few days for thin fibre up to months for, say, 2-inch fibre. Getting at the cost of the fibre naturally depends, after the cost of the paper, upon the period of immersion and consequent absorption and the period of drying. Since these lengths of time vary with every form and thickness of fibre it is a cost which is extremely difficult to get at.

The old company made no attempt whatever to find the cost on these processes. At that time very few paper companies in the country knew their costs; our company had in addition to the ordinary troubles of paper cost-finding, the added trouble of the subsequent processes through which the stock had to go before it became fibre. It is true that they had some rule-of-thumb notions of cost, but the figures, we later discovered, bore no relation to the true costs. Of course, there was no chemical analysis to find the best composition of paper for fibre, so rags were bought solely on price. The time of cooking, as well as the intensity of the heating, were all left to chance. The company had a small plant for the making of paper and actually made about one-quarter of the requirements, but home making was not favored; it was believed that better and cheaper stock could be bought outside. Because of the lack of analysis of stock, the processes were uncontrolled and about one-half of the finished fibre of the more difficult sizes to manufacture had to be rejected as imperfect.

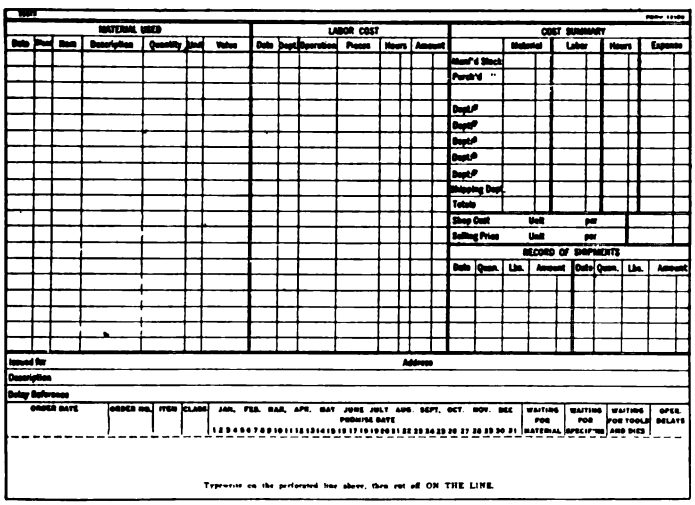
The operations were carried on in two shops; some of the machine work was done in one shop and some in another. The work was neither planned nor routed. When an order came in for special articles it went to the old foreman at his desk and he doped out as best he might how the work should be done. He did not have the facilities to design special tools. He commonly had to makeshift with what he already had. Under the circumstances there could be no machine cost-keeping. The work got through as best it might; sometimes it went through rapidly or again it was held up for months. The company had no record nor regular system of storage of the material and articles which it designed to keep in stock. Usually on the annual inventory it turned out that sizes had been manufactured under the impression of shortage when as a matter of fact the stock was ample—if only someone had known where to look for it.

I have not exaggerated the conditions in the plant, but also I want to say that they were not at all unusual. The management were neither ahead of nor behind the usual run of management. Even today I seriously doubt if more than a tiny fraction of all manufacturing plants control their processes.

The company, having a practical monopoly, did not really have to give much attention—so it thought—to process. But inevitably the high prices attracted competition. Some of the competitors were powerful and made their own paper. Our company, not having developed its own paper plant to a proper basis and being compelled to buy outside for the larger portion of its needs, shortly found that it was depending for its supply

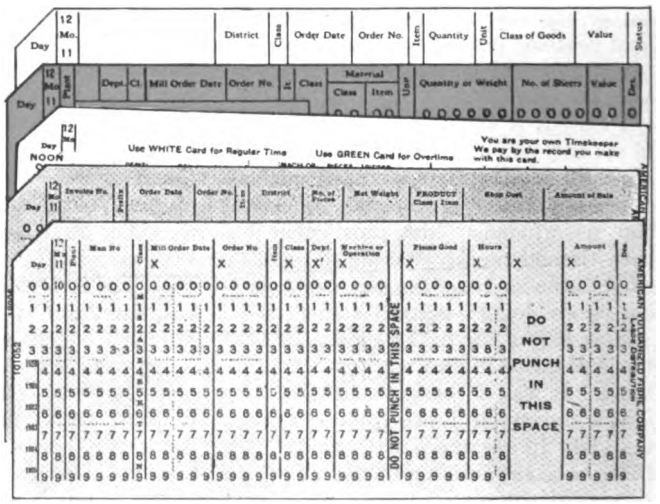
WHERE PROFITS ARE NOW DETERMINED

All cost statistics are handled here on tabulating machines. Analyses are usually available on the 10th of the month for the preceding month, and these figures enable the company to determine which classes of goods are bringing the greatest profits



PRODUCTION AND COST RECORDS ON ONE CARD

On this card is collected all cost information. It is a combined cost and production card, and shows at all times the status of the order, the date promised, and the reason for delays, if any

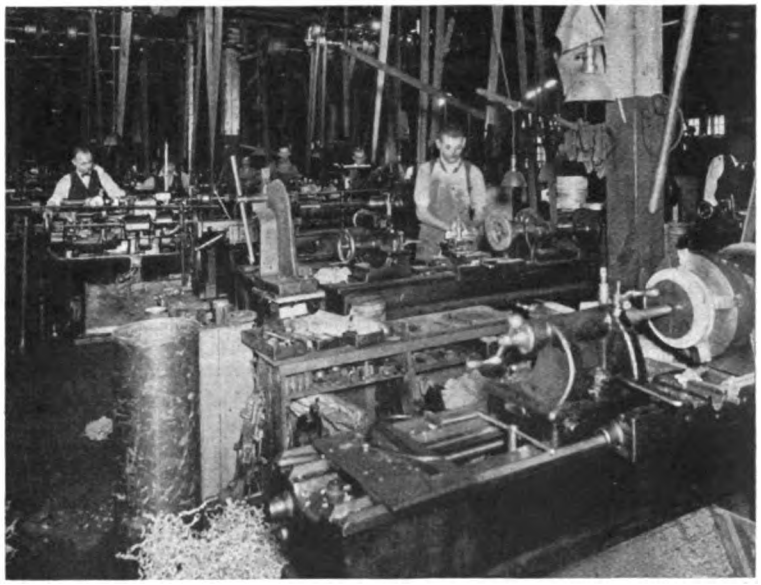


ACCURATE COSTS ARE ESSENTIAL

These cards recording payroll, card payroll distribution, requisition, order analysis, and sales data make it easy to determine costs on all goods by classes of goods and by districts

ONE OF THE FIRST STEPS

Too much of the paper used in the process was defective, without any apparent reason. "The plain course was to put in a chemist and find out why. That we did, and we discovered many things"



ANOTHER MOVE WHICH RESULTED IN ECONOMY

Machines and processes were scattered through two factories. By gathering all the machines in one building and arranging them in sequence of operation, the cost of factory transportation was cut to a low figure. Besides this, better supervision and lower costs resulted

upon a paper company that had also gone into fibre. It was then in the impossible position of buying its raw material from a competitor—and, of course, its prices were absolutely controlled by that competitor. He could dole out paper in the quantities and at the prices that he saw fit. By 1910 competition had so far closed in on the company that it had ceased to make any money at all and was in a fair way to default in bond interest. It was at a standstill.

Then in 1911 the management decided that some sort of industrial survey had to be made to discover if the company could be saved. The management called in some outside engineers to study the problem. I happened to be one of the men put on the job. What has since been done was started by the engineers and continued by the company—of which I have since become president. That is the ancient history.

Our first step was to determine costs. From that work and from the subsequent elaboration of the cost system have sprung all of the improvements which have served to turn a failing company into a very prosperous one. The beginning and the end of every manufacturing operation is cost. The cost may be taken simply as a matter of dollars and cents, but that is to employ only a tiny fraction of the whole function of cost. Costs are directions for betterment. Every step that we have taken has been directed by the cost figures—they have shown the place to which attention was needed. Then we have gone to those places. It took six years to get to a point of really efficient manufacturing; we made no sudden changes—no changes without experimenting. The changes are still going on and, I hope, will continue to go on. But the point I want to impress is that all of the changes grew out of cost exhibitions and were gradual. We have done nothing in a hurry.

The start was with costs. The striking facts that appeared were those relating first to the waste through spoiled material and second to the waste of human power through the scattering of machine and other processes through two shops. We found it possible to get the costs on the paper-making process through the methods which are now common among the more advanced paper mills. The after-process caused more trouble; it seemed that the hundreds of different times needed for the immersion and the drying of the hundreds of different sorts of articles could be found only by a system so elaborate that discovering the costs would amount to more than the material was worth. But, as so often happens in an apparently complex series of operations, the operations, when studied, grouped themselves into comparatively few classes.

GROUPING ARTICLES TO AID IN COST FINDING

Instead of getting a cost on each article we reached figures on groups of articles of like times of process although not of like kinds. We found that the cost on fibre tubes depended upon the thickness of the walls of the tubes. This made it possible to form unit costs and allowed the preparation of a cost table covering this detail of process throughout the entire range of our product. There is no opportunity for variation in these costs with our present process, so we do not bother to carry piece or even lot costs. That would be an extremely complex operation involving much record keeping and our results—by actual test—would not be more accurate than under our present system. It is easy to overdo cost-finding. Costing short cuts are as valuable as any other short cuts—if made on full knowledge.

All our cost statistics are handled by tabulating machine. The five forms shown on page 152 enable us to determine costs on all goods sold by classes of goods and by districts as well. This information is available usually by the tenth of the month for the preceding month. When our cost system was first established it was very interesting to note the difference in the profit on the different classes of goods. I might state that if anything it is more interesting to compare the profits in our different districts, inasmuch as this gives us a means of scientifically measuring the efficiency of our different salesmen. It shows us that the best volume salesman is not always the best profit producer.

The item of spoiled goods was, as I have noted, a serious profit taker. The percentage was high in the product made from bought paper. It was still higher in the paper made on the company's own machines. It used to be accepted as a fact that every process in manufacturing necessarily involved a certain waste and that cutting down a waste where the cause was not apparent was in the way of flying in the face of Providence. There was no apparent reason why so much fibre should be defective. Two sheets of paper, apparently alike, would start into process and the one would come out perfect and the other imperfect—without anyone knowing why. That was an absurd condition. The plain course was to put in a chemist and find out why. That we did. The laboratory is shown at the left above .We discovered many things. We discovered that our paper varied widely in chemical composition because of the kind of rags used, and also because of the length of time and of the temperature in cooking and beating. The

paper made in the company's own plant varied more widely than the paper bought outside—which accounted for the higher spoilage average. Working steadily we found that by controlling absolutely the kind of rags, the composition and the process, we could get a paper that would go through to fibre practically without spoilage. That immediately made it not only possible, but in fact imperative, to extend our paper-making facilities to care for all of our requirements. That we immediately did and without any considerable expenditure. This made us independent as to supply—a necessary prerequisite to putting the company on its feet. More than that and simply by cutting out the wastage it turned a sales volume that had been resulting in a loss to one that resulted in a profit. We saved a flat 10% on the cost of paper—without taking into account the saving on wastage.

It is sometimes thought that profits are to be had only by pushing sales, that unless a certain volume of product is disposed of there must be a loss. There is naturally a minimum volume necessary to cover overhead, but I am rather convinced that more often than not increasing the sales volume is the wrong road to profit. I believe that it is better first to take the volume as it stands and to discover what can be done with it and then to push sales only after the factory knows, and with considerable exactness, just what it can do. Sales promotion is more expensive than efficiency promotion and its results are not so lasting. In our own case had the sales been pressed and the volume increased, even without an increase in the percentage of selling expense, the company would only have lost more money! Throughout our entire series of changes we have not aimed considerably to increase the volume of our output. The volume which today makes this company extremely profitable is not materially larger than that on which it formerly lost money.

The machine plant was scattered through two buildings. We gathered all of the machinery in one building and arranged it as far as possible in the sequence of operation so that there would be a minimum of inter-plant transportation. Since a portion of our work—about 25% now—is on job order we could not make the machine arrangements of a standardized production. The machining had not been controlled and all wages were by the day. Practically none of the machinery was special. Our finished fibre is, as a raw material goes, fairly expensive. In the machining to customer's order each job had been a separate undertaking unrelated excepting through memory to any previous undertaking and our cost showed that, considering the nature of the operations, the labor charge was exceedingly high. It usually exceeded the material cost.

MAKING AUTOMATIC MACHINES REDUCE LABOR COSTS

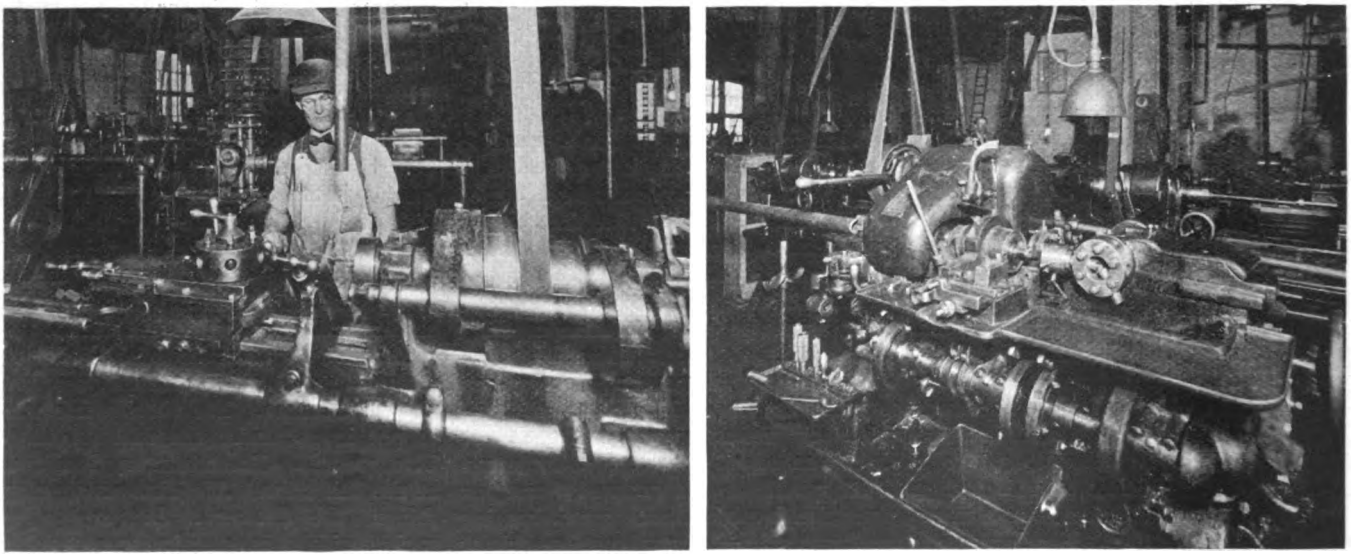
That situation we gradually attacked. We found that many of the operations, although on widely dissimilar articles, were really much alike and for such operations we installed automatic machinery. Take one operation. We make a large number of fibre links for fan belts. These are small, flat pieces of fibre cut to a designed shape and drilled with three holes. The old method had been first to punch them out and then put the holes through on a drill-press. The labor cost exceeded the material cost and the spoilage was large, for often the punch left a ragged edge and again the workman sometimes erred in feeding the links to the drill, which of course resulted in misplaced holes. Now the entire operation is automatic. A strip is fed into a punch. One set of dies cuts up and the other cuts down so that there is no chance for a ragged edge. Another die punches the holes so that with each stroke of the press a complete link is made. There is no spoilage. The labor cost is one-tenth of before and is far below the costs of the raw material.

We thread many fibre screws. Formerly it was done by hand. Now we use automatic machinery. We have studied every possible operation with the cost sheet and wherever we find that an operation can be performed automatically we discover how often it will need to be performed, how much of an initial investment will be required, and what the resulting cost per piece will be. Then if the saving over a term appears to be large enough to warrant making the expenditure—we make it. This also has its sales angle, for if a certain group of machines have not enough work ahead, it is reported through to the sales office and the sales manager knows what kind of orders he should press for.

All of the wages have been taken from the straight day basis and put on task and bonus. This applies to practically every job in the shops, whether in paper-making or in machining. All of the rates were set by time study. The process was simple enough for the repetitive tasks.

It was somewhat more difficult to arrive at rates for jobs on special order, but here again study showed that the situation was not nearly so complex as it had at first seemed to be.

Take the course of a special order. That will illustrate the whole process. Let us say that we have been asked to give a price on some special article on the customer's design. We can, and often do, make the design, but that makes no difference. Start with the design. The estimater, having his cost sheets before him, runs the article through its approximate route and thus he arrives at an accurate cost. This goes to the sales department. They make the sale price. Before, however, the figures go out to the prospective customer the whole proceeding is referred to what we call the "Customer's Agent." He is a member of



PUTTING THE BRAINS INTO THE MACHINE

"Transfer of skill" here means that the automatic machine at the right now performs with slight attention several times the work which, by the old process, took the full time of a man and a machine. This is only one of the better methods adopted

our staff who oversees everything that we do from the standpoint of the customer. He might be likened to the "Devil's Advocate." It is his duty to pick flaws in our arrangements or designs—to discover if he, as a keen and critical customer, would be satisfied with what we offer.

The order is received. It goes at once to the planning division. A new blueprint is made and on it our engineers specify what tools are to be used and in what order. If any special jigs or arrangements of any kind are to be used, the designs for them accompany the instructions. Every fraction of the work is laid out before any work at all is done. Then these sheets go to the rate setter and he from his data sets the standard task and rate so that a man working on this special job will receive a fair wage—no more and no less than he would receive by expending the same amount of skill and energy on any other job. The planning department also sees that the necessary stock is in hand. The job is not started until it can be put through without a delay. This is the large economy of our working method, for a special job goes through in what amounts to repetitive process. The planning avoids the makeshifts that ordinarily attend the fabrication of comparatively small special lots. Thus we were able to bring the one-quarter of our work that might fall into the haphazard class into line with our repetitive work.

The work of planning is closely related to the keeping of our inventory, and is illustrated in some detail by the cards and photograph at the right. In each file tray are two rows of cards, side by side, each left-hand card representing the inventory record of a single item and the corresponding right-hand card containing the planning records for that item. The entries on the cards show how the records are kept.

This work of the planning department enables us to control systematically the manufacture of our finished material without building up heavy stocks of unsalable material.

Our power plants were the subject of improvement, also. The power plants of our paper mill and fiber mill at Newark, Delaware, were centralized and up-to-date power plant equipment, including automatic stokers, was installed.

The company still does a considerable business in finished but unmachined fibre such as sheets, rods, and tubes. This, for sales purposes, is raw material. Its sale depends upon the state of business. We cannot sell fibre unless those who buy from us are doing business. Therefore, our sales are what might be called secondary sales. The portion of the work on special order falls into the same class and we early recognized this as an element of weakness, for it gave us no direct outlet to the ultimate consumer. We needed an anchor to windward in the shape of a trade-mark specialty.

We had made a few waste-baskets, roving cans, and trucks, but almost

71640

Date	Machine Prod.	In Process	Rec'd in Stock	Disb. from Stock	In Stock	Total in Plant
8/23					70	
8/25	70	70			70	40
10/30		5	15		35	40
11/2				10	25	30

Maximum Stock 500 Issue Stock Order When 250

ARTICLE	CLASS	ITEM	COST	
1/8" red fibre	9	5	70¢	lb.

63704

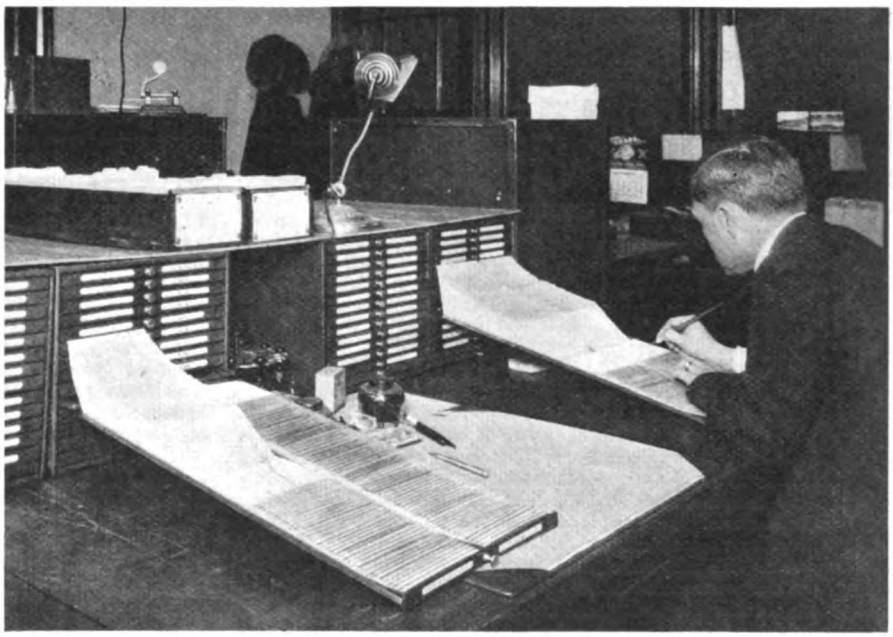
Order Number	Est. Reqmts.	Date	Orders Unfilled	Date	Shipments	IN PLANT Date	IN PLANT Quantity	Surplus	Deficit
14372	10	8/31	60	11/2	10	8/23	70	70	
6782	50	11/2	50			8/25	40	40	
						8/30	40	30	
						8/31	40		70
						11/2	30		20

Issue Stock Order When 250

ARTICLE

1/8" red fibre

FOR PLANNING ONLY



KEEPING A CLOSE CHECK ON PLANNING AND INVENTORY

A set of easily accessible cards like the two above, one for inventory and one for planning, represents every article manufactured. The figures show typical transactions, and the photograph illustrates how the files are used in the planning and inventory control

entirely on jobbers' order. We needed a product the demand for which would not be seasonable and which would fit into our production schedule. We found it in a waste-basket for office use. We trade-marked it, advertised, and very quickly brought out sales that permitted us to standardize both the product and the manufacture.

We saved 40% in labor cost alone and we are continuing to save—so much so that we now sell the basket retail at a profit for $1.50 as against a high price of $2 during the war period and $1 before the war. And that in spite of the fact that we are now paying about double as much as we did before the war for raw material and wages.

There is no mystery about the changes that have come about—I do not want to represent that there has been anything approaching the marvelous. It has been simply a case of steady application to manufacturing process of common sense.