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Control and evaluation of raw material inventories

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Boston University
BOSTON UNIVERSITY
College of Business Administration

THESIS
The Control and Evaluation of Raw Material Inventories

by

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(B. S., Massachusetts Institute of Technology, 1945)

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Chapter I - Introduction

A. Purpose

The goal of the author of this work is to present a complete working outline for the establishment of an efficient raw materials control system in a manufacturing plant. There is also included a chapter on the various methods in use today for arriving at a value of inventories on hand. Although an attempt was made to be impartial, there can be little doubt that the material which follows does cater to the medium and small sized firms built around one production plant. It is hoped that organizations not falling within these limits can make use of the information gathered together in this thesis even though some modification may be necessary.

B. Importance of Inventory Control

The importance of good raw material control cannot be overemphasized. As shown by a recent statistical study the net working capital tied up in inventory in a manufacturing concern may run as high as 305.1 percent. (1) This study for the year 1941 shows clearly that in almost all of the

seventy-two lines of business actively represented, inventories accounted for well over sixty percent of net working capital. A further study covering the period of 1937 to 1941 shows additional facts of interest. (1) In sixty-four out of sixty-eight industries represented the 1941 median figure exceeded that amount shown for 1940. Furthermore, in fifty-four fields this 1941 percentage was the highest recorded over the five years shown. Since this is so, it becomes self-evident that proper control methods must be employed in order to obtain the maximum investment from this capital. Losses can come from several sources including waste, obsolescence, dishonesty, and carelessness. Also, there is the question of tying up too much working capital due to excessive inventory stocks. Better control can and will help to eliminate these faults.

C. Scope

Although the topic is rather broad, an attempt has been made in this thesis to include as complete a discussion as is possible on the subject of inventory control and evaluation. The first section deals with the function of control. This function is, in turn, divided into its two basic components, purchasing and stores. Chapter II goes into the former work in considerable detail, including sections on the setting up of a purchasing department, together with a discussion about the policies and aims to be considered in carrying out such a pro-

(1) Ibid, pp: 52-63
ject. Then there are several sections given to the explanation of a purchasing department in actual operation. Illustrations of approved forms needed by this group are included here.

Of equal importance in the plan to be presented in this work is the task of the stores department. The storekeeper and the purchasing agent are the key men in the system of raw materials control, and it is their job to work together in the closest of cooperation in order to attain a maximum of effectiveness. For this reason two chapters have been devoted to the stores function. Chapter III presents the proper method of approach to be used in deciding upon the physical location and layout of the storerooms. Chapter IV deals with the actual use of records in the control of stock.

D. Method of Presentation

The thesis is set forth in two distinct sections. The first comprises the bulk of the work and deals with the matter of control. The second is presented in one chapter and outlines briefly some of the better known methods of evaluating raw material inventory.

In the four chapters on control a definite policy has been adopted. As each new topic is introduced the author has tried to point out the "one best way" of doing the job while also discussing in many cases various other methods which are
feasible. In the chapter on evaluation, however, this plan has been discarded and instead several perfectly acceptable methods are set forth with accompanying comments as to their advantages and disadvantages. The justification for this approach is that the desires of the owners and executives of a firm govern the method of evaluation to be chosen since each method will differ from the other mainly in the effect it will have on the financial statements and the balance sheet of the company. Hence the final choice of method will depend upon whether a conservative or radical position is desired in regard to a firm's operations. This choice rests with its executives and directors. On the other hand good control of raw material is the aim of all firms and so the pointing out of a definite plan of attack would seem justifiable in this case.
Chapter II - The Purchasing Function

A. Importance of Purchasing

The initial step in obtaining raw material occurs when a purchase requisition is filled out and sent to the purchasing department. Hence it is with this department that the control of raw material must start. If poor purchasing practice is in evidence no amount of control in the plant subsequent to this function can make up for the loss already incurred. Control must begin at the source in order to be thoroughly effective.

United States Census Bureau data has shown that on the average fifty-seven cents of the manufacturer's dollar goes into the purchase of materials. Of the remaining forty-three cents, twenty-six cents goes for overhead and profit and seventeen cents for wages. These figures show the importance of having a well-organized and smoothly functioning purchasing department. In the past it has been the habit of many industrial concerns to stress the control of expenditures which deal with wages and overhead and to be somewhat lax in regard to controlling purchasing. Yet these figures just quoted show that over one-half of every dollar involved in the carrying on of business goes through the

B. Functions of Purchasing Department

Before setting up the purchasing department we must decide what its functions are to be. In order to determine what these functions are, the major objectives of this group should be summarized. These objectives should include the following.

1. To provide the necessary materials, supplies, and services of the quality and character required.

2. To provide these materials, supplies, and services for the enterprise so that they will be available when wanted.

3. To secure these items at the lowest possible cost consistent with sound business practice and ethical procedure.

In order to meet these objectives the purchasing department should set up a method of procedure which includes (a) receiving purchase requisitions, (b) seeking quotations from dealers, (c) placing purchase orders with dealers, (d) verifying the invoices of the shippers with their quotations and with the quantity ordered, (e) following-up of orders and (f) inspecting of shipments received.

In addition the purchasing department should either

(1) Landsburgh and Spriegel, Industrial Management, John Wiley and Sons, Inc. (1940), p. 501
In conclusion, the conclusion of the paper states that...

(continues on next page)
formulate specifications or have a hand in their final determination and also maintain adequate records of sources of supply and the character and reliability of each source.

These then are the functions around which an efficient department should be built.

C. Organization of Purchasing Department

1. Position in the Firm

The first question to be answered is where to place the purchasing department within the organizational structure of the firm. To whom should be the purchasing agent directly responsible. An interesting study made just before World War II revealed that in thirty-seven percent of the companies questioned the purchasing agent was responsible to the president. Further information showed that in twenty-seven percent of the cases the purchasing agent was directly under the general or plant manager; in twenty-five percent, under a vice-president, and in six percent, under the treasurer.

What does this data show? It would seem to indicate that purchasing today is considered an important enough function to be responsible to executive control in most instances. (1)

Only in rare cases is the purchasing department under the manufacturing or production chiefs. Furthermore the financial department as represented by the treasurer seems to act as a coordinating or checking function upon purchasing rather than as a direct control.

Regardless of its position the purchasing department should be charged with definite responsibility and the necessary authority to carry out this responsibility. Above all, the purchasing agent should be kept informed of any impending changes in this company's policy which may affect his work.

2. **Centralized or decentralized purchasing**

There are two questions to be settled in the matter of centralized or decentralized purchasing. The first deals with purchasing as related to one plant, the second, with purchasing in a large organization consisting of several plants not all located in the same area.

Within a given plant there can be little doubt that centralized purchasing should be practiced. Statistics show that about ninety percent of the concerns with a single plant or several local plants practice centralized purchasing. The reason for this can be readily seen. There can be no lasting economy if every department in the plant is allowed to

(1) Ibid, p. 12
do its own buying. A competent purchasing agent with a staff thoroughly familiar with all the available channels of supply can affect a far greater savings for a company than can a system, if it may be so called, of buying in which everyone interested takes a fling. The purchasing agent should have complete authority over purchasing to accompany the specific responsibility placed upon him of obtaining materials for the company. All sources of supply should be selected by this department and any preliminary negotiations carried on by another group in the firm concerning some needed material should never be allowed without the knowledge of the purchasing department. All final negotiations should go through the purchasing department.

There are many advantages to a centralized system, including:

1. Savings effected by large volume buying as a result of combining various small requisitions from departments throughout the firm.

2. Savings through buying at the right time. The purchasing department would be aware of a favorable buying period and also would know how much material of a certain type would be needed by the firm as a whole. Individual departments, unfamiliar with the present market situation, would be unable to make such a savings.
3. The setting up of only one surplus stock section for the whole plant thus saving capital from being tied up in excess inventory stores. This would not be the case if each interested department bought its own material and hence had its own inventory on hand. It makes for a more mobile inventory situation in which all departments draw from one central reservoir of material thus not only cutting down on excess stock on hand but also assuring each department of an adequate supply of raw material in case of a sudden demand on its part in excess of its usual requirements. It assures the company of a complete knowledge of its inventory situation at all time through the records of the purchasing department as well as the stock room records. (1)

4. In connection with the preceding advantage, there is also the advantage of simplifying materials standards and hence cutting down on the varieties of materials used in a concern. Centralized purchasing helps to do this and thus effects another savings in capital.

5. The speed-up of the actual purchasing process from the time the order is placed with the vendor through receiving, inspection and delivery to stock or to specific department. It presents a mechanism for coordinating all these functions under a single guidance.

6. A large savings as a result of having one depart-

(1) Based upon lecture notes of Prof. E. H. Schell for course on Production, M. I. T., 1943.
ment whose business it is to know all about various sources of supply, vendor relationships, and advantageous price situations.

Thus we can see that it is necessary before going further to realize the advantages of centralized purchasing and to act accordingly.

The matter of setting up centralized purchasing in a large corporation with plants situated over a wide area is, of course, dependent upon the closeness of the relationship between the various branch plants and the main office both with regard to the type of product being made and the responsibilities of management. While this thesis is not directly concerned with such a large type of organization a general method of approach to this problem might be of value. The General Motors Corporation seems to have a good slogan with regard to its purchasing, that is, "decentralized responsibility with coordinated control." Here, the parent organization buys those major items used by several divisions which can best be purchased by the central organization. When these items are not bought by the head purchasing office, the main purchasing department of the division involved usually does this buying. Finally, many minor items are

(1) Landsburgh and Spriegel: _op. cit._ p. 505
actually bought by the individual plants within a division.

Hence, even in such a large corporation the idea of centralized purchasing is followed in a modified manner. To refer once more to the statistics collected by the National Association of Purchasing Agents, a further study indicated that in concerns with scattered plants centralized purchasing was practiced in about fifty-seven percent of the cases while partial centralization was used in about thirty percent of the firms. These results would seem to bear out the idea of centralization as brought out in the preceding paragraph in that almost ninety percent of the concerns with scattered plants practice some type of central control over purchasing.

3. Internal Organization

The internal organization of the purchasing department is directly dependent upon the size of the enterprise and the type of materials used. The head of this department is usually called the purchasing agent although not infrequently he may have the title of vice-president in charge of purchasing. As was mentioned in the preceding section of this chapter, the purchasing agent in about thirty percent of the cases answers directly to the president of the company. In most other

(1) National Association of Purchasing Agents, op. cit., p. 12

(2) See page 7
plants he is directly under either a vice-president or the general manager. In the smaller firms purchasing may be combined with storekeeping or the purchasing agent may also have some other duties in addition to buying.

In the medium sized concerns on which the emphasis in this thesis is being placed the purchasing departments are fairly highly functionalized. If the demand for material is large enough and varied enough the purchasing agent has assistant buyers each of whom specialize in a particular group of materials. Thus in a radio manufacturing plant there might be a buyer specializing in tubes, another in resistors, condensers, and potentiometers, a third in heavy metals and castings, and so on. There should also be a follow-up division, records clerks, and if size permits, a traffic division and a materials engineer along with various clerks, stenographers, and typists. Figure 1 illustrates the type of purchasing department which might be found in a medium-large sized company.

In the preceding paragraph the emphasis was placed on the active or buying group in the purchasing department. There is another class of worker in this department who performs a very important duty of the purchasing function, namely the maintenance of a complete system of records.

The purchasing department has perhaps a more con-
Figure 1

Simple Organization Chart of a Purchasing Department
sistent need for records than any other department in a business. The staff assigned to this work is usually under the direction of a chief clerk. They should set up and maintain several types of records. First, there should be a file of suppliers. This should include a list of manufacturers, jobbers, agents, and other vendors who can supply material needed by the firm in question. Each vendor's card or folder should have all pertinent information such as location, freight rates, names of relevant personnel, and time necessary for delivery.

There should also be a quotation file in which are placed all past bids received whether successful or not. This file presents a record of all past experiences on order for which bids were asked.

The largest and most important set of files is that of the actual purchase records. First, files should be set up containing copies of all completed orders. These records should be filed in three ways, by firm, by material, and by order number. The file by firms gives a complete picture of past dealings with each vendor, showing discount policies, prices and speed of delivery. Files by material indicate price trends of a specific item.

A file of purchase records by order number is important in several ways. Requests for information by
I
departments such as shipping, receiving, or accounting on complete or incomplete purchase orders are usually asked for by order number alone. This results in the maximum speed and accuracy since several similar orders may have been placed with the same vendor within a short space of time. Hence, reference to a definite order number would facilitate action. Incomplete orders are usually filed by order number alone until completed. Then they are removed from the incomplete file and placed in the complete files by firm, material, and order number.

The files and records kept will depend for their scope upon the type of business involved. They should be checked regularly and kept up-to-date at all times. Figure 2 presents an interesting example of a form which might be found acceptable. It is an extremely useful card since it may be used for all three of the files mentioned in the preceding paragraph of this section. It is equally well adapted for use as a catalogue index, a record of quotations received, or a record of all material purchased.

There are several other files which may be set up in (1)

Purchasing Agents' Association of Toronto, Canada, Responsibilities and Prerogatives of the Purchasing Agent and His Department, National Association of Purchasing Agents, Inc., (1932), p. 5.
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**Figure 2**

Catalog Index, Etc.
addition to those just mentioned if size of the organization warrants. A file of information on material used by the firm may be set up. This is similar to the vendor file except that all information regarding material in common use by the firm is filed by item instead of by vendor.

A file may be made for follow-up in which orders to be followed-up are placed in the file under future date headings. As each date arrives, the orders filed in its folder are removed and investigated. Orders completed before the arrival of the specific date are removed from the file.

4. Authority

To accompany the responsibility of obtaining material the purchasing department should be cloaked with the necessary authority. As mentioned, before final selection of the source of supply as well as such related functions as method and route of shipment should be left in the hands of the purchasing department. However, the authority of this group with respect to finances should be closely defined and limited. The best method of doing this is by the use of a budget. The budget may be part of a general business budget system used by the entire plant. If this type of overall budget is not employed, a special purchase budget may be set up.

In a budget system the purchasing department is definitely limited in the spending that it can do over a given period.
For example if an item is used regularly, the buyer may be allowed to purchase on the basis of past consumption. Once he has reached the limit set, perhaps, by consumption over the past three months, he must have special authorization to make more purchases. In buying other material the purchasing agent may be allotted so much money. This capital may be used to purchase material in whatever amounts he thinks wise over a given period. Thus it is up to the purchasing agent to study the needs of his company thoroughly and to plan his future purchases carefully in order to be able to supply the necessary items toward the end of the period in question without exceeding his budget.

5. Policies

The basic policies of a firm with regard to purchasing are a function of top management. However, the purchasing agent should take part in the formation of all policies relating to his department. Many decisions such as whether to purchase or manufacture a certain part affect other departments besides purchasing and hence all groups concerned should be represented. On the other hand there are many policies dealing directly with buying which should be left entirely to the discretion of the purchasing department.
Statistics have been compiled which indicate that about twenty-three percent of the firms questioned allowed their purchasing agents to determine the purchasing policies. \(^{(1)}\) Seventy-four percent of the companies used the method advocated in the preceding paragraph, namely, to set up purchasing policies prescribed by the purchasing agent in collaboration with management. Only three percent of the firms felt this decision should be dictated solely by management.

Before going into actual buying methods in more detail a question of general policy should be considered, namely, the contrast of hand-to-mouth purchasing with purchasing in volume for stock. After the depression of 1920 - 21 there began an era of buying small quantities as materials were needed to prevent the building up of large stocks. There are several advantages to this system. First, working capital is not tied up in inventories. Then expenses of storage and handling are cut down as are possible losses from obsolescence, spoilage, or declining prices.

However, there are also some disadvantages to hand-to-mouth buying. Sudden increases in demand for a firm's products cannot be taken care of easily since there are no surplus stocks

\(^{(1)}\) National Association of Purchasing Agents, \textit{op. cit.}, p. 12
The text on the page is not legible due to the quality of the image. It appears to be a page from a document, possibly containing paragraphs of text, but the content cannot be reliably transcribed. The text is not clearly visible, and there are no tables, images, or diagrams present on this page.
of raw material to be used for the unexpected orders. Next, certain costs are actually increased due to this procedure. Since small amounts are bought, quantity discounts are usually not available. Also, expenses of buying are higher, as more purchases have to be made than would otherwise be necessary. Transportation costs to the factory increase through the use of less-than-carload lots. Finally, although in a period of declining prices a savings is made, the converse is true when prices are rising.

The solution to this question seems to lie in a compromise between hand-to-mouth buying and buying for stock. As will explained further in the chapter on Stores Control maximum and minimum points on stock should be set up and so adjusted to insure and adequate but not excessive supply of material on hand at all times.

a. Methods of Purchasing

There are seven basic methods of purchasing which may be employed in obtaining materials. It is better to apply specific methods to specific items rather than to try to use one method for all acquiring of the material needed. The methods are:

1. **Purchasing by requirement.** Under this procedure no material is purchased unless a definite need for it arises. When it is needed, only enough is bought to cover this one requirement. As is apparent, this means buying according to production schedules. There is no capital tied up in inventory as all material theoretically, is utilized the moment it is received. However, in practice this is rarely the case. Even if it were possible to set up infallible production schedules as far as materials needed were concerned, it would be almost impossible to deliver all the items at the proper time to enter directly into production. A delay in procurement could and would cause a serious tie-up of production schedules. The best time to purchase by requirement is when goods not regularly purchased are needed to meet a specific emergency.

2. **Purchasing for specified future periods.**

This method of buying requires not only an accurate record of production schedules but also a systematic and complete set of inventory records. From the inventory records an up-to-date check can be kept on stock-on-hand and on material issued over a given period. From these records the company can decide on a definite ordering point and ordering quantity for each item. This will be discussed further in the chapter on the control of stores. The basic principle here is one of maintaining an inventory large enough to cover material requirements for a predetermined length of time. The best items to
purchase under a plan such as this are those which are standardized and are bought regularly but in small quantities.

3. Purchasing and market trends. This method attempts to make a savings for the company by buying when prices are low. In theory little if any purchasing of an item is done when prices are high while an adequate supply is obtained later on when the market drops. A careful analysis of market trends is required. A distinction, however, must be made between market purchasing and speculative buying. Concerns which can predict their future material needs with a reasonable degree of accuracy may follow the practice of buying on market trends with justifiable results. Planned production schedules are an essential to successful market purchasing.

4. Speculative Purchasing. This policy has as its basis the price advantage of the material rather than any production requirements. Speculative purchasing is almost a business in itself and as a result it is not unusual to have a major part of the company's profits come from this source. Manufacturers of cotton cloth or users of cotton cloth use this method of buying to a great extent. There are, however, several disadvantages to this policy. First, errors in judgment on the part of the buying may cause an operating loss to the firm even though production
methods are highly efficient. Then, too, problems of obsolescence, need for excessive storage space and handling, and uncertainty as to available material when needed are constantly arising.

5. Contract purchasing. This policy involves the purchasing under contract of materials whose delivery is spread out over a period of time. As may be seen this is actually a refinement of method 2, purchasing for a specified future period. In contract purchasing future requirements must be usually known for a longer period and to a closer accuracy than under method 2. This is necessary since total amount of goods bought under contract is not all delivered at once. Hence, there is no large stock of inventory on hand to cover sudden emergencies. Instead, a moderate amount is delivered regularly over the life of the contract. The advantages of this plan are the minimizing of inventory and the attempt to take advantage of a favorable price level.

6. Purchase by quantity orders and scheduled releases. This policy might be called a further refinement of contract purchasing. In scheduled purchasing contracts for material are usually made calling for fairly evenly spaced delivery over a specified period with the option on the part of the buyer to postpone the actual receipt of the goods if his requirements decrease and, conversely, to speed
up delivery if his needs increase. This type of buying requires close cooperation on the part of both the buyer and the vendor.

7. Group purchasing of small items. The basis here is to affect a savings by placing one order for a number of small items rather than by placing individual orders. Usually the purchasing department makes an arrangement with one vendor whereby he agrees for a certain period of time to supply the estimated requirements. Thus a great deal of clerical and delivery costs are reduced both to the buyer and the vendor.

b. Summary of Methods Used in Purchasing

On the basis of recent data two tables have been included at this point relative to the question as to what buying policy purchasing departments in industry today are following. The first table considers all types of purchases while Table 2 includes only purchases of raw materials thus affording means of comparison. From Table 1 it is evident that about seventy percent of the purchases made come from carefully planned production needs. When we include the eleven percent average of contract purchasing it becomes clear that on the whole the purchasing policies of today are

(1) National Association of Purchasing Agents, op. cit., pp. 175, 179.
### TABLE 1
Extent of Use of Various Purchasing Policies in Percent of Total Purchases Made

<table>
<thead>
<tr>
<th>Size of Firm</th>
<th>Known Requirements</th>
<th>Specific Future Periods</th>
<th>Market Trends</th>
<th>Contract for Future Period</th>
<th>All Other Policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>53.3%</td>
<td>14.1%</td>
<td>10.3%</td>
<td>12.9%</td>
<td>9.4%</td>
</tr>
<tr>
<td>Medium</td>
<td>47.1</td>
<td>21.8</td>
<td>7.9</td>
<td>12.2</td>
<td>11.0</td>
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<tr>
<td>Large</td>
<td>43.6</td>
<td>21.7</td>
<td>10.2</td>
<td>10.8</td>
<td>13.7</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>47.2%</strong></td>
<td><strong>20.8%</strong></td>
<td><strong>9.8%</strong></td>
<td><strong>11.1%</strong></td>
<td><strong>11.1%</strong></td>
</tr>
</tbody>
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### TABLE 2
Extent of Use of Various Purchasing Policies in Percent as Applied to Purchases of Raw Materials

<table>
<thead>
<tr>
<th>Size of Firm</th>
<th>Known Requirements</th>
<th>Specific Future Periods</th>
<th>Market Trends</th>
<th>Contract for Future Period</th>
<th>All Other Policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>29%</td>
<td>25%</td>
<td>10%</td>
<td>36%</td>
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</tr>
<tr>
<td>Medium</td>
<td>48</td>
<td>24</td>
<td>9</td>
<td>19</td>
<td>--</td>
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<tr>
<td>Large</td>
<td>31</td>
<td>31</td>
<td>12</td>
<td>26</td>
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</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>41%</strong></td>
<td><strong>25%</strong></td>
<td><strong>10%</strong></td>
<td><strong>24%</strong></td>
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on the conservative side. When we look at Table 2 we notice that the total of market and contract buying is thirty-four percent or a little over one-third of the total of all raw material purchases. The reason for this apparent attempt to take greater advantage of price fluctuations than was done in general buying is not too difficult to fathom. In the first place raw materials are more apt to be subject to wide swings in price levels. In connection with this fact it is also true that much more publicity is given to the market conditions as related to raw materials than there is in the case of other items. Another factor is that the continued use of the same raw material is more certain than in the case of supplies or equipment. Turnover is faster, obsolescence is less, and future need is more certain.

c. Sources of Supply

No treatment of the subject of purchasing would be complete without mention of sources of supply. The more vendors a concern is in touch with the better and easier will be the latter's ability to get material when needed. It is always a good policy to spread orders around a little rather than to depend upon one vendor for all material required. Another aid to better buying is to ask for competitive bids whenever possible.

In selecting vendors there are several factors which must be considered. The first, and perhaps the most
important, is dependability. The quality of the vendor's product, his ability to give service, the price, and his own credit rating all are included under this heading. Past experience both of the firm in question and of other firms in dealing with a particular vendor are the basis of judgment. Hence the value of complete records of past purchases can be seen. Other factors of importance include the geographical location of the vendor and the preference as to a jobber or manufacturer as a vendor. The former factor brings in transportation problems and freight rates. Then, too, closer personal contact can be made with a local vendor which many times may result in a better understanding of the problems of both buyer and seller. The question of whether to use a jobber or manufacturer as a source of supply depends mainly on the comparative advantages afforded by each which, in turn, depends upon the type of industry in question.

While on the subject of sources of supply it would seem appropriate to discuss the system of reciprocal buying found in many businesses today. This simply means buying some or all of your raw materials from the consumers of your product. There is an extreme difference of opinion in regard to the advisability of using this system of buying. Some authorities claim it is the exact opposite of scientific purchasing and hence a detriment to the firm. Others take the attitude that it is a good policy as it tends to build
up good-will among the customers. As an example of this lack of agreement on the subject the reader need merely consult the three prize winning papers on the subject, "Selecting the Source of Supply," as sponsored by the National Association of Purchasing Agents Committee on Education. (1) One contestant thought it was a good idea to use reciprocity if the vendor-consumer met the standards of dependability required. The second entrant, on the other hand, was not in favor of the system except in a few cases while the third refused to give any opinion and merely mentioned ideas on the subject put forth by other writers.

It would seem to me that if there were no sacrifice in the standards of dependability, price, and other similar factors mentioned in the second paragraph of this section, reciprocity within limits might be practiced perhaps to some advantage to the buyer. If all the standards set for determining proper sources of supply were met, there should certainly be no disadvantage to the system. On the other hand some amount of consumer goodwill might be initiated through appropriate use of this policy.

To summarize briefly, three general rules may be applied to the matter of sources of supply. First, only reliable dealers should be considered. Special odd lot bargains offered by comparatively unknown vendors should be avoided unless there is some accurate means available for testing the material. Second, the buyer should expect to pay a price commensurate with the cost of the goods. This policy eliminates the tendency of the vendor or the buyer to "chisel." Finally, the purchasing department should seek to maintain two active sources of supply. By following this policy the buyer may secure competitive bids on purchases and hence be sure of buying at proper prices. Another advantage is the protection thus afforded against the possibilities of a long shutdown in a supplier's plant.

d. Specifications

A difficult but important part of the work of the purchasing department is that of presenting adequate specifications to the vendor. This is especially true when competitive bids are to be asked. While the basic design is a product of the engineering department, it is up to purchasing to work together with engineering in order to make the specifications in accordance with accepted trade standards as often as possible. Unusual design requirements

result in higher prices. Purchasing in conjunction with all departments concerned must make absolutely sure that the materials being ordered are adequate for the purpose for which they are being procured without being too good. There should be no money spent for excess quality which is not being utilized to the fullest. Many times the original design itself can be modified in some minor way in order to conform to a standard product of a vendor.

D. Purchasing Procedure

1. The Original Purchase Request

As shown in Table 3 about sixty-two percent of all purchase requisitions originate with department heads. Far behind is the storeroom with only twenty-one percent. This practice would appear to be due to the nature of the requisition as a reflection of the operating program of the company. (1) Thus as that program goes from the planning stage into actual operation, the detailed material needs appear at the point of use.

A variance of the above system is reflected in the fact that about thirteen percent of the requisitions originate either with the production department or the superintendent. These cases may be considered as belonging under the same

<table>
<thead>
<tr>
<th>Size of Firm</th>
<th>Dept. Heads</th>
<th>Stores</th>
<th>Production Dept.</th>
<th>Superintendent</th>
<th>Executive</th>
<th>Purchasing Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>66%</td>
<td>--</td>
<td>17%</td>
<td>17%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Medium</td>
<td>56</td>
<td>21%</td>
<td>9</td>
<td>8</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>Large</td>
<td>64</td>
<td>23</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Average</td>
<td>62%</td>
<td>21%</td>
<td>9%</td>
<td>4%</td>
<td>3%</td>
<td>1%</td>
</tr>
</tbody>
</table>

heading as those found in the preceding paragraph.

A different system is employed by some firms as is reflected in the twenty-one percent figure under the storeroom heading. Many of the firms in this group use the storeroom as an intermediate step between the originator of the requisition and the purchasing department. Thus all requisitions are sent first to the stores department. If it cannot be filled from stock, the storekeeper fills out a purchase requisition and sends it to purchasing. This latter system, although not so widely used, seems to me to offer several advantages. When the bulk of requests come from individual department heads rather than from one source there would appear to be considerable opportunity for excessive buying and unnecessarily large inventories. As a result one department might put in an order for some material a large quantity of which was on hand and not needed in another part of the plant. Although all purchases are actually made by the central purchasing department, it is not their job to know where all the material obtained is after it has been received and issued to the group who requested it. Under this second system all requests with the few exceptions later mentioned originate from the storeroom as a result of one of two conditions. First, requests for stores replenishment as indicated by the balance-of-stores ledger would result when minimum or order points were reached on individual items. Second, any request for material by
department heads would go first to the stores department. If the latter could not fill the requisition a new request would be made out by the storeroom clerk and sent by him to the purchasing department. A copy of this request would be sent to the department issuing the original requisition with a probable delivery date as indicated by the purchasing department. Thus the stores department would act as a central funneling agent for all requests for material and would prevent any excess inventory by having all stock centrally located.

The requisition itself may vary in appearance according to the amount of information included on it. A sample form is shown in Figure 3. This form although simple contains space enough for complete information regarding material, price, delivery date, and terms.

2. Purchase-Order Quotation Request

The first step taken by the purchasing department after receiving a requisition for material is to ascertain the price to be paid for the article and the vendor from whom it is to be purchased. In many cases this information can be obtained from the records of the purchasing department itself. This is true in regard to standard material whose price may be obtained from catalogues, discount sheets, or trade publications. On material such as this the buyer may usually determine both price and vendor without much
PURCHASE REQUISITION

To Purchasing Agent:

Please order the following:
Ship to................................

Approved by............................

Checked by..............................

Date Material Wanted...................

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Material on hand</th>
<th>Average Consumption</th>
<th>Price</th>
</tr>
</thead>
</table>

Special Instructions

Ordered from....................... Purchase Order No..............

Date Ordered...................... Approved by......................

Purpose.............................. Checked by......................

Charge to.........................

Figure 3

delay. However, when goods are needed on which there are no catalogue prices or other published data, the buyer must seek quotations. This is accomplished by sending out purchase-order quotation requests such as that shown in Figure 4. These requests are sent to various vendors whom the buyer knows are reliable in order to obtain the most economical price in conjunction with the quality, quantity, and delivery date required.

3. The Purchase Order

After the buyer has decided upon the vendor to be solicited, he fills out and sends the latter a purchase order. This order should be so drawn up that no misunderstanding on the part of the vendor is possible. Many different forms are used but all usually include such facts as the purchase order number, the quantity and description of the material requested, the delivery date, shipping instructions, and the price and any agreed upon terms. Figure 5 presents a standard purchase order and inquiry form adopted by the National Association of Purchasing Agents. The form is divided into seven zones and may be modified for use in any type of firm.

The next question is one of procedure. To whom should copies of the purchase order be sent? In all but the smallest firms an excess of copies is to be preferred. The original is, of course, sent to the vendor. Then there
of the worst kind we can imagine, and even more so in the case of the present condition of the world. It is not possible to describe the situation as it was during the war, and it is not possible to predict the future. It is the duty of Statesmen and leaders to provide for the welfare of their people, and they must do so in a way that will not lead to war and destruction.

As a result of these considerations, the work of the international organization is of great importance. It is our duty to ensure that the principles of the present constitution are upheld and that the organization is not used for selfish purposes. It is the duty of Statesmen to consider the welfare of their people, and they must do so in a way that will not lead to war and destruction.

In conclusion, it is the duty of Statesmen to consider the welfare of their people, and they must do so in a way that will not lead to war and destruction. It is our duty to ensure that the principles of the present constitution are upheld and that the organization is not used for selfish purposes.
INQUIRY FOR PRICES

This is a request for quotation on the items enumerated herein.

No__________________
Date__________________
Quotations must be in by ____________________

This inquiry implies no obligation on the part of the buyer.

If substitutes are offered make full explanation

For Shipment To__________________
Date Shipment Can Be Made__________________

Delivery F.O.B.__________________
To Be Shipped From__________________

Terms: Net Cash______________ Days______________ %______________ Days

Keep One Copy For Your Files
Return One Copy With Full Information

<table>
<thead>
<tr>
<th>Item No</th>
<th>Quantity</th>
<th>Description</th>
<th>Unit</th>
<th>List Price of Unit</th>
<th>Discount Offered</th>
<th>Net Unit Price</th>
<th>Est. Gross Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

THIS IS NOT AN OFFER

The undersigned offers the prices, terms, and delivery herein set forth.

By__________________ |
Purchasing Agent

By__________________ |
Seller's Signature

Figure 4

NATIONAL STANDARD PURCHASE AND INQUIRY FORM

ZONE 2
Space is reserved for Name, Address, etc. of Buyer

ZONE 3
For Name and address of seller to whom Purchase Order is to be mailed

ZONE 1
Space is provided for all necessary instructions of buyer and seller, in upper right hand corner, convenient for reference in loose file or binder.

ZONE 4
is used for shipping instructions

ZONE 5
is devoted to general conditions of purchase

ZONE 6
is used for listing materials ordered

ZONE 7
For signature of the Buyer

Figure 5

Source: National Committee on Purchasing Department Organization and Procedure, Purchase Order Forms, National Association of Purchasing Agents, (1932), p. 18
<table>
<thead>
<tr>
<th>Date</th>
<th>Notes</th>
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<td>7 Nov 50</td>
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<td>10 Nov 50</td>
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</table>

**A P.G.**

**Address by Undersecretary**

**A.G.**
must be one copy filed numerically in the purchasing department's files of incompleled orders. Another copy should be sent to the receiving room to be held by them until receipt of the material. A fourth copy should be sent to the accounting department and a fifth to the inspection department if this function is not included in the receiving operation. It is a good idea although not absolutely necessary to include a copy for the follow-up group of the purchasing department. A final copy is sent to the department originally requesting the material. In the plan presented in this thesis this last copy would go to the storekeeper.

E. The Follow-up Function

The duty of a follow-up man, as the name implies is to make sure that the material on order reaches the plant on the required date or, if the material is late, to ascertain the cause of the delay and attempt to bring pressure to bear to speed up delivery. This function is strictly a task of the purchasing department. If there are enough orders placed regularly to warrant it, one or more persons may be assigned to this work on a full-time basis. The work may be split up so that one person checks all slow orders on a specified group of companies or on a specified type of material.

The follow-up file mentioned earlier is an excellent way of preventing goods from becoming forgotten
until well past their delivery date. The file is set up on a date basis and a copy of every purchase order placed is filed under its critical date. The critical date may be before or just after the actual delivery date according to the urgency of the order. Every morning all orders filed under that date are removed and checked on with the vendor. Naturally any orders which have been received are removed from the file on the date received.

F. The Receiving Function

When the original purchase order is sent to the vendor, a copy of this order is given to the receiving department. This copy informs the receiving room that a shipment is due on or about a certain date. When the goods are received this department accepts them and may or may not check on quantity and quality depending upon whether there is a separate inspection department. It would seem best to have the receiving group accept and count the material and then pass it on to inspection for another count and a test of quality. The receiving room should inform purchasing of the arrival and the exact count of the material.

G. The Inspection Function

Although many firms combine receiving and inspection it would seem better control to separate the duties. A separate inspection department should be set up to whom a copy
...
of the original purchase order would be sent. After the goods have been accepted and counted by the receiving department they would be sent to inspection where another count plus a test of the quality would be made on the goods. If in good order the material would then go to stores and purchasing would be notified of the results of the inspection.

A question has developed over whether or not information regarding the count of the goods ordered should be withheld from the receiving or inspection department or both. If both functions were combined in one operation there might be considerable justification for this suggestion, but the plan as presented in this thesis to set up these two functions as separate and distinct from one another seems to set up sufficient check on the matter of ascertaining a correct count. Hence, the withholding of information with regard to quantity would seem to be of little if any value there.
Chapter III - Stores Management

Once material has entered the plant the responsibility for its control rests for the most part with the stores department. The importance of the stores operation is so great that two chapters will be devoted to its study. In the first chapter such related problems as location, layout, and personnel will be considered while the second chapter will discuss the problems of actual operation including ordering, recording, and issuing. The salvage function will also be reviewed briefly.

A. Storeroom Location

No hard and fast rule can be laid down for storeroom location. The size of the plant and the nature of the industry are the determining factors, and both must be considered together. However, there are a few principles which it may be helpful to remember. First, no matter whether one or a dozen storerooms are set up, there should be a central system of control. A perpetual inventory record of the material on hand in all the stockrooms should be kept in a central office. If this were not the case, the benefits mentioned in Chapter II resulting from funneling all orders through the stores department would be lost, since the clerks in charge of the various storerooms would constantly be ordering goods which were actually on hand in other stockrooms.

(1) See page 33
Next, there is the question of how many stockrooms to have. Much here depends upon the nature of the material being stocked. It is not unusual for heavy material such as large castings and metal stock to be held in one supply room located near the receiving room. If the plant is large and various manufacturing departments are scattered throughout the building it would be profitable to have small stockrooms placed in each department to supply frequently used items. In this way losses due to delay and materials handling costs can be appreciably cut down.

Subject to the limits and desires of the individual firm a basic plan of storing material might include

1. **A base stockroom.** This would be a general stockroom carrying all but the heaviest or largest items. Its major function would be to keep the smaller more specialized stockrooms supplied. The central records office would be located here.

2. **A metals or castings stockroom.** Located near the receiving room this storeroom would carry all heavy bar stock, castings, and machinery. It would deal directly with the manufacturing departments although its inventory records would also be kept by the central stores office.

3. **Small departmental stockrooms.** These storerooms, all under the control of the storekeeper not the manufacturing departments involved, would be located in various production divisions throughout
the plant and would handle only the materials needed by their particular department. They would be supplied by base stock.

B. Storeroom Layout

After determining the location system to be followed there arises the very important question of storeroom layout. It is basic that the material should be easily accessible and yet economically stored with as little wasted space as possible. Materials handling costs should be at a minimum consistent with efficient and swift delivery. In the following discussion a small stockroom located in a manufacturing section is to be considered rather than a base stockroom or a special stockroom used solely to store heavy bar stock, castings, or machinery. These latter two stockrooms would follow the plans presented below in most details.

In deciding upon the location of the stores system the amount of space necessary for storage purposes would also have been determined. This space should not be too great, as overhead costs will be increased unnecessarily as a result. On the other hand it should be remembered that too little area may cause considerable inefficiency in storeroom operations. Also, there will be a tendency to understock materials due to the lack of storage space.
In deciding upon the actual arrangement of storeroom equipment and material three questions must be answered. First, what equipment is going to be used to store the material? Second, how is the material going to be identified or classified? And finally how is the material and equipment going to be arranged within the storeroom?

To answer the first question, there are many kinds of equipment available for storing material. According to the size and type of the material one may use yards, floors, bags, vaults, racks, or bins. The general policy is to place large or bulky objects on the floor in stacks while using racks containing bins and placed back to back for all other items. The racks may be either wooden or steel but the sections should be adjustable so as to take care of the maximum number of articles in each rack.

Next, a system of identification should be adopted so that each item may have its proper place in the stockroom and hence may be located swiftly and accurately. There are two systems in general use today. One is to store material by classification, the other, by index.

In storing material by classification the racks nearest the issuing window should contain all items whose

---

symbols begin with A. Then all remaining racks are so arranged that the material is located alphabetically around the storeroom. On the end of each rack facing the main aisle a keyboard would be placed indicating the alphabetical range included in that particular rack. As each rack is made up of divisions which are in turn divided into sections and subsections a classification system similar to that found on an encyclopedia of several volumes would be followed. If material is too heavy or bulky to be kept in a bin, it should be placed on the floor in a separate section with a tag in the appropriate bin indicating its actual location.

Storing by classification develops swift issuing procedure but is not flexible since a rapid change in the type of goods handled causes continual rearrangement. Thus any addition of a new material might cause an entire rack to be rearranged. Also, there is considerable wasted space since about one-fourth of every rack must be left unused to take care of possible expansion. Another disadvantage occurs when materials most often used do not happen to have the same symbol as is found on the racks placed nearest to the issuing window. This common situation cannot be remedied if the proper sequence is to be kept.

The second system and the one recommended here is that of a simple index. Under this system every rack is given a letter or number with the racks arranged in the proper sequence
around the room. Then each row from top to bottom and each section from left to right is also numbered in each rack. Material may then be placed in the racks with the items of fastest turnover located nearest to the issuing window. It is also best to place related items in the same general location. After all the items have been stored an index book or file catalogue is made out in which all materials are listed alphabetically with the stockroom location of each indicated beside its name. All heavy or bulky items may be treated in the same way as they were in the classification system or this may be omitted by showing their exact location in the index book. An example of an item location might be M4L, meaning rack M, row 4, section or bin L.

This method has several advantages over the preceding system. First, as explained, articles in great demand can be located near the issuing window. Second, no space is wasted since an expansion in material stocked merely means adding another rack or two. There is no need for rearrangement in case a new item should be added to the inventory.

With the question of equipment and material identification settled, there remains the problem of the overall layout of the storeroom. While most of the available space will be used to store material, there should be at least
three other separate areas inside a stockroom. The first is, of course, used for issuing material. Adjoining this section there should be a window or other means of entrance for the receipt and inspection of goods. All material coming into the stockroom would pass this point whether it was sent from base stock or just being returned by a worker. A third space should be allotted for assembling and holding material requisitioned by the production planning department. The remaining space of the storeroom should be utilized for storing the material. As shown in Figure 6 the racks all end on a main aisle which should be wide enough for two hand-trucks to pass. The aisles between racks should be wide enough to permit one truck to pass along it.

In any system designed to give adequate inventory control the stores function is of vital significance. Together with the purchasing department, the stores group forms the basis for complete and efficient raw materials control. Thus it can be readily seen why the problem of personnel and authority are extremely important here. The stores department should be divided into two groups. First, there would be a central office section located near or in base stock who would keep all the necessary accounting records. These records as explained in detail in the next chapter

(2) See page 61
Figure 6
Storeroom Layout
must contain accurate postings of all the material in the plant including total quantity, location, and quantity in each location. The head of the stores department would be located in this central office with the full responsibility of keeping inventory above a specified minimum and the authority to meet said responsibility.

The rest of the stores personnel would consist of the actual stockroom operators or clerks. There should be a fixed rule that no one but these clerks be allowed in the stockrooms and that all material must be issued through them and signed for on the proper forms. This procedure will be discussed more thoroughly in Chapter IV.
Chapter IV - Control of Stores

The two basic responsibilities of an efficient stores control system are first, to be sure that the correct quantities of all materials are being constantly ordered so that inventory is never in danger of being depleted and second, to know exactly how much of each item is in stock at all times. These two tasks are mutually dependent and must both be carried out in order to have complete stores control as efficiency in only one would be useless unless the other were also handled correctly. Considerable loss can be incurred through lack of proper control either as a result of excess purchasing or the slowing up of production by not having material on hand when wanted.

A. Ordering Material

In an efficient storeroom the ordering of material is not based on whim but upon scientific study both as to the time to order and the amount. For every item carried in stock there should be at least three, preferably four amounts set. First, a quantity should be decided upon below which it is dangerous to carry that item since an unexpected production order might find the storeroom unable to fill the requirements for the item in question. This quantity is known as the minimum point and no item should be allowed to slip below this figure without every effort
being made to remedy the situation. This is the danger point in inventory control.

Another point to be determined is the maximum point. In theory the best amount of any item to carry in stock would be the minimum quantity since every time this is exceeded, all overhead expenses such as rent, heat, light, insurance and obsolescence charges are working against the storeroom. If it were possible to replace an item at the exact moment of its depletion there would be no need to carry any more than the minimum quantity. However, this is rarely ever the case, hence a margin of safety must be allowed. For this reason a maximum quantity must be set. However, this maximum point should also be set carefully as too high a point will set up excessive losses due to obsolescence and storeroom expenses. In a perfectly run storeroom the quantity of any item stocked should never exceed the maximum point and never fall below the minimum. This however, is rarely if ever the true case.

Since the minimum point is actually the danger signal it is best to decide upon a point slightly above this for ordering purposes. In theory this ordering point would be so set that the actual material ordered would be received at the exact moment when the supply of the item in stock hit the minimum point. In other words the time that elapses from the original requisitioning of a purchase order to the
The text on the page appears to be a continuous flow of paragraphs, possibly discussing a technical or scientific topic. However, the specific content is not legible due to the readability issues. The page seems to contain multiple paragraphs, each starting with a capital letter, indicating a formal or academic writing style. The text is dense and appears to be part of a larger document or book, given the page number and layout.
actual receipt of the material from the vendor should just equal the time it takes to use up enough material to bring the stock on hand down from the order point to the minimum point.

There is one more quantity to consider and that is the actual amount to be ordered when the order point is reached. Again according to pure theory, this order quantity should just equal the difference between the maximum and minimum points, since the goods should arrive just at the moment when the inventory on hand reaches the minimum point. However, this is rarely the case in actual practice. Also, there is the very important question of purchasing in the most economic quantities. If a substantial savings can be made by buying a certain quantity of an item in excess of the maximum amount allowable in stock, this savings should be compared with the extra expense that will be incurred in carrying the excess stock. If the savings is greater than the expense, the purchase should be made, if it is less, the maximum point should prevail.

1. The Minimum Point

In any finished product there is a certain amount of cost due to the storage of the original raw material which went into its manufacture. The greater the amount of raw material stocked, the greater will be the storage cost
allocated to each unit produced. Thus it is most important that a minimum supply of any item be kept in stock consistent with safety.

The first step in determining the minimum point rests with the production department. The production manager must consider several factors in order to decide upon his raw material needs over a definite future period. First, there is the question of whether the factory output is uniform throughout the year or if there are seasonal peaks and depressions. He must also consider whether any manufacturing changes are contemplated which might change the rate of output or the demand for any material. In connection with these considerations of probable output such factors as the general market conditions, the financial shape of the firm in question, and the company's manufacturing policy are important. Once the production manager has collected all the pertinent information, he should draw up a schedule of requirements for all items needed. This schedule should be subject to constant revision or else its value is soon lost. The schedule is then turned over to the storekeeper.

From the production departments' schedule of raw material requirements, the storekeeper must determine the minimum quantity of each item which he can stock in order to satisfy the expected demand. He must base his judgment not only upon the schedule of production requirements but also
upon several other factors. First, there is the question of probable depreciation or obsolescence. Another factor to take into consideration is the time lag between the placing of an order and the final receipt of the material. The longer this time differential is, the higher the minimum point must be. The storekeeper should weigh each factor carefully and arrive at a satisfactory minimum point for each article to be stocked.

A simple example of arriving at a minimum point would occur in the case of a plant where production is fairly constant. If 500 units of a certain material were used each week and it took one week to fill an order, the minimum point would equal a reserve supply of 500 plus the amount used in one week, 500, or a total of 1000 units.

2. The Maximum Point

The basic principle behind an adequate maximum point is flexibility. The quantity must be set for every item carried, but it must be able to be moved in order to take advantage of favorable situations. The storekeeper must keep available storage space and attendant costs constantly in mind. Usually, the larger the inventory the larger the handling and storage costs. However, in many cases the costs do not increase for a small increase in inventory and then an additional increase in material will cause a sudden jump in costs. Another factor to be taken
into consideration is that of a rising market trend. If the price of an item is increasing it may be wise to purchase in excess of present needs in order to make a savings on future inventory costs. Also, due to freight charges there is a certain economic lot size for each item where the cost per unit is at a minimum. Another factor especially on small items is that of clerical costs. Naturally, the larger the order the smaller is the clerical cost per unit. Again, as in the fixing of a suitable minimum point, the time necessary to complete an order must be considered.

3. The Ordering Quantity

Closely tied in with the maximum point is the determination of the best ordering quantity. It is dependent upon all the variables mentioned in the preceding section. The actual quantity to be used for each item may be arrived at by estimate, trial and error, use of a schedule, formula, or graphing. An example of the use of a graph is shown in Figure 7. On this graph the carrying costs and the set-up costs are both plotted. A third curve which represents the total of the two original cost curves is also plotted and the lower point of this third curve indicates the economic ordering quantity.

An example of one of the more commonly used formulae follows:
Figure 7

Sum of set-up and carrying costs equals total unit costs for any lot size. This addition is performed graphically in C. Point D indicates the economical quantity in which to order the item.

Source: Dutton, H. P., "Inventory Control", Factory Management and Maintenance, 93 (August, 1935), p. 79
Computation of Economic Lot Size by Formula

Item: Coil Spring

Unit Cost (C): $0.035

Set-up Costs (S): Machine set-up, $ \frac{1}{2} \text{ hour at ~} 1.00 \text{ for labor and burden} \quad 0.50

Clerical and general charges per order \quad 0.65

Total set-up cost per order per annum \quad 1.15

Carrying Costs (I): Interest \quad 6\%

Depreciation \quad 20

Storage, miscellaneous \quad 4

Total carrying cost per annum \quad 30\%

Average Consumption (Y) 1000 per week.
Time required to fill orders, 1 week.
Reserve supply, 1000

Minimum or ordering point: Reserve supply \quad 1000

Use per week (1000)

X 1 week \quad 1000

Ordering point or minimum \quad 2000

Quantity to order or maximum

\[ E = \frac{2YS}{IC} = \frac{2 \times 52000 \times 1.15}{0.30 \times 0.035} = 3374 \]

B. Records

The importance of keeping an accurate record of all raw material on hand at all times cannot be overemphasized. In comparison with the accuracy employed in checking the exact amount of such expenses as rent, heat, and power, the values found for inventory costs are often quite lax. This condition, as can be readily seen, is due in a large part to the handling of raw materials. They are purchased in large quantities and so when these orders are received by the storeroom it is a simple matter to check on the amount of each item going into the bins. However, the discrepancies occur when the items are taken out again for use in the plant. Hundreds of stores requisitions may be received in one day all demanding different amounts most of which are extremely small. Here is the place where the errors are committed. Stores may be issued without a requisition and hence no record is ever made of the transaction. If the material needed is very small in size and a large quantity is requested the stockroom clerk may fill the order by roughly guessing the correct amount as a result over or under filling the order. In my own personal experience I have seen an order for 100 small lugs come back with 550 lugs in the package. A hundred orders filled in this
manner could completely eliminate any practical control over the material on hand.

These errors may have a serious reflection upon the financial statements of the company. If more material is issued than is actually recorded on the records, the inventory will be overstated since the balance on hand of the raw material will be at a higher figure than an actual physical inventory would reveal. Since these errors, although appearing in the opening inventory figure, would be mounting up during the financial period in question, the closing inventory would be so overstated that the cost of goods sold would be actually understated, resulting in an overstatement of profit. By the same token the work-in-process and finished goods would not be carrying all their actual charges.

There is a two-fold solution to this problem. First, an adequate method of charging material in and out of stores should be set up so that the errors in actual count are cut down to a minimum. However, since the clerks in charge of stores are human, some discrepancy in the balance of stores must be expected. To make sure that this discrepancy is not reflected in the financial statements of the firm and to be sure that the work-in-process and finished goods are not seriously undercharged, some method of accounting must be employed to offset this error. The following two sections will outline a plan designed to cope with this situation.
once nothing as significant as the natural world. It seems that nature was

merely a backdrop to the human experience. But as we learn more about

the complexity and interconnectedness of the natural world, we realize that

it is an integral part of our lives. The natural world provides us with

resources we need to survive and thrive. It also offers us opportunities to

connect with others and find a sense of purpose.

The preservation of nature is not just a matter of protecting our

environment, but also of preserving the knowledge and wisdom that

nature holds. As we continue to explore the natural world, we are

learning more about its mysteries and marvels. This knowledge is not

just of academic interest, but also has practical applications in our daily

lives. From agriculture to medicine, the natural world offers us endless

opportunities to learn and grow.

In conclusion, the natural world is an integral part of our lives. It

provides us with resources and opportunities, and it is our responsibility
to preserve it for future generations.
1. The Stores Ledger

The controlling account for raw materials is the Raw Materials Inventory account. Here such entries as scrap and salvaged material sent to the storeroom, raw material returned to the vendor, and the total of each month's purchases and issuances are recorded.

The stores ledger is the subsidiary record of the controlling Raw Materials account. It consists of a ledger card or balance-of-stores sheet for every item in stock. The form of the balance-of-stores sheet is very important, as all pertinent information should appear here. There are many different types in use, but the one recommended for general use is shown in Figure 8. This card contains six main headings. The first column presents a record of all orders which have been placed for the item in question, including the date on which the order was made, the order number, and the quantity desired. This data is important as it shows when the last order was placed. By comparing this information with that found under heading 2, one can tell what orders are outstanding or overdue. The third column shows the amount issued with spaces for the date of issuance, the order number, the quantity, and the value. The fourth heading appears in logical sequence as the actual balance on hand and is the difference between column 2 and column 3. Many balance-of-stores sheets stop here, but it would seem
This page contains the same text as the previous page, but with minor differences in the formatting. The text is difficult to read due to the quality of the image. It appears to be a continuation of the same topic, discussing some technical or scientific matter. The page number at the bottom indicates it is page 17 of the document.
<table>
<thead>
<tr>
<th>On Order No.</th>
<th>Date</th>
<th>Quantity</th>
<th>Date Quants.</th>
<th>Order No.</th>
<th>Date</th>
<th>Quantity</th>
</tr>
</thead>
</table>

**Available Quantity**
NAME OF ITEM
SPECIFICATIONS

<table>
<thead>
<tr>
<th>ORDERED</th>
<th>RECEIVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Quantity</td>
</tr>
<tr>
<td>Order No.</td>
<td>Date</td>
</tr>
<tr>
<td>Date</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 8**
Balance of Stores Sheet

**SOURCE:** Dutton, H.P., "Inventory Control", *Factory Management and Maintenance*, 93, (August, 1935) P 84
wiser to include two more headings as illustrated. The fifth column should show that amount of the material which is still on hand but which has been apportioned to some particular order. The last column would be the difference between column 4 and column 5 and would indicate the actual supply which is on hand and available for order. It should be noted that any material which is apportioned is not subtracted from the balance on hand until the order is actually taken from the stockroom by issuance to the requisitioning party.

These last two columns serve as a guard against the planning and production department's relying upon the same material twice. The sixth column gives a more accurate figure on the actual material upon which future orders can be based.

C. Handling Material

1. Receiving

An accurate record of all material entering the storeroom should be made. If material is being received for the first time, that is, the arrival of a purchase order from the inspection department, it should be counted and examined briefly at the stockroom receiving window. Then a "Materials Received" report should be made out with four copies, one to go to purchasing, one to accounting, one to the balance-of-
Extranea.
stores clerk, and one to be retained.

Material may come back to the stockroom after it has been issued. This is usually the result of an original over-issue or the curtailment of production on a certain item. This material should be carefully inspected by the stockroom clerk before being accepted. If deemed usable the material is put back in stock and the credit requisition made out by the foreman in charge of the department returning the surplus is sent to the balance-of-stores clerk who makes the proper entries. This requisition, an example of which is shown in Figure 9, is then sent to the accounting department in order to credit the work-in-process account involved.

Often there is a third time when material may be received at the storeroom. This occurs when scrap is an important item. Many manufacturing plants collect and hold all their scrap material for a considerable length of time before selling it. Some firms store this material in the shipping room, but this procedure is not advisable unless the scrap has been sold and is awaiting shipment. The best plan is to send all scrap to the storeroom where it can be kept in space specifically allotted to it. Also, records of all scrap material should be kept so that the storekeeper can inform the purchasing agent, or whoever is in charge of selling the material, how much scrap is on hand at any time. Obsolete material should be treated in the same manner. When
CREDIT REQUISITION

Credit is requested for the Material Listed Below

<table>
<thead>
<tr>
<th>Date</th>
<th>Credit to apply on Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Price</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From Dept. No. ______ Foreman ______
Delivered by ______ Received by ______

Figure 9

Credit Requisition.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Value</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
</table>

**Signature**

[Signature]

Date: [Date]

[Handwritten signature]
scrap material is returned to the storeroom it should be accompanied by a memorandum such as the one appearing in Figure 10 so that accurate records may be kept by the balance-of-stores clerk.

2. Issuing Material

No material should be allowed out of the storeroom unless a stores requisition properly filled out and signed by an authorized person is presented. An example of a simple stores requisition is found in Figure 11. All stockrooms should be supplied with lists of the persons who may sign these requisitions, and the clerks working on the counters should be familiar with these names. Usually foremen and production managers are so authorized. All the details on the requisition blank except for the price should be completely filled in before presentation at the stockroom.

When the requisition is accepted at the stockroom, the clerk who fills out the order should initial the request thus insuring an element of control on the issue. He will be more exact in his count if he realizes that any surplus can be traced back to him.

The requisition is then sent to the balance-of-stores clerk who enters the data in the stores ledger and prices the request. It is sent next to the accounting department where the proper credit to the raw materials
SCRAP MEMORANDUM

To the storekeeper

Date ______

The following scrap material is being sent
to the storeroom

Credit return to Dept. ______ Material on Order No._

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Condition</th>
<th>Original Cost</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Delivered by ______ Foreman ______________

Received by __________________

Figure 10

Scrap Memorandum
<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Time</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Smith</td>
<td>01/01/2023</td>
<td>10:00 AM</td>
<td>Lunch meeting</td>
</tr>
<tr>
<td>Jane Doe</td>
<td>01/02/2023</td>
<td>2:00 PM</td>
<td>Conference call</td>
</tr>
<tr>
<td>Mike Johnson</td>
<td>01/03/2023</td>
<td>4:00 PM</td>
<td>Team meeting</td>
</tr>
</tbody>
</table>

---

**Notes:**
- Attendee: John Smith
- Location: Office 302
- Duration: 1 hour
**STOCK ROOM REQUISITION**

**RADIATION LABORATORY - M.I.T.**

| No. B | 89862 |

**DATE**

194

**STOCK ROOM NO.**

**DELIVER TO**

**DATE REQUIRED**

194

**ROOM NO.**

**GROUP NO.**

**APPROVED BY GROUP LEADER**

**PROJECT NO.**

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>DESCRIPTION OF MATERIAL</th>
<th>UNIT PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>REQUIRED</td>
<td>ISSUED</td>
<td></td>
</tr>
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</tr>
</tbody>
</table>

**TOTAL**

1

**FILLED BY**

**DELIVERED BY**

**REC'D BY**

**STOCK CONTROL**

SEND FIRST THREE COPIES INTACT DETACH AND RETAIN FOURTH COPY

---

**Figure 11**

**Store Requisition**
inventory account is made as well as the correct cost charge to work-in-process.

D. Correcting Discrepancies

Even after setting up the aforementioned plan for stores control there is bound to be some difference between the actual amount of material in stock and the figure shown on the accounting records. Almost always the actual amount will be the smaller of the two numbers. If this condition is allowed to go unchecked, inventories will be overstated with a subsequent overstatement of profits and understatement of manufacturing costs. Thus it is evident that some method is needed whereby this discrepancy can be adjusted. One system which may be employed involves the setting up of a Reserve for Inventory Shortage account. (1) The storekeeper and the accounting department then determine from past records what the approximate shortage is for every month. It may be a constant figure or one which varies considerably due to the fluctuation in the volume of output of the plant. Then at the end of each month the figure decided upon is used as the basis of the following adjustment:

Overhead Expense (Inventory Shortage) XXXX
Reserve for Inventory Shortage XXXX
To charge the cost of production for the estimated shortage of raw material for the month of ________

Thus this entry prevents any undercharging of costs by spreading the expense over all the orders worked on during the month in question. At the end of the year or whenever the annual physical inventory is made, the exact amount of the discrepancy between the actual inventory and the figure on the stores records is found. This requires another adjusting entry this time to correct the Raw Material Inventory account.

The entry is as follows:
Reserve for Inventory Shortage XXXX
Raw Material Inventory XXXX
To bring the perpetual inventory in agreement with the physical inventory at this date.

This debit to the Reserve for Inventory Shortage may result in one of three conditions in the balance of this particular account. If there is no balance at all it means that the estimate made over the year of the probable raw-material shortage was in perfect agreement with the exact loss for the year. Although this is the goal aimed at, it is rarely, if ever, the actual result. Next, there may be a debit balance
in the Reserve account. This means that the actual loss exceeded the estimated loss and hence the costs have been understated. As it is too late to find out to which monthly manufacturing periods this should be charged, an adjusting entry is made debiting Profit and Loss and crediting the Reserve for Inventory Shortage account for the amount of the debit balance, thus closing out this latter account. The third condition would be a final credit balance in the Reserve account. This would indicate that the probable inventory shortage was overestimated and hence the costs of production were overstated for the year. Again it is impossible to ascertain during just which production period or periods this overestimation occurred. As a result, the correcting entry to close the credit balance is a debit to the Reserve for Inventory Shortage and a credit to the Profit and Loss account. These final discrepancies are usually very small especially when compared to the error that would result if no attempt was made to correct the situation until an actual physical inventory were taken.

A second system would be to set up an Inventory Adjustment account. After a physical count has been taken the Raw Materials account is adjusted to the correct amount by an entry in which the off-setting debit or credit is to this Inventory Adjustment account. At the close of the

---

period this account is closed to either Profit and Loss or Earned Surplus according to the desires of the company and the reasons for the discrepancies.
Chapter V - The Physical Inventory

Although a highly efficient system of inventory records such as those described in previous chapters may be set up in a firm, it often becomes necessary to supplement this perpetual inventory with an actual physical count of all the material in the plant. This is needed in order to check on the system of records in use and in order to prevent errors from appearing on the balance sheet and especially the financial statements of the company. An inventory error of one or two percent might not cause any great harm in the balance sheet, but when reflected in the cost of goods sold section of the profit and loss statement the change in income for the period in question might be considerable. Hence, the taking of a physical count becomes essential in any plan for efficient inventory control.

It will be noted that this chapter includes not only the taking of a physical count on raw materials but on all other types of inventory as well. Since a physical inventory is usually taken on all the various inventory classifications instead of on just one segment, it seems wise to cover the subject completely by expanding the scope of the thesis in regard to this topic.
A. Time to Take Inventory

Although the exact time to take a physical inventory depends upon the requirements and operating conditions of the individual concern, the count might be made during one of several periods. First, each item might be checked every time it reached its minimum point. (1) If this plan is followed the count is always low and hence can be done quickly. Also, no shut-down of the plant is necessary, since items will probably reach their low point at different times of the year.

A second method which is somewhat similar to the first is to assign two or three men to the full-time job of taking a continual physical count over a stated period of time. (2) Every day the men check a certain number of bins and compare the results with the stores ledger figures. This method also has the advantage of not interfering with the regular operations of the plant.

The third way to take a physical inventory is by closing down plant operations completely, or to a minimum, for two or three days or a week and making a count on all.


the material on hand. This usually takes place during a period of low production when both plant activity and material on hand are at a minimum. This third method is the one which will be described in detail in the following pages of this chapter. Any simplified methods of taking a physical inventory such as were mentioned above are merely modifications of the plan to be presented here.

B. Procedure

1. Organization

In preparing for a physical inventory, distinct lines of authority should be set up so that everyone involved understands his task and to whom he is responsible. The general manager or works manager should appoint an executive committee, of which he will be the head, whose task it will be to make all final decisions regarding classifications, valuations, and all similar matters pertaining to the inventory. (1) This group will actually be the committee in general charge.

Next, a representative of the accounting department should be chosen to supervise any account procedure relative

(1) Harvard Graduate School of Business Administration, "Morris Production Company No. 2," Interpretation of Industrial Accounting Statements, p. 1.
a thorough analysis of the data. However, it is also important to consider the limitations and potential biases in the data collection process. The results presented should be interpreted with caution, as the findings may not be applicable to all populations or settings.

In conclusion, the study provides valuable insights into the relationship between sleep quality and cognitive function. The observed associations highlight the importance of addressing sleep-related issues in order to improve overall health and well-being. Further research is needed to explore the underlying mechanisms and to develop effective interventions to promote optimal sleep and cognitive performance.
to the taking of the inventory. Also, an inspector of inventory should be appointed to oversee the actual physical counting. It is this inspector's duty to select sectional supervisors, who shall have supervision, under the general direction of the inspector of inventory, of the taking of inventory in the particular sections assigned to them. It is up to these supervisors to select enough men to assist them in carrying out their job. The men chosen for this work should, if possible, be familiar with the procedures of counting and recording used in checking inventory.

Finally, a pricing clerk must be appointed to take charge of the pricing of all material. It is his responsibility to set up and supervise a competent staff for the purpose of presenting an accurate set of inventory sheets at the conclusion of the inventory.

There are, of course, other ways of setting up the organization. Some firms prefer to place the head of the accounting department in full charge since the physical inventory is closely related to the accounting function.\(^1\)

2. Preparations

About one month before the actual taking of the inventory preparations for the coming inventory should begin. During this month a general clean-up should take place so that the task of counting all stock is simplified as much as possible. All scrap material should be sold if possible or at least segregated from active items. At this time the storekeeper should check his records carefully in order to weed out any obsolete items. These goods should be removed from stock and placed with the scrap.

All packages such as boxes, kegs, bales, and crates should be arranged in rows so that by the simple multiplication of width, height, and depth the total quantity on hand can be determined.

It is best to hold material received just prior to the start of the inventory apart from the bulk of the stock-on-hand. It can be kept either in the receiving room or in a special section of the storeroom. A separate list will be made of these items and will later be combined with the rest of the inventory.

Foremen and other department heads should be instructed to clean up all work in their department as much as possible prior to starting the actual count. All material and work in process should be sorted by type and arranged in the
best manner for counting. All finished goods should be taken out of the production departments and placed in finished stores.

All departments, including maintenance and production, should be cautioned only to withdraw from stores that amount of material which will actually be needed before the day on which the inventory is to commence. In this way the quantity of raw material found in these departments will be at a minimum during the inventory.

All these precautions are for the purpose of simplifying the actual counting and checking of material when the inventory begins. Naturally, the better the system of accounting and stores control and the better the stockroom layout, the easier will be the task of taking a physical inventory.

3. Method of Taking Inventory

a. Use of Tags

Most methods employed today in taking a physical count of inventory seem to use tags for recording the count. There are many variations of this basic plan. One is to use tags printed in four colors, a different type to be used for the various classes of material to be recorded. Thus,

(1) Harvard Graduate School of Business Administration, op. cit., p. 4.
blue might designate raw materials, green, work-in-process, yellow, finished goods, and white, expense supplies. Before the inventory starts each sectional supervisor must requisition the number of tags he estimated he will need, a tag being used for each type of item to be counted by his group. The tags he received will be recorded by number in the inventory control department, and each supervisor must make sure that he returns every tag at the close of the inventory, as they have all been charged out to him. This means that no tags should be destroyed. If an error is made, the tag in question should be marked "Void" and returned to the control department along with the other tags at the close of the inventory.

If bin tags are used in a stockroom the above process may be simplified. A bin tag is merely a simple balance-of-stores card which is kept in front of each bin in the stockroom and on which the stockroom clerk, as he receives or withdraws material, enters the item in the "in" or "out" column and carries down the balance on hand. As a result when a physical inventory is being taken, the balance of each item on hand can be read directly from this card instead of making an actual count.

b. Taking the Count

The actual work of taking the initial count should

(1) Dutton, H. P., op. cit., p. 85
be done by groups of two people. They should make an accurate count of each item and record all the required information on a tag which is then fastened to the lot just checked. A separate tag is used for each type, size, or weight of material. There should be no doubling up of material on one tag. Also, as noted, a different colored tag should be used for raw materials, work-in-process, finished goods, and supplies. An example of a tag is shown in Figure 12.

The inventory bulk items cannot be made by an actual count. Usually, the amount of such material as coal, sulphur, or sand which is ordinarily kept in piles out of doors in a yard is determined by surveys and measurements. If the material is so stored that it can be traced back to the original carload, a closer check may be possible.

The inventory of work-in-process is somewhat more difficult than the counting of raw materials or finished goods. As mentioned in an earlier section it is advisable to attempt to complete as much unfinished work as possible during the two or three weeks previous to the beginning of the inventory without starting many new production orders. As a result when the plant does shut down there will be as few orders in the process of completion as possible, all finished goods having been transferred out of the manufacturing departments.
<table>
<thead>
<tr>
<th>Tag No.</th>
<th>Stock No.</th>
<th>Quantity</th>
<th>Location</th>
</tr>
</thead>
</table>

c. Checking the Count

After all material has been counted and tagged, each section supervisor should check all the tags to be sure that they have been properly filled out. He is not expected to count the items again, but merely to ascertain whether or not all tags have been completely filled out. When satisfied, he must then notify the inspector of inventory and await further instructions.

It is the job of the inspector of inventory to test check every section either personally, if the plant is small, or with the aid of a competent staff. He must make enough sample counts to satisfy himself of the accuracy of the work. When this is done he may order a release of the material so checked. The supervisor of the section then proceeds to tear off the removable sections of the tags, leaving only the stubs on the material counted. These sections along with any voided tags are sent to the control department. Before the supervisor and his staff can be released from their responsibility in the inventory, a receipt for all the tags originally assigned to their section must be received from the inventory control department.

A less exact method of checking the initial count is sometimes employed in sections where bin tags are in use. (1)

In this case the only test is made by the head storekeeper and his assistant who make a spot check of various items. The theory being that the stockroom personnel is considered capable of keeping accurate records on the original bin tags.

Before proceeding with the next step, it might be advisable to mention a slight modification of the first system. Tags with two removable sections instead of one (as above) are used. The two men making the first count attach the tag to the item checked, and record their results on the outer section which they then remove. When finished, they send all the sections so removed to the control department. Then a second crew goes through the department repeating the count on all items and recording their results on the second section which they also remove and send in to the control department. If these two teams agree on their count of an item, the material is released. If their counts differ, a third counting team is sent out to make one more test. This is a more exact method of taking an inventory, but it requires much more time and a considerable increase in clerical work.

A third generally accepted method of counting material is to use lists instead of tags. However, the latter method gives a better system for control and is recommended as the superior plan.

4. Inventory Price Sheets
After all the tags have been turned in, the inventory control department must enter the data on the inventory price sheets. These price sheets may be colored according to their classification just as were the tags. Many different forms may be used for the price sheet but all should include such data as the inventory tag number, a description of the article, the unit of quantity used, the price per unit, the total quantity on hand, and the total value of the stock on hand. The considerations peculiar to each type of material involved in regard to the price sheets will be noted below.

a. Raw Material

All material used in the manufacture of the company's products should be listed in this section. This includes any semifinished goods or purchased parts which are obtained from outside vendors. The method of pricing raw materials on the inventory price sheet will be the same as the method in general use for purposes of inventory valuation on the firm's balance sheets and financial statements. A detailed discussion of methods of valuing raw material will be found in Chapter VI of this thesis.

b. Expense Supplies

All supplies should be placed on the same
price sheets and valued at the cost or market price whichever is lower.

c. **Work-in-process**

Work-in-process should be listed according to the department in which it was located at the time of inventory. Its total value should be made up of three items, the material involved, the direct labor, and the overhead. The material involved should be valued by the same method being used to evaluate the raw material in stock. The direct labor should be priced at departmental average rates or individual rates if possible. The overhead should be priced at the established departmental rates. This means the standard rate if a standard cost system is in operation.

d. **Finished goods**

All finished goods manufactured by the company and all goods purchased for resale, on hand at the time of the physical inventory, belong in this group. Goods manufactured by the company should be priced at approved list prices as of the day the inventory began. This means that the products are being priced at standard rather than actual cost, a condition which is justified due to the difficulty in ascertaining the actual costs
of each lot involved. Any finished goods which have been purchased from an outside vendor should be priced at cost or market, whichever is lower.

e. **Goods on Consignment - Out**

All raw material, finished goods, and supplies out on consignment to dealers and other firms should be included in the inventory records since title still belongs to the firm making the inventory. These items should be valued in accordance with the rules set forth above in the sections on raw materials, finished goods, and supplies. Confirmation of the balance of consigned goods on hand should be requested from dealers holding them.

f. **Goods on Consignment - In**

Goods sent to the firm taking the inventory by an outside company should not be included in the lists of material owned at that date. Instead, it should be inventoried on separate sheets and valued at the prices charged by the consignor.

g. **Goods in Transit**

The determining factor here is the question of who holds the legal title to the goods being considered. If the company making the in-
ventory owns the title to the materials, they should be included in the inventory with a special note regarding this condition. However, if the title to the goods has passed to the buyer in the case of a sale or if the title is a purchase, the material should not be included in the inventory of the company taking the physical count. In this latter condition a separate list should be made with a note to the effect that the goods in question do not belong to the firm yet.

Under the heading of goods in transit should be included goods still within the limits of the plant which have been sold to a buyer and on which legal title has passed. Similarly, goods which have arrived and are on hand in the plant but are not the property of the firm should not be included in the inventory. There might be several reasons for this failure to take title such as refusal of acceptance, defective material, damage, or other reasons for an adjustment claim. The goods should be listed separately, and a comment made regarding the reason for their exclusion from inventory.
5. **Inventory Summary**

After the price sheets have been properly drawn up, priced, extended, and checked, a summary report should be compiled. The purpose of this report would be to arrive at a total figure showing the total amount of goods owned by outsiders but still on hand. Heading might include raw materials with its major subdivisions, a total expense supplies entry, work-in-process with its major subdivisions, and a similar set of entries of finished goods. Each of the four major headings would have its own total, and then the four totals would be added together for a figure showing the total inventory owned by the company. A single entry should be included to show goods owned by outsiders.

6. **Summary**

To summarize, it should be noted that a complete physical inventory has four distinct parts. First, there is the setting up of the organization which will carry out the inventory. This step also includes the preparations necessary before the counting can begin. The second step is the actual counting, checking, and tagging of the inventories. The third step is the setting up of the inventory sheets and the last

(1) Harvard Graduate School of Business Administration, op. cit., p. 9.
is the compiling of an inventory summary report.

After the physical inventory has been completed, the adjusting account entries presented on page in Chapter IV can be made in order to bring the perpetual inventory records in agreement with the actual count.
Chapter VI - Evaluation of Raw Materials

Much has been written on the subject of inventory valuation, and considerable difference of opinion exists as to which of the several generally accepted methods is the best one to use. The solution to this problem will not be found in this thesis. The purpose of this chapter is merely to point out the various methods in common use today and to include any pertinent comments about these systems. The type of business involved and the desires of the owners are the determining factors in deciding the question of how to evaluate the raw material of a firm. A special section at the end of this chapter will be devoted to the tax regulations in regard to inventory evaluation.

A. Methods

1. Cost

Probably the simplest method to understand is that of using the original cost of the material as its inventory value. However, it is necessary to define the limits of the term before accurate results can be obtained. Just what expenses incurred in obtaining a shipment of goods are to be included in the costs assigned to the material? The general rule is to include such items as duties, and freight charges in the cost of the materials. Buying expenses and storage costs in transit, on the other hand, are usually termed production overhead although in theory it might be argued
that they belong with the other costs included in the inventory. The difficulty in ascertaining the exact amount of these expenses and in apportioning it to the items purchased makes it seem best to exclude them. Trade discounts and any cash discounts over two percent should not be considered as costs.

Now that the term "cost" has been defined, a further refinement is necessary. Where similar material has been bought at different times and at different prices a decision must be made as to the best manner to arrive at the total inventory value. There are four methods of solving this problem which are in general use.

a. **First-in, First-out**

This method, as the name implies, makes the assumption that the material which has been in stock the longest is the first to be withdrawn on an order. As a result the goods on hand are valued at the cost of the most recent purchases starting with the very last receipt and working back until all the stock has been valued. In the same way goods taken out of stock are valued at the earliest purchase price covering stock still on hand. A simple example might help to explain the system. Assume the stock on hand had been acquired through the following purchases:
January 1. Balance, 50 units at $1.00...$50.00
7. Purchases, 50 units at $2.00,100.00
14. Purchases, 50 units at $3.00,150.00
Thus there are now 150 units on hand at a total value of $300.00. If on January 15, 75 units were withdrawn their cost would be determined as follows:

January 15, 75 units...............$100.00
50 at $1.00
25 at $2.00
The inventory still on hand after this withdrawal would include:

January 14th Purchase-50 units at $3.00..$150.00
January 7th Purchase-25 units at $2.00....50.00
January 1 Balance - none
Balance on hand.......75 units.........$200.00
To check this, one need merely add the January 15 balance of $200.00 to the $100.00 assigned to the order issued on the same day. The sum of the two figures is $300.00 which was the closing inventory on January 14.

First-in, first-out, or "fifo" is about the most popular of the cost methods although it is usually used in conjunction with the cost or market whichever is lower method of inventory valuation. In a bad business year when prices are falling "fifo" is apt to accentuate a poor financial statement since
null
the closing inventory, the bulk of which is made up of recent purchases at low prices, is at a very low figure. The opening inventory, on the other hand, reflects the higher prices of the preceding operating period. The result is a large cost of goods sold and a smaller profit figure. In good years just the opposite is true since the closing inventory has recent higher prices to push it up whereas the opening inventory was dragged down by the lower prices then in evidence.

b. Last-in, first-out

The second method, and one which is becoming more popular since the government for income tax purposes has begun to recognize it in a modified form, is that of valuing inventory under the last-in, first-out, system. (1) This is the reverse of "fifo" in that the withdrawals are considered as taken from the most recent purchases. To repeat our first illustration using lifo:

January 1. Balance, 50 units at $1.00...$50.00

  7. Purchases, 50 units at $2.00,100'.00
  14. Purchases, 50 units at $3.00,150.00
      Balance 150 units $300.00

(1) See page101 for tax discussion.
Now assume that on January 15 the 75 units were withdrawn but this time on the last-in, first-out basis. There cost would be:

January 15. 75 units.............. $200.00
50 at $3.00
25 at $2.00

The inventory still on hand after this withdrawal would include:

January 14th Purchase - none
January 7th Purchase-25 units at $2.00..$50.00
January 1 Balance -50 units at $1.00...50.00

Balance on hand.......75 units..........$100.00

A check shows 150 units at $300.00 as was shown in the January 14 balance.

As might be expected, "lifo" tends to cut down wide fluctuations in a firm's profits by having a smaller cost of goods sold figure and hence a larger profit return during a period of declining prices and a larger cost of goods sold and small profit figure during a period of increasing prices.

c. Moving Average

Under the moving average method a new average cost figure is calculated every time a purchase is made. To continue with the example, the following would be the moving average method:
January 1. Balance, 50 units at $1.00...$50.00
7. Purchases, 50 units at $2.00...100.00
14. Purchases, 50 units at $3.00...150.00
Balance...150 units...$300.00

However, were 75 units withdrawn on January first their cost would be $300 divided by 150 or $2.00 per unit, giving a total of $150.00. The balance on hand would then be $150.00. As mentioned above, every time a purchase is made a new average cost must be figured out. Thus on January 1 the unit cost was $1.00 and the inventory balance, $50.00. On January 7 the unit cost was $150.00 divided by 100 or $1.50 with a total balance of $150.00. On January 14 the unit cost was $300.00 divided by 150 or $2.00, and the balance was $300.00. After the withdrawal the unit cost was $150.00 divided by 75 or still $2.00. The total balance was $150.00.

d. Weighted Average

This method may only be used to determine the value of an inventory at the close of a period. The first step is to calculate the weighted average unit cost. This is done by dividing the total cost of all the units available over the period in question by the total number of units available. Next, this resultant figure is multiplied by the number of units on hand at the close of the period. In our previous example the
total cost of goods available for January, assuming no more purchases or withdrawals would be $300.00, the opening balance plus the two subsequent purchases. The total units available were 150. Hence the unit cost would be $300.00 divided by 150 or $2.00. Since only 75 units were left on hand at the close of the period, the closing balance would be 75 multiplied by $2.00 or $150.00.

These are the four better known cost methods. A fifth would, of course, be to carry all goods at their actual cost. Thus, as each unit was withdrawn it would be charged at the true price paid for that particular item. This involves specific identification, however, which is too great a task for most firms to accomplish.

2. Market

Another method of evaluating inventories is to price everything at its present market value. The principle behind this is, that this is approximately the amount of money the firm would receive in the case of liquidation. No recognition is given to the original investment. This method accentuates the results found by using "fifo". If prices are falling the maximum loss in inventory values is obtained since the closing value of the inventory is at the very bottom of the price decline while the opening stock is set at the peak. As a result losses are emphasized. Naturally during a period of
rising prices the opening inventory is at a minimum and the closing inventory is at a maximum. This gives a very small cost of goods sold and an inconsistently high profit return.

3. Cost or Market, Whichever is Lower

This use of cost and market values is the generally accepted solution to the problem of evaluating inventory. It is more conservative than either method alone, as it attempts to prevent the anticipation of profits while providing for all losses. In arriving at the total value of an inventory under this method every item must be considered individually as to whether its cost or market is lower. The final figure is the total of all the lower of cost or market figures for each type of material stock. An example of how to determine this figure is as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
<th>Market</th>
<th>Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>6L6 tubes</td>
<td>$500.00</td>
<td>$450.00</td>
<td>$450.00</td>
</tr>
<tr>
<td>5RG4 tubes</td>
<td>350.00</td>
<td>350.00</td>
<td>350.00</td>
</tr>
<tr>
<td>VR-150/30 tubes</td>
<td>750.00</td>
<td>825.00</td>
<td>750.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1600.00</strong></td>
<td><strong>$1625.00</strong></td>
<td><strong>$1550.00</strong></td>
</tr>
</tbody>
</table>

Thus the figure to be used would be $1550.00.

Another way of arriving at the same results is to reduce inventory to the lower of cost or market by the setting up of a reserve for this purpose. This method will be presented in the illustration at the close of this chapter.
4. Normal or Base Stock

Perhaps the most conservative method of evaluating inventories, if the proper price is used, is the normal or base stock method. Under this method a certain amount of stock is valued at the same price each year regardless of market conditions. The excess stock on hand over this normal stock is valued at cost, market or whatever system is desired. It is usually the policy of firms using this method to value their normal stock at an extremely low level, for example the lowest price level of the material in question over the past ten years. If a large enough quantity of the firm's total stock is considered normal stock the total inventory balance is held at a very low figure and hence no mark-ups on stock on hand are made and no book profits which could never be realized are taken. Conversely, in periods of declining prices the firm need not reduce inventory values since no rises were taken. Although book profits and book losses tend to cancel themselves over any length of time, companies using the base stock method feel that book profits lead to extrava-gence on the part of the firm while book losses present a more depressing picture than is actually necessary in the financial statements of the business. As may easily be con-cluded, this policy is one of extreme conservation.

(1) Harvard Graduate School of Business Administration, "National Lead Company," Interpretation of Industrial Accounting Statements.
The normal stock method is based upon the fiction that the normal stocks are never touched and that the material used in the products sold during each month is supplied by purchases made during that same month. If the time does come when the quantity of material on hand drops below the quantity set up as normal stock, a reserve is created in the normal stock inventory sufficient to buy back the missing amount at the replacement value at that time. Then the first quantity of material purchased is used to bring the normal stock up to the required level. The government does not recognize this fiction and refuses to sanction the base stock method of valuing inventory in regard to federal income tax returns.

5. Estimated Cost

There are two well-known ways of arriving at an inventory evaluation by estimation:

a. Gross Profits Method

The first step in this method is to arrive, at a gross profit percentage based on sales or costs. This is done by reference to past records. Next, the purchases for the period under consideration are added to the opening inventory to determine the cost of goods available for sale. The third step is to multiply the net sales by the gross profit percentage to find the cost of goods sold. The difference
between the cost of goods available for sale and the cost of goods sold is the estimated ending inventory. An example follows:

Data:

Sales, $50,000.00
Purchase, $25,000.00
Opening Inventory $10,000.00
Estimated Gross Profit = 40 percent of Sales
Closing Inventory = ?

Solution:

Cost of Goods Available for Sale:

Opening Inventory........10,000.00
Purchases.................25,000.00
Cost of Goods available for Sale........................35,000.00

Deduct: Estimated Cost of Goods Sold:

Sales.....................50,000.00
Cost Percentage (100-40).....60%

Cost of Goods Sold...........30,000.00
Closing Inventory.............5,000.00

b. Retail Inventory Method

This method, since it applies to retail stores has no importance here. However, a brief outline of the method employed is as follows:
To the opening inventory valued at the retail sales price add the net purchases at the sales price and also any net markups. From this total subtract all sales and net markdowns. The final figure is the closing inventory at the retail sales price. Convert this to cost by the use of the percentage of costs to sales prices.

B. Tax Law on Valuation of Inventories

The present tax law provides that a concern may adopt either the straight cost or the cost of market whichever is lower method of evaluating inventory for tax purposes (Sec. 29.22(c) - 2). However, when one method is chosen it cannot be changed without permission of the Tax Commissioner. Application for permission to change the method of valuation must be made within ninety days after the beginning of the year to be covered by the return (Sec. 29.41-2).

1. Inventories at Cost

On raw materials cost is considered to be the invoice price plus freight and other charges to obtain possession of


(2) Numbers in brackets refer to sections in the Internal Revenue Code.
the goods minus trade or other discounts. Cash discounts may or may not be deducted as long as the taxpayer is consistent.

2. Inventories at Cost or Market, Whichever is Lower

If an item may be identified accurately with regard to its original cost, this figure is compared to the market value of the item and the lower figure is taken as the inventory value of the article (Sec. 29.22(c)-4). If, on the other hand, the same type of merchandise was purchased at various prices during the year and so intermingled that it cannot be identified with specific invoices, the "cost" of the amount on hand at the end of the year is the cost of the goods last purchased. If, however, the quantity on hand is greater than the amount purchased at the last price, the excess should be inventoried at the next to the last purchase price, and so on (Sec. 29.22(c)-2). This is the same as the first-in, first-out method of inventory evaluation.

3. Inventories at Last-in, First-out

With the approval of the Commissioner any taxpayer who is required to take inventory can use the so-called "last-in, first-out" method (Sec.29.22(d); 29.22(d)-1; 29.22 (d)-3). Under this method the following points should be noted (Sec. 29.22(d)-2):
1. The inventory is taken at cost regardless of market values;

2. Goods of the specified type included in the opening inventory of the taxable year for which the method is first used are considered as having been acquired at the same time and at a unit cost equal to the actual cost of the aggregate divided by the number of units on hand.

3. Goods of the specified type on hand as of the close of the taxable year in excess of what were on hand as of the beginning of the taxable year are included in the closing inventory, regardless of identification with specified invoices, at costs determined in one of the following ways depending upon the choice made by the taxpayer in his application:

   a. By reference to actual cost of goods most recently purchased or produced;

   b. By reference to actual cost of goods purchased or produced during the taxable year in order of acquisition;

   c. By application of an average unit cost equal to aggregate cost of all goods purchased or produced throughout the taxable year divided by total number of units so purchased or produced (the goods reflected in such inventory increase being considered as having been
acquired all at the same time); or
d. Pursuant to any other proper method
which, in the opinion of the Com-
missioner, clearly reflects income.

4. Methods Disapproved

The following methods are disapproved (Sec. 29.22
(c)-2):

1. Deducting from inventory a reserve for price changes,
or an estimated depreciation in the value thereof.
2. Taking work in process, or other parts of the inven-
tory, at a nominal price or at less than its proper
value.
3. Omitting portions of the stock on hand.
4. Using a constant price or nominal value for so-
called normal quantity of materials or goods in
stock.
5. Including stock in transit, either shipped to or
from the taxpayer, the title to which is not vested
in the taxpayer.

C. General Illustration

The best means of comparing several of the more
common methods of evaluating inventory is by the use of an
illustration. The example chosen is the Gravert Leather
Company case which originated in the Harvard Business School
casebook, "Interpretation of Industrial Accounting Statements." In this case the profit and loss statements and balance sheets for 1938 and 1939 are presented. In the former year prices were dropping on raw materials while in the latter they were rising, giving a comparison of the methods under both types of business conditions.

There are several interesting results in this case. First, it should be noted that the use of the straight market value gives the widest fluctuations in profits, hitting the lowest and highest figures for the two years. Next in regard to variances comes the lower of cost or market. The results are the same for this method whether a reserve is used or not since this alternate method is merely a slightly different accounting approach although it is of value as it gives more information as to the relative status of cost and the market. Last-in, first-out and normal stock on the other hand tend to even out the results for both years, actually reporting a profit for 1938 as well as one for 1939. It is interesting to note that the profits for the second year are less using the lifo method than they were for the first although all other systems showed an increase.

The data for the problem follows:
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<th>Month</th>
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</tr>
</thead>
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</tr>
<tr>
<td>February 28</td>
<td>20,000</td>
<td>25 $5,000</td>
</tr>
<tr>
<td>April 30</td>
<td>50,000</td>
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</tr>
<tr>
<td>June 30</td>
<td>40,000</td>
<td>23 9,200</td>
</tr>
<tr>
<td>August 31</td>
<td>30,000</td>
<td>22 6,600</td>
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<tr>
<td>October 31</td>
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<td>21 8,400</td>
</tr>
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<td>December 31</td>
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<td>21 5,250</td>
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<td></td>
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</tr>
</thead>
<tbody>
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<td>January 1</td>
<td>60,000</td>
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</table>

The Gravert Company

Purchases

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<th>Year</th>
<th>Month</th>
<th>Quantity (feet)</th>
<th>Price (cents)</th>
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</thead>
<tbody>
<tr>
<td>1938</td>
<td>January 1</td>
<td>60,000</td>
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<tr>
<td></td>
<td>February 28</td>
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<tr>
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<td>20 $6,000</td>
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<tr>
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</tr>
<tr>
<td>Date</td>
<td>Place</td>
<td>Event</td>
<td>Notes</td>
</tr>
<tr>
<td>----------</td>
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<td>1944</td>
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<tr>
<td>1965</td>
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*Note: Details of events are not visible in the image.*
### Operating Statement for the year ending January 1, 1939

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost (First-in, First-out)</th>
<th>Market</th>
<th>Lower of Cost or Market (First-in, First-out)</th>
<th>Cost with Reserve to Reduce to Lower of Cost or Market (First-in, First-out)</th>
<th>Cost (Last-in, First-out)</th>
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<tr>
<td>Net Sales</td>
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<td>Addition to Inventory Reserve</td>
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<td>1600</td>
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### Balance Sheet January 1, 1939

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<th>Description</th>
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<th>Market</th>
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<tbody>
<tr>
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<td>31750</td>
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<td>31750</td>
<td>35000</td>
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**Figure 13**
### Operating Statement for the year ending January 1, 1940

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
<th>Market</th>
<th>Lower of Cost or Market</th>
<th>Cost or First-out</th>
<th>Cost with Reserve to Reduce to Lower of Cost or Market</th>
<th>Cost (Last-in, First-out)</th>
<th>Normal Stock (60,000 lbs. 15 cents per lb.)</th>
</tr>
</thead>
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<tr>
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<td>52500</td>
<td>52500</td>
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<td>45200</td>
<td>46200</td>
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### Balance Sheet January 1, 1940

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<th>Description</th>
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<th>Accounts Receivable</th>
<th>Inventory</th>
<th>Less Reserve</th>
<th>Total Current Assets</th>
<th>Equipment</th>
<th>Total Assets</th>
<th>Accounts Payable</th>
<th>Notes Payable: Bank</th>
<th>Total Current Liabilities</th>
<th>Capital Stock</th>
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<td>15000</td>
<td>7450</td>
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</tr>
<tr>
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<td>8000</td>
<td>14000</td>
<td>15000</td>
<td>7450</td>
<td>36850</td>
</tr>
<tr>
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<td>Total Current Assets</td>
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<td>31450</td>
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<td>36450</td>
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<td>8000</td>
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<td>15000</td>
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<td>36450</td>
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<td></td>
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<td>8000</td>
<td>14000</td>
<td>15000</td>
<td>7450</td>
<td>36850</td>
</tr>
</tbody>
</table>

Figure 14
Chapter VII - Summary and Conclusions

A. Control

1. Purchasing

The purchasing function has an extremely important place in the plan of raw material control presented in this thesis. The department should have complete authority over all purchases and should be represented in any conference regarding material specifications and requirements. The head purchasing agent should report directly to either the works manager or the president of the firm.

The department itself should be centralized within the organizational structure of the company. Internally there should be a definite assignment of responsibility with the necessary authority to carry out that responsibility. Complete records should be kept on vendors, material, and purchase orders both completed and incomplete. A definite buying policy should be adopted which best satisfies the needs of the company based on the type of material required.

A definite ordering procedure should be set up as follows:

1. All original material requisitions whether for goods in stock or not should be sent to the stockroom.

2. The stores department will fill the order if
possible. If the item is not in stock the storeroom clerk will send in a purchase requisition to the purchasing department, a copy going back to the originator of the order and another being kept in the storeroom files.

3. The buyer handling the order will then send out a purchase quotation request or otherwise determine the price and delivery date for the item.

4. If the purchase quotation request is answered satisfactorily a purchase order is sent to the vendor. Copies of this order are sent to the receiving, inspection, accounting, and stores department, with another being kept for the purchasing files and a final copy being sent to the department initiating the order.

5. The goods when received are counted by receiving and then turned over to inspection for a recount and a check on quality. Both departments inform purchasing of the results.

6. The material is then turned over to stores for another inspection, recording in the stores ledger, and storage prior to issuance.

A separate division of the purchasing department should be set up to handle all the follow-up work, aided by a file system for keeping track of all outstanding orders.
2. Stores

a. Location

A plan of storeroom location was presented calling for:

1. A base stockroom set up to supply other subsidiary stockrooms. The central files would be located here. These files would carry perpetual inventory records on all the stock in the plant both in regard to quantity and location.

2. A subsidiary stockroom in each manufacturing division of the plant, stocking all the material ordinarily required in that division.

3. A metals or heavy equipment stockroom located near the receiving room where all bar stock and heavy, bulky material would be kept.

b. Layout

The basic layout design should call for:

1. A receiving window where all incoming material can be received, inspected, and set aside for future allocation in the storage section.

2. An issuing window where all issues of stock are made.

3. A special space set aside for the assembling of production orders which are to be removed in the
near future.

4. A large storage space economically subdivided to permit the maximum amount of material to be stored in a logical, prearranged sequence.

c. Ordering and Records

The control of stores depends upon two things, the proper ordering approach and the correct procedure for recording and retaining information on goods once they have been received.

Proper ordering is based upon four factors:

1. The maximum point. This is the point of maximum supply of an item and must be carefully determined for each item.

2. The minimum point. This is the danger point below which no balance-on-hand should be allowed to fall. Production requirements based upon past performance and future expectations govern the figure chosen.

3. The ordering point. This is the point at which an order is placed. It is usually higher than the minimum point to allow for the delay between the time of placing the order and the actual delivery date.
4. The ordering quantity. This quantity depends to a great extent upon the rate of turnover of the item and the most advantageous lot size to purchase from an economic standpoint.

Correct control of goods on hand depends for the most part upon the introduction of an accurate system of records. This system should include:

1. A stores ledger card or balance-of-stores sheet for every item in stock showing purchases on order, material received, issued and on hand, material apportioned, and material available.

2. A stores issue blank to be filled out by the proper authority and presented at the stores window before any goods are issued. It should be initialed by the clerk making the issue.

3. A definite procedure for the return of unused material previously issued so that proper record of its return is made.

4. A definite procedure for the collection, recording, and storage of all scrap material.

d. Physical Inventory

A complete physical inventory should be made at least once a year in order to ascertain the true quantity
of all materials on hand and to correct any variances in the perpetual inventory records. The procedure recommended is as follows:

1. Set up a committee under the works manager to direct the general policies.

2. Appoint an inspector of inventory who in turn selects section supervisors. These supervisors pick a staff of assistants and proceed to take a complete physical count of the section to which they have been assigned.

3. Pricing clerks are chosen to price the material after the count has been made.

4. In taking the count numbered tags are used, different colors being used to designate raw materials, work-in-process, finished goods, and supplies.

5. When the first count is finished, a test check is made by the inspector of inventory. If the check proves satisfactory, the material is released.

6. The removable sections of the tags are sent to the inventory control department where the pricing clerks prepare inventory price sheets.

7. From these price sheets a final inventory summary report is compiled.
B. Evaluation

The section on evaluation made no effort to select the one best method of arriving at an inventory value. Instead, several methods were presented such as cost, market, lower of cost or market, normal stock, and estimated cost with comments on the results to be found in using each. The conclusion was that the goal of management as dictated by the owners was the deciding factor as to which method of evaluation should be used.

C. Conclusions

The importance of proper inventory control cannot be overemphasized. Its primary value appears in its relationship to the costs of a business. The better the inventory control, the lower will be the material costs. Losses due to spoilage and waste will be cut down to a minimum. If the control methods are accurate theft of material by the employees will be eliminated. As a result of these improvements in the inventory situation, the company will be better able to plan and meet production schedules and hence its reputation for efficiency will be higher.

Considering the theoretical point of view, there are several interesting aspects of good inventory control. First, the marked improvement in the efficiency of the large group of workers affected by inventory control might well be
influential in a general increase in the efficiency of all the workers in the plant. This condition might also apply to the employees' honesty. To expand this theory further, this internal increase in a firm's efficiency and honesty could quite conceivably be reflected in its dealings with its vendors and customers, thus resulting in improved relations with these groups. Hence a favorable increase in the goodwill of the firm plus a new high in plant efficiency should bring about new orders, higher production, lower costs, and better earnings for the workers.
Bibliography


Atchinson, Jr., W. B., "Taking the Physical Inventory", National Association of Cost Accountants Bulletin, Vol. 27, December 1, 1945


Busseman, Lee J., *Responsibilities and Prerogative of the Purchasing Agent and His Department*, National Association of Purchasing Agents, New York, 1932


Callaway, P. "Four Major Evils of Distribution: Hand-to-Mouth Buying", *Printers' Ink*, Vol. 207, April, 1944


Chamber of Commerce of the United States, *Perpetual Inventory or Stores Control*, Washington, D. C., 1922

Chamber of Commerce of the United States, Department of Manufacture, *Perpetual Inventory or Stores Control (Revised)*, Washington, D. C., 1926


Duncan, C. S., Stock Records and Perpetual Inventory, Bureau of Business Research, 1931

Dutton, H. P., "Inventory Control", Factory Management and Maintenance, Vol. 93, August, 1935

Dutton, H. P., Purchasing, A. W. Shaw, New York, 1927

Encyclopedia Americana, "Inventory", Vol. 15


Gaa, Charles J., Effects of Inventory Methods on Calculation of Profits and Income Taxes, University of Illinois, Urbana, Illinois, 1943


Hoffman, A., "Materials Control Without Unnecessary Paperwork", Factory Management and Maintenance, April, 1945

Kiechlin, A. C., "Is Your Inventory Method Efficient?", Inland Printer, Vol. 114, January, 1945


Kilduff, Federic W., Inventory Practice and Material Control, McGraw-Hill, New York, 1925

Landsburgh, Richard H. and Spriegel, W. R., Industrial Management, John Wiley and Sons, New York, 1940


LeBaron, G. I., "Storage Methods That Save Factory Floor Space", Factory Management and Maintenance, Vol. 102, September, 1944

Lewis, Howard T., Industrial Purchasing; Principles and Practice, Business Publications, Chicago, 1940

McCormack, R. E., "Supply; Centralized Purchasing Department", Engineering and Mining Journal, Vol. 144, November, 1943

Metropolitan Life Insurance Company, The Physical Inventory in an Industrial Plant, New York

Metropolitan Life Insurance Company, Inventory Control Methods, New York


National Association of Cost Accountants, The Control and Valuation of Inventories, New York, 1941


Reitell, Charles and Johnston, C.E., Cost Accounting, International Textbook Company, Scranton, Pa., 1937


Stevens, R.W., "Card System for Closer Control of Inventories", Factory Management and Maintenance, Vol. 103, July, 1945


Twyford, H.E., Storing, D. Van Nostrand Company, New York, 1918

The control and evaluation of raw material inventories