A METHOD FOR THE DETERMINATION AND
DISTRIBUTION OF THE MILL ROOM COSTS
OF THE CONVERSE RUBBER SHOE COMPANY.

BY
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MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASSACHUSETTS. JUNE 1920.
TO THE SECRETARY
OF THE FACULTY.
Cambridge, Massachusetts, June 1, 1920.

Professor A.L. Merrill,
Secretary of the Faculty,
Massachusetts Institute of Technology.

Dear Sir:

In accordance with the requirements for graduation we herewith submit a thesis entitled "A Method for the Determination and Distribution of the Mill Room Costs of the Converse Rubber Shoe Company".

Very truly yours,

Signature redacted

Signature redacted

128676
APPRECIATION
WE WISH TO EXPRESS OUR APPRECIATION

to the CONVERSE RUBBER SHOE COMPANY for their thorough-going cooperation.

to MR BOMMER, MR DILLON, and MR SANBORN for their advice and assistance.

to MISS POWERS for her valuable assistance in the detail work.
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The object of this thesis is to develop a method for determining and distributing the mill room costs of the Converse Rubber Shoe Company.

The Converse Rubber Shoe Company is located in Malden, Massachusetts. It has about seventeen hundred employees and uses about seven tons of rubber per day. It was started in 1908 and grew rapidly from a production of a million pairs during the first year to two and a half million in 1916. Its already rapid growth received a great impetus during the war and the production has been almost doubled again in the past four years.
With this rapid increase in volume of production it is no wonder that production control has not been developed to the degree that it has in those concerns which expanded more slowly.

THE MILL ROOM

The mill room of a rubber company is the room in which the raw materials are put thru the processes which prepare them to be cut up into the various parts which go to make up a rubber shoe or tire. All the raw rums and all fabrics, except plain tennis canvas, are treated in some way in
the mill room. The original bales of rubber from Brazil, or Ceylon, or India are broken down and cleansed. They are next mixed together in various proportions and with certain chemicals to give desired color, toughness, resilience and so on. This mixing is a sort of kneading effected by passing the mixture between large heated rolls upon machines known as "mills". After this process, the gum is allowed to age one day, more or less. It is then broken down again and put thru another kneading process known as "warming-up". The warmed gum is then put thru large calenders and rolled into sheets for shoe soles, or for the uppers of rubbers or rubber boots or coated upon the various fabrics for use in shoes or tires. These sheets constitute what might be termed the finished product of the mill room.
METHOD

In a plant expanding as rapidly as the Converse Company it is evident that there are two points of view from which any cost problem may be handled. The plant may be taken in its present going condition and a method of costing devised upon the basis of the production and other data already available. The other viewpoint looks to a future development along lines of better material and production control and the cost method devised to fit these conditions. With this in mind the authors undertook to present two schemes, one of which may be placed in operation by the simple expedient of securing certain additional data about the stocks now produced while the second is based upon the establishment of a stock room and a centralized control of material.
MACHINE HOUR RATE

In both methods certain elements are common. The cost in each case is based on a machine-time rate which is divided into two parts; Direct Labor, and Overhead. It is figured in the following manner. Take some machine, say the gum upper calender. At this machine there is one calender man and three helpers. A fifth man divided his time between this and a neighboring calender. Their rates of pay are:

- Calender man $0.50 per hour
- Helper .53 " "
- " .47 " "
- " .49 " "
- Fifth man .30 " "

Total $2.39 " "

The total direct labor charged for this machine per hour, or machine-hour rate is thus seen to be $2.39.
The overhead was apportioned to the individual machines on the basis of floor space. The total occupied by all the machines was first determined and then the percent of this belonging to each individual machine was calculated. This figure, determines the share of overhead belonging to the machine under consideration, thus:

Floor space of calender 98.2 sq. feet
" " " all machines 1415.6 " "
98.2
Share of this machine =---- x 100
1,415.6
= 06.95%

Just as the rates of pay and personnel on this machine will change from time to time, the overhead costs also vary from period to period. Let us take for example the month of March 1920. The share of this belonging to the mill room for this period of 454 working hours is ascertained to be $12,902.00
The hourly overhead to be apportioned to the various machines is therefore

\[
\frac{12,992}{454} = \$28.40.
\]

and the share of this chargeable to the particular calender we are considering is

\[
0.0695 \times \$28.40 = \$1.975
\]

which is the machine-hour overhead rate for this machine.

DIVISION OF OPERATIONS

The other feature common to both methods is the division of the mill room operations into two parts. The primary operations are those in which the unit of stock is still the batch measured in pounds. These are operations such as cracking, milling and mixing. The secondary operations are performed by the calenders. Here the stock may be measured in lineal feet. Practically all gums go thru the same preliminary operations so that an approximately correct
average cost per 100 pounds for all these operations may be figured.

**MATERIAL COST**

The material cost for all of these products per pound has already been carefully figured in the laboratory of the Company so that further calculations of this character are unnecessary.
FIRST PLAN
The method of figuring mill room cost is based upon production as it now exists. The time unit has been assumed to be one week. The finished products of the mill room have been divided into classes:

- Processed Stock
- All-Gum Stocks
  - Boot Upper
  - Gum Upper
  - Sole

The first classification includes all stocks which contain fabric.

Stock from the primary operations is divided into:

- Rag Stocks
- Gum Stocks

The records of weekly production needed to determine the costs are kept at present. These follow:
<table>
<thead>
<tr>
<th>Classification</th>
<th>Data Required</th>
<th>Name of Record No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Processed Stocks</strong></td>
<td><strong>Name</strong></td>
<td><strong>Weight</strong></td>
</tr>
<tr>
<td>All Gum</td>
<td></td>
<td>Weighers Tag 1</td>
</tr>
<tr>
<td>Boot Upper</td>
<td>Number,Gage</td>
<td>Stock Order 2</td>
</tr>
<tr>
<td>Gum Upper</td>
<td>&quot;Frames&quot;</td>
<td>&quot;2&quot;</td>
</tr>
<tr>
<td>Sole</td>
<td>&quot;Pairs&quot;</td>
<td>&quot;2&quot;</td>
</tr>
<tr>
<td><strong>Primary Oper's.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rag Stock</td>
<td>&quot;Weight Rec'd</td>
<td>Weighers Tag 1</td>
</tr>
<tr>
<td>Gum Stocks</td>
<td>&quot;Weight Mixed</td>
<td>Mixing Record 3</td>
</tr>
</tbody>
</table>

The total direct labor and overhead for any given period is also recorded. To apportion this data it will be necessary to rearrange certain of this already available and to acquire new information.

**PROCESSED STOCK**

Let us consider first the processed stocks. The production of these is measured in pounds. The calender operates at a sensibly constant speed of output in linear feet per minute. The weights of the various stocks, however, differ markedly due to the various
fabric weights and amounts of gum added to it. It seems evident, therefore, that our first task for any output of stock is to transfer from pounds to linear feet.

The data required to effect this transfer is already at hand on the "Material Cost" cards (#1):  

<table>
<thead>
<tr>
<th>Fabric</th>
<th>Width in inches, (a)</th>
<th>Weight per square yard, (w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gum</td>
<td>Friction</td>
<td>Weight of gum per 100 lb. fabric (f)</td>
</tr>
<tr>
<td>Coat</td>
<td>Weight</td>
<td>(c)</td>
</tr>
</tbody>
</table>

The number of lineal feet per pound of finished product (L) is obtained by the following formula, the derivation of which is set forth in the appendix:

\[
L = \frac{108}{F \times C \left(1 + \frac{1}{100}\right) a W}
\]
With the production transformed into feet the next step towards the cost is to discover the time required by the machine to produce this much fabric. This requires, first, the number of times the fabric passes thru the calender, second, the calender on which the operation is performed, and third, the speed of the calender in feet per minute. The first of these may be determined by inspection for each fabric from the "Material Cost" cards, in general the stock going thru the machine once for each frictioning and once for each coating. The second may also be determined by inspection, certain gums being always handled on certain calenders, as is indicated in the Appendix (#5). The third is taken as a factor, minutes per 100 feet, from the "Machine Record Chart" (#6). The results of the computations and deductions from the "Material Cost" cards are tabulated
on a "Stock Record Sheet" (#7). The production in hundreds of feet is first multiplied by the number of times it goes thru a calender and then by the minutes per hundred feet. The product is the operating time required to produce the stock.

An inspection of the sample week computed later in this thesis will readily show that the sum of all these operating times for a given period is only a small fraction of the actual working time paid for, which is 6000 minutes per normal working week. To apportion this non-productive time, subtract the above sum, in one case 718.5 minutes, from the total time paid for and find the relation between the productive and non-productive time, thus:
The productive times are then multiplied by this factor to give the non-productive times and the two added together and multiplied by the machine-minute rate, also taken as a factor from the "Machine Record Chart" gives the direct labor cost as far as the secondary set of operations is concerned.

The machine's overhead rate has already been determined in the manner described earlier in the report so that all that is required is to calculate the machine minute rate for this part of the cost and multiply by the time.

**ALL GUM STOCKS**

The problem in the case of all-gum stocks is somewhat simpler. In the
case of the boot and gum upper stocks
the production again must be transformed
into feet and also into pounds. The
first transformation is simple the only
requirement being a standardization of
the amount of stock in a frame or reel.
At present the number of frames to a
reel varies from 15 to 20 and the number
of feet in a frame from 9 to 11. The
transformation into pounds is effected
by means of another simple formula de-
rived in the Appendix from the follow-
ing data which is listed on the "All-
Gum Stock Record" (#8):

Specific Gravity, S

Width in inches, W

Gage, G

Thinnest gage used, N

Thickness of N gage in inches, a

Weight of G gage in pounds per foot length, P
The transformation into feet having been made the secondary direct labor cost and overhead is figured in the same manner as for the processed stocks.

SOLE STOCKS

The sole stocks present a slightly different problem in that the variations in thickness across a stock are not negligible as they are in the case of the upper stocks. The weight per foot would have to be determined by weighing a known length of the stock for the various gages. The production is listed in this case in pairs and frames. Here again the problem of standardization comes up. In this case, however, there is the alternative of
figuring an average from production from time to time as the lack of uniformity and hand cutting may save a certain amount of gum. The problem after the production in pounds and feet has been figured is exactly the same as before.

**PRIMARY OPERATIONS**

Practically all gums go thru the same primary operation so that an approximately average cost per 100 pounds for this operation may be figured. The amount of gum stock contained in each 100 feet of calendered stock is already known so that it is a simple matter to apportion to each of these stocks its share of the cost of the primary operations.

The cost is arrived at in this manner. The total production of gum is indicated on the "Daily Mixing Record" (#3) It may in general be said to have occupied the entire time of a number of the machines
whose rates are known. The total cost of operating these machines is therefore determined and this divided by the number of pounds of gum handled gives the cost per pound during the period.

The apportionment in the case of all-gum stocks is obvious. In the case of the processed stocks it will be necessary to determine what part of the weight of the finished product is given. That is, how much of the stock has gone thru the primary operations. The data is determined from the Weighers Tag (#1).

The total cost of the primary operations is then figured in the same way as for the all-gum stocks. These cost figures are entered upon "Cost Sheets" (#9a, b, c, etc.)
CONCLUSIONS

It must be noted that this is simply a statement of a method and the figures are illustrative rather than exact. This system may be brought to a very excellent standard of accuracy by

1 Standardization
2 Redetermination of the constants on this basis
SECOND PLAN
INTRODUCTION

The new mill room of the Converse Rubber Shoe Company is to occupy about four times the present mill room area. This floor space takes up that now occupied by the mill room and sections of the four floors of the new building which is being added to the factory. A plan of this floor space is shown in the appendix. The fourth floor takes care of the cloth or fabric, the third the drugs, and the second the weighing of the compound. The first floor is the operating floor but also has storage area for the raw gum.

The operation of this department is to be as follows. The raw gum will be received on the second floor and will be taken to the first where it is to be broken open, cleaned, washed, dried and stored. From here it is taken, as production requires, at night and is pre-cracked. It is then taken to the temporary store on the second floor for less than twenty-four hours.
From this store it will be weighed into the compound pans and will then go to the first floor again where it is mixed. From there it will be placed in the mixed gum store for at least twenty-four hours. As needed it will be taken from this store and go thru the calen-dering process and then in its finished form will be forwarded to the next department. The cloth will be taken to the fourth and is here dried and then stored in a warm dry room until needed. The drugs will be taken to the third floor and stored. As production requires they will be moved into a drying room in their original containers. They are dried for a while and then sifted and shot from the sifts by gravity to the second floor where they will be stored in bins until weighed out into the compound pans which are run on mono-rail conveyors. The drugs and gum will be taken from this weighing room to the first floor by gravity on the mono-rail conveyor where they will be mixed.
The purpose of the following plan is to obtain the costs of taking these materials thru the various operations enumerated above and to distribute this cost to the finished materials as they leave the mill room. This cost must be a fair representation of the material, labor and overhead used in this finished product as the grades and kinds are taken by different departments. It would be manifestly unfair to one department to make it pay for the labor and overhead which was used by another.

The preceding plan is to be used as a transition means of obtaining cost figure. The following is designed to meet conditions as they will probably be under the new system. It is hard to foresee all the conditions in the future so that certain assumptions have been made.

**ASSUMPTION**

The first assumption is that there will be some central planning department which
will control all production. This department is assumed to issue all production orders to the mill room and to make out all Material Requisitions and Job Tickets.

It is assumed that either the Cost Department or the Planning Department will look after the time keeping of the jobs, that is, will take the time when a batch starts on its operation and the time when it finishes. This time and the weight of the material used is absolutely necessary for this cost system.

The next assumption is that there will be absolute control of materials and that all material used in the mill room will be weighed out and that all material coming into the factory will be weighed out and that some stores system will be devised for keeping tract of these weights. This weighing is absolutely necessary to obtain the data on material for the tables and for costs.
The last assumption made is that a hundred pound batch of any material will be a unit weight and that all cost will be obtained on this unit.
GENERAL PROCEDURE

The Production Order is first received by the mill room from the Planning Department. The necessary Job Tickets and Material Requisitions are attached. The number of the unit which is to do the job is on the ticket and all the foreman does is hand over the Job Ticket and Material Requisition to the boss of that unit. The latter takes the requisition and gets the specified material. When he starts the job he takes the Job Ticket to the Time Keeper who stamps the time and then when he has finished the operation he takes it to the time-keeper again who stamps the time in the finished space. At the end of the day the boss turns his Job Tickets into the foreman who forwards them to the Planning Department and they take the necessary data from it and then forward them to the Cost Department.
The latter, by means of tables obtained as below, calculates the costs and enters on the proper forms.

**TABLES**

The tables are made up of those elements of cost that are constant or nearly constant and which, when once determined, will last a considerable time and save unnecessary labor of calculation. Some data for these tables may be easily obtained from the books of the Company, other will have to be determined by time study, and still other by observation and experience.

The first table we want is the cost of the gum weighed out into the pans in the compound room for each kind and grade of gum. The following data will be necessary to obtain this:

1. Cost of Raw Gum per 100 lbs.
2. " " opening, cleaning & washing 100 lbs. of gum, which includes
(a) Time it takes
(b) Laborers and their rates
(c) Machine or Spacehour rate
(This latter will be obtained from a subsequent table.)

(3) Cost of Operating Drier per 100 lbs.
(4) " " Storing
   (a) Average time in storage.
   )b) Space-hour rate for store.
(5) " " Pre-cracking per 100 lbs.

By adding together all the costs above we will get the desired cost figures.

The next table gives us the cost of drugs as weighed out of the bins in the compound room. This cost will be listed according to the kind of drug and its quality. It will be composed of the following:

(1) Cost of Drugs to purchase per 100 lbs.
(2) " " drying " " "
(3) " " sifting " " "
which includes (a) Average time taken.
 )b) Men and their rates.
 (c) Space- or Machine-hour rate.
The last table of Raw Stock is that for cloth or fabric. This as the other will be tabulated according to the kinds and grades. It will consist of the following for each cloth.

1. Cost of Cloth per 100 lbs.
2. "drying"
3. "keeping dry"
4. Space hours.

We now have the cost for all raw materials.

Our next table is of the Cost of material in the various combinations which form the stock gum when mixed. The cost elements of a 100 pound batch will be obtained from the following and when listed will give us the complete material cost in the mixing process.

1. Cost of gum and scrap element.
2. "drug elements.
3. Storage hours.

The next two tables are those for the material in the mixed store. These materials are mixed gum and scrap gum. The first of these two tables is one which con-
tains the percentage of scrap returned from 100 pounds of finished gum delivered to Cutting Room or other departments by that department. This will have to be obtained by experiment and observation. This scrap may be constant for the various finished product and if so no table will be necessary, but, if it varies a table will be of first importance for determining the cost of the scrap in the next table. The first part of the next table is made up of the cost of the different stocks as delivered to calendering process. This is obtained from the following data for each stock.

<table>
<thead>
<tr>
<th>Scrap Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-Finished Gum Stock</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gum Stock</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| (1) | Cost of material in 100 lbs. of mix. |
| (2) | Machine Cost. |
| (a) Time in mixing |
| (b) Machine-hour rate |
| (3) | Storage Cost |
| (a) Average time in store |
| (b) Space-hour rate |

In the next column will be the scrap value for a 100 pounds of scrap of that stock as
determined from preceding table. This figure will probably have to be arbitrary.

All the above tables have been of costs into which only the element of weight entered. We must now obtain the costs into which the element of time enters. These costs consist of the labor expended and the overhead chargeable to the product. These are elements into which time enters the most and which are usually measured by that method.

There is only one table required for this element and that table is of the machine-hour rate. This rate will be made up of the labor rate per hour on any machine or unit and its space rate which will be figured from the overhead. A unit for this will consist of the series of machines which enter into one operation as at present in the mixing operation there is a wracker and mixer and in the calendering operation there is a cracker, a warming mill, and a calender. The sub-machines in these units are constant, that is they have a standard number of men working on them and the rates of these men is assumed to be uniform.
The overhead is also assumed to be uniform. The element of these units that govern their machine-hour rate is the capital machine such as the mixer and the calender. The labor-hour rate on a unit is figured by taking the number of men on the unit and multiplying it by the average rate for those men:

\[
\text{No. men on unit} \times \text{Average rate} = \text{labor-hour rate for unit.}
\]

The machine-hour rate is obtained from the overhead or what is now called total department expense on the books of the company and which is referred to as overhead throughout this thesis. The total overhead for the preceding cost period is taken and divided by the total number of working hours for that period. This gives us our overhead rate for the entire department per hour. To apply this rate to a unit or to storage space, we take the total amount of space occupied by that unit or storage space and divide it by the total area of the mill room and then multiply it by overhead rate per hour for the whole department.
Overhead for Preceding Cost Period

\[ \text{Working hours in Preceding Cost Period} \times \text{Area occupied by unit} \times \text{Total area of Mill Room} \]

= Space-hour rate.

To obtain space-hour rate for the stores substitute their area in place of area of unit. The machine-hour rate is obtained by adding the labor-hour rate and the space-hour rate together.

\[ \text{Labor-hour rate} + \text{Space-hour rate} \]

= Machine-hour rate.

For storage space where there is labor employed this will be called store-hour rate, for other stores it will be called just space-hour rate. The space occupied by a unit includes a reasonable amount of floor sur-
rounding it and all space should be accounted for in some way each working day. This machine-hour rate will be tabulated for each unit as it is determined and when a batch of material goes thru that unit machine-hour rate will be used. The labor-hour and space-hour should be listed in separate columns so that the charge to labor and overhead may be checked with that actually expended.
CONSTANTS

There are certain constants which must be ascertained or arbitrarily set. These constants are the times that the stocks shall be considered to remain in the storehouses so that we may charge them a share of their overhead as rent. This constant may be found by observation or by simply assuming it. The purpose is to distribute the storage overhead equitably over all the material. There is one thing that must be looked after and that is that all the overhead is charged to the product or else true cost figures are not being obtained.

RECORDING COSTS

A number of forms are shown in the appendix and will be described briefly here. Form 1 is the Job Ticket and contains a description of the work and spaces for the time started, finished and elapsed. It also contains the Unit No. and Production Order No.
all of which are necessary to the Cost Department in figuring their costs. Form 2 is the Material Requisition and contains the P.O. No., quantity of material issued, the kind of material, the scrap returned from the mill room (not from the outside. This does not enter into material calculation for mill room.), Material used, and then some items to be filled in by the Cost Department. Form 3 is not of much importance to the Cost Division as they obtain all the information they desire from the two preceding forms. Form 4 is a posting sheet for the determination of the Mill Room Cost. The place where the information is obtained is marked in the columns and it is probably self explanatory. Form 5 is for the purpose of determining the variation in cost for one particular product and comparing that cost with the average
for the last cost period and also the present average with the last. The data for this is taken from the preceding form and consists of P.O. No., Date, Cost per 100 pounds delivered, and Cost per 100 pounds Used. An average is made at the end of each cost period and in case of variation in the average on a product in which the average is used as a means of costing the new cost is used. Forms 6 and 7 are used to obtain the costs of material into the different stores and are self explanatory.

The cost of labor and space (overhead) should be posted from Form 4 to some account and checked against the actual expenditure for labor and overhead. Any deviation in these figures should either be charged or credited to the next months overhead.
The following are typical examples of cost calculation and will serve to show what is done in putting cost on forms. It is assumed that all this information is obtained from Job Tickets, Material Requisition, and Tables.

Example 1

Job Ticket: 600# .20 White. Time Elapse: 45 min
Machine No. 3. In this case Material Requisition is unnecessary as we know the cost of materials entering into 20 W.

Tables:
- Machine-hour rate for Unit 3 = $4.40
- Material Cost per 100 lbs. mix = 20.40

Calculation:

Cost of 600# = Cost of Material + Machine Cost
= 6 x $20.40 + 45 / 60 x $4.40
= $125.70

Example 2

Job Ticket: 450# Men's No.8 Soles 20-11 Time
Elapse: 1 hr. 30 min. Machine No 8

Material Requisition: 225# of 20 gum
= 225# of 20 scrap
Example 2 (cont)

Cost of 450# = \(4.5 \times \$21.00 + 1\frac{1}{2} \times \$8.10\)

\[= \$94.50 + \$12.15\]

\[= \$106.65\]

\% of scrap in Men's No. 8 = 62.0

Value of scrap = \(\$12.60 / 100\#\)

Weight of scrap = 0.62 450

\[= 279 \#\]

Value " " = \(279 \# \times \$12.60\)

\[= \frac{\$35.20}{100}\]

Actual cost of Material in Men's No. 8

\[= \$106.16 - 35.20\]

\[= 70.96\]

Example 3.

Job Ticket: 500# Men's No. 8 Uppers 187 -

3 Time Elapse 1 hr. 45 min. Machine No.9

Material Requisition: Gum = 200#

Scrap = 300#

Tables:

Machine-hour rate for Mch No.8 = \$7.80

Scrap Cost / 100#

\[= 40.50\]

Gum Cost / 100#

\[= 73.50\]

\% of scrap in Men's No. 8 U

\[= 59.0\]

Value of Scrap = \$31.20
Calculations:

Cost of 500# = 2.0 x $73.50 + 3.0 x $40.50 + 1.75 x $7.80
= $147.00 + 121.50 + 12.65
= $281.15

Weight of Scrap = 500 x .59
= 295 #

Value of " = 295 x $31.20
= $92.10

Cost of Material Used
= $281.15 - 92.10 = $189.05

Example 4.

Job Ticket: 500# 152-11 oz. Grey Wool
Time Elapse 2 hrs. 15 min. Machine No. 12

Material Requisition: Cloth 350#
Gum 100#
Scrap 50#

Tables: Machine-hour rate for Mach No. 12
= $10.10

Cloth Cost / 100# = 85.00
Gum Cost / 100# = 18.33
Scrap " " " = 15.00
Example 4 (cont)

Calculations:

\[
\text{Cost of 500#} = 3.5 \times \$85.00 + \$18.33 \\
+ 7.50 + 1.75 \times \$10.10 \\
= \$297.50 \quad \$18.33 \quad \$7.50 \quad \$22.72 \\
= \$346.05
\]
APPENDIX
PROCESSED STOCKS

Let us consider first the processed stocks. The production records are received daily upon small cards; (#1):

<table>
<thead>
<tr>
<th>No. 1272</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>Stock</td>
</tr>
<tr>
<td>Gross</td>
</tr>
<tr>
<td>Tare</td>
</tr>
<tr>
<td>Net</td>
</tr>
<tr>
<td>Weigher</td>
</tr>
</tbody>
</table>

and tabulated upon the Cost Sheet (9a).

The first requirement is the transfer of this record in pounds to feet. This is accomplished by means of the conversion factors taken from the Stock Record Sheet (#7).
The amount of this stock produced is so great that for purposes of illustration the production of a single day, only, was figured.

Take for example Gum Roughback of which 206 was produced. This is converted into feet by multiplying by the factor taken from the Stock Record Sheet (#7)

\[206 \times 1.67 = 344 \text{ feet}\]

The production time is composed of two factors, the frictioning time and the coating time. As both of these operations in this case were performed on Machine #19 at the same rate the productive time is found by multiplying the number of hundreds of feet by the number of times it passes thru the machine and the machine rate:

\[3.44 \times 3 \times 3.49 = 25.8 \text{ minutes}\]
The non-productive time factor for this day was 1.20 so that the total time is:

\[ 25.8 + (1.2 \times 25.8) = 56.9 \]

An error was introduced here in figuring the non-productive time. The total time on #6 should have excluded the time spent in running rag. On this particular day the effect was very small.

The direct labor cost is found by multiplying by the machine rate taken from the Machine Record Chart (#6).

\[ 56.9 \times \$0.0524 = \$2.98 \text{ D.L. Cost} \]

The Overhead is figured as noted for the plain gum stocks. The rate for this machine is \$0.0440 per minute

\[ 56.9 \times \$0.0440 = \$2.49 \text{ Overhead Cost} \]

In order to determine the primary cost...
the amount of the finished product which has gone thru the primary operations must be known. This is obtained from the "Weighers Tag" #1 by subtracting the net weight of the total.

\[ 206\# - 111\# = 95\# \text{ gum} \]

The cost of the primary operations per 100\# gum have been ascertained to be $1.319 for Direct Labor and $0.694 for Overhead.

\[ .95 \times 1.319 = 1.251 \text{ Primary Direct Labor Cost} \]

\[ .95 \times 0.694 = .659 \text{ Overhead} \]

**STOCK RECORD (#7)**

The Stock Record Sheet contains the data on processed stocks.

The number of feet per pound is determined by the formula the derivation for which is given in this appendix.
This data for determining this is taken from a Material Cost Card (#4).

<table>
<thead>
<tr>
<th>FABRIC</th>
<th>GUM</th>
<th>ROUGHBACK</th>
<th>DATE</th>
<th>NO.</th>
<th>WT.</th>
<th>PRICE</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>40&quot;</td>
<td>Friction one side</td>
<td></td>
<td>152</td>
<td>180</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloth price</td>
<td></td>
<td>Friction other side</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost per sq. yd.</td>
<td></td>
<td>Cost one side</td>
<td></td>
<td>152</td>
<td>240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wt. per sq. yd. in lbs.</td>
<td>.51</td>
<td>Cost other side</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost per 100 lbs.</td>
<td></td>
<td>Total gum</td>
<td></td>
<td>420</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost per 100 sq. ft.</td>
<td></td>
<td>Total Weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scrap per cent</td>
<td></td>
<td>Total cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut cost lb.</td>
<td></td>
<td>Cost per lb.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut cost sq. yd.</td>
<td></td>
<td>Total wt. sq. yd.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut cost 100 sq. ft.</td>
<td></td>
<td>Cost 100 sq. ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[
P = \frac{108}{\left\{ \frac{180 \times 240}{1 \times 190} \right\}} = 4.20
\]

We discover also from the shop that this is frictioned on one side by Machine #19 and coated on one side by Machine #19.
<table>
<thead>
<tr>
<th>STOCK</th>
<th>LINEAL FT/16</th>
<th>19</th>
<th>6</th>
<th>FCFC</th>
</tr>
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<tbody>
<tr>
<td>39 Yellow</td>
<td>4.93</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-39-310</td>
<td>1.87</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10-39-310</td>
<td>0.803</td>
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<td>1</td>
<td></td>
</tr>
<tr>
<td>12 Blue Ariz.</td>
<td>0.533</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 &quot;</td>
<td>0.360</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Straw</td>
<td>1.78</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Blue</td>
<td>1.01</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Straw</td>
<td>1.36</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 &quot;</td>
<td>0.985</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Garnet</td>
<td>0.867</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 White</td>
<td>1.31</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Black</td>
<td>1.38</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 White</td>
<td>0.932</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38 Triangle</td>
<td>4.81</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.95 Yellow</td>
<td>2.78</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39 Black</td>
<td>4.54</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#1-39</td>
<td>4.47</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>261-8 oz Duck 2 sides</td>
<td>1.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red Arizona</td>
<td>3.92</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>201 &quot;</td>
<td>3.42</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>261-2.95</td>
<td>3.56</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#2-8 oz Duck</td>
<td>1.92</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#1-8 oz &quot; 2 sides 201</td>
<td>1.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>261-39</td>
<td>4.82</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Oz Grey Fleece</td>
<td>3.69</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comb Top Straw</td>
<td>1.71</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imit. Korxole</td>
<td>0.352</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Red Steam Shield</td>
<td>1.52</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7 oz Osna Lining</td>
<td>2.66</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red &amp; Black</td>
<td>1.71</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>261-10 oz H Duck</td>
<td>2.39</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Omit. Leather</td>
<td>1.08</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Red Poplin</td>
<td>6.06</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quarter Cord</td>
<td>4.53</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>111 Dble Comb Top</td>
<td>1.30</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>156 &quot;</td>
<td>1.09</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>310-14 R B</td>
<td>0.720</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Gum R B</td>
<td>1.67</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>14 White R B</td>
<td>0.436</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Cotton Merino 152</td>
<td>2.45</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#2 Black Wool</td>
<td>2.16</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 oz Grey Wool</td>
<td>1.49</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton Merino 261</td>
<td>2.29</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PLAIN GUM STOCK
In figuring the week's production let us consider next the plain gum stocks. The record of the production comes up on a "Stock Order", (#2), thus:

<table>
<thead>
<tr>
<th>CONVERSE RUBBER SHOE CO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order for</td>
</tr>
<tr>
<td>Wanted</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Roll</th>
<th>Gauge</th>
<th>Comp.</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>15.8</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>15.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>17.7</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>17.7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>17.7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>17.7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>17.7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>17.7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>17.7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>17.7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>17.7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>17.7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>17.7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>17.7</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
It is tabulated on the Cost Sheet and transferred into feet. The conversion factors used in this calculation were

11 ft. = 1 frame

20 frames = 1 reel

The number of feet was multiplied by the time per 100' taken from the Machine Record Chart (#6) (2.87 minutes was used in this case)

For example, take Stock #187, 5 ga.

Production was 14 reels 32 frames

\[14 \times 20 = 280\]

\[\frac{32}{312} \text{ frames total production}\]

\[\frac{11}{3432} \text{ feet } " "\]

\[34.32 \times 2.87 = 98.3 \text{ minutes production time}\]

Total time paid for 6,000.0 min.

Total productive time on all plain gum stocks 718.5 "

Total non-productive time 5,281.5 "
\[
\frac{5281.5}{718.5} = 7.36 \text{ Non-productive time factor}
\]

The total time on #187, 5 ga. is then

\[98.3 + (7.36 \times 98.3 = 723.5) = 821.8\]

and the direct labor cost is found by multiplying this by the Machine Minute Rate for this Machine (#20) which is $0.0511.

\[821.8 \times 0.0511 = 42.19\]

This was produced on Machine #20 which has an overhead rate of 8.92% of the total rate for the Mill Room. In this period it was $0.473 per minute so that the share of this machine is $0.0421 per minute. This rate multiplied by the time gives the overhead cost for this stock.

\[0.0421 \times 821.8 = 34.60\]

In order to ascertain the primary costs it is necessary to find the production in pounds which is effected by multiplying the production in feet by the gage and the factor taken from the Plain Gum Stock Record (#8).
For example, take the stock above #187, 5 ga.

$$3432 \times 5 \times 0.0995 = 1,710 \#$$

The cost of these primary operations is obtained on a basis of a 100# batch and in the following manner:

The total production of gum stocks for the week was 92,460#. This figure is obtained from the Mixing Records (#3).

### Daily Mixing Record

<table>
<thead>
<tr>
<th>Date Mixed</th>
<th>May 1, 1920</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>Batch Weight</td>
</tr>
<tr>
<td>125</td>
<td>100</td>
</tr>
<tr>
<td>115</td>
<td>100</td>
</tr>
<tr>
<td>113</td>
<td>100</td>
</tr>
<tr>
<td>112</td>
<td>100</td>
</tr>
<tr>
<td>585</td>
<td>100</td>
</tr>
<tr>
<td>175</td>
<td>100</td>
</tr>
<tr>
<td>169</td>
<td>100</td>
</tr>
<tr>
<td>201</td>
<td>100</td>
</tr>
<tr>
<td>310</td>
<td>100</td>
</tr>
</tbody>
</table>
The cost of performing these operations upon this much stock is readily figured by taking the machine rates of the various machines used and adding which gives a total of $0.203\,1$ per minute. The time paid for is 6,000 minutes so the labor cost is $0.203\,1 \times 6000 = $1218.60 \text{ or } \frac{1218.60}{924.50} = $1.319\text{ per } 100\#

The overhead figure for the operations is obtained in a very similar manner. The total overhead rates of all these machines is $37.83\%$ and the total overhead accordingly

$$37.83\% \text{ of } 2840 = 751.00$$

which is

$$\frac{751}{924.60} = 0.814 \text{ per } 100\#$$

If, then, the number of pounds of the stock produced is divided by 100 and multiplied by the figures obtained above, the result obtained will be the labor and overhead primary costs.
17.10 \times $1.319 = $20.35 \text{ Primary Labor Cost}
17.10 \times $0.694 = $11.89 \text{ " Overhead "}
The number of pounds per foot is found by the formula:

\[ P = \frac{0.434 \times W \times a \times S \times G}{N} \]

which is derived in this appendix.

The width seems to average about 29" and the thinnest gage is 3 which is .015" thick and the figures there listed are factors which multiplied by the gage and the weight give the number of lineal feet of product.

For example take # 175 which has a specific gravity of 1.68 The factor is

\[ \frac{0.434 \times 29 \times .015 \times 1.68}{3} = 0.1060 \]
### PLAIN GUM STOCK RECORD (#8)

<table>
<thead>
<tr>
<th>STOCK</th>
<th>FACTOR</th>
<th>STOCK</th>
<th>FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Comb.</td>
<td>058</td>
<td>194</td>
<td>096</td>
</tr>
<tr>
<td>#2 &quot;</td>
<td>058</td>
<td>201</td>
<td>103</td>
</tr>
<tr>
<td>#3 &quot;</td>
<td>595</td>
<td>203</td>
<td>112</td>
</tr>
<tr>
<td>#4 Torene</td>
<td>630</td>
<td>261</td>
<td>088</td>
</tr>
<tr>
<td>#1 118</td>
<td>118</td>
<td>293</td>
<td>101</td>
</tr>
<tr>
<td>10 130</td>
<td>130</td>
<td>406</td>
<td>128</td>
</tr>
<tr>
<td>16_U</td>
<td>115</td>
<td>408</td>
<td>074</td>
</tr>
<tr>
<td>19 114</td>
<td>114</td>
<td>419</td>
<td>064</td>
</tr>
<tr>
<td>20 112</td>
<td>112</td>
<td>424</td>
<td>107</td>
</tr>
<tr>
<td>69 111</td>
<td>111</td>
<td>431</td>
<td>071</td>
</tr>
<tr>
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<td>106</td>
<td>432</td>
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<td>123</td>
<td>434</td>
<td>101</td>
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<td>113-S</td>
<td>118</td>
<td>445</td>
<td>072</td>
</tr>
<tr>
<td>113-U</td>
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<tr>
<td>169</td>
<td>115</td>
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<td>099</td>
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<td>173</td>
<td>090</td>
<td>602</td>
<td>096</td>
</tr>
<tr>
<td>175</td>
<td>106</td>
<td>604</td>
<td>093</td>
</tr>
<tr>
<td>184</td>
<td>084</td>
<td>611</td>
<td>087</td>
</tr>
<tr>
<td>187</td>
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<td>078</td>
</tr>
<tr>
<td>178</td>
<td>088</td>
<td>801</td>
<td>107</td>
</tr>
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</table>
TIME STUDIES
### Basis for Weighing and Mixing Times

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<thead>
<tr>
<th>Weight</th>
<th>Time Weighing</th>
<th>Time Mixing</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>Comp.</td>
<td>Gum</td>
</tr>
<tr>
<td>200</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>201</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>202</td>
<td>5</td>
<td>5</td>
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<tr>
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<td>300</td>
<td>7</td>
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</tr>
<tr>
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<td>4</td>
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<tr>
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<td>6</td>
<td>4</td>
</tr>
<tr>
<td>200</td>
<td>5</td>
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*Time per 100#: 2.13 1.57 12.30*

Mr. Gerrie
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Mr. Gerrie
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CALCULATIONS

(For name of machine see attached blue print)

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Mr. Dillon
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<td>100#</td>
<td>2.6</td>
<td>0.0174</td>
<td>4.40</td>
</tr>
<tr>
<td>10</td>
<td>Warms for lining &amp; Sole Calenders</td>
<td>100#</td>
<td>3.45</td>
<td>0.0175</td>
<td>2.55</td>
</tr>
<tr>
<td>11</td>
<td>Calenders All Gum Uppers</td>
<td>100#</td>
<td>3.13</td>
<td>0.0398</td>
<td>6.95</td>
</tr>
<tr>
<td>12</td>
<td>Calenders Sole Stock</td>
<td>100#</td>
<td>3.20</td>
<td>0.0519</td>
<td>3.50</td>
</tr>
<tr>
<td>13</td>
<td>Makes Soles</td>
<td>100#</td>
<td>3.20</td>
<td>0.0458</td>
<td>2.20</td>
</tr>
<tr>
<td>14</td>
<td>Warms for 13</td>
<td>100#</td>
<td>0.315</td>
<td>0.0168</td>
<td>3.46</td>
</tr>
<tr>
<td>15</td>
<td>Cracks &quot;</td>
<td>100#</td>
<td>0.186</td>
<td>0.0172</td>
<td>2.83</td>
</tr>
<tr>
<td>16</td>
<td>Refines Rag From 5</td>
<td>100#</td>
<td>4.07</td>
<td>0.0184</td>
<td>3.82</td>
</tr>
<tr>
<td>17</td>
<td>Warms for #19</td>
<td>100#</td>
<td></td>
<td>0.0088</td>
<td>3.82</td>
</tr>
<tr>
<td>18</td>
<td>Warms for #20</td>
<td>100#</td>
<td></td>
<td>0.0088</td>
<td>3.80</td>
</tr>
<tr>
<td>19</td>
<td>Makes Fabric Stocks</td>
<td>100#</td>
<td>2.49</td>
<td>0.0524</td>
<td>9.33</td>
</tr>
<tr>
<td>20</td>
<td>Makes Boot Uppers</td>
<td>100#</td>
<td>3.35</td>
<td>0.0511</td>
<td>8.92</td>
</tr>
</tbody>
</table>
DERIVATION OF FORMULAE
DERIVATION OF FORMULAE

To find the number of lineal feet per pound of processed stock.

Weight per square yard of fabric = W

Width in inches = a

Weight of gum coat per 100# fabric = G

Weight of friction per 100# fabric = F

Weight per lineal foot = P

The width then is \( \frac{a}{12} \) feet, and the weight per square yard \( \frac{W}{9} \).

In 1 ft. length there is \( \frac{1 \times a}{12} \) product per 100# fabric and \( \frac{F + G}{100} \) \( \frac{a W}{9 \times 12} \) # product per 1 lineal foot. The number of lineal feet per pound of product is the reciprocal of this, or:
To find the weight of one lineal foot of plain gum stock.

Smallest gage in which stock is made = N

Thickness of this gage in inches = a

Width of stock in question (inches) = W

Specific Gravity of Stock = S

Gage of stock in question = G

The volume of 1 lineal foot of stock is

\[
W \frac{a}{12} \times \frac{a}{12}
\]

This multiplied by the weight of one cubic foot of water (62.5#) and the specific gravity of the stock (S) gives the weight of one lineal foot of N gage.
The G gage stock is obviously \( \frac{G}{N} \) times as heavy since this is a definite straight line relation. The weight of the stock per lineal foot then becomes:

\[
0.434 \frac{W a S G}{PK} \frac{-1}{N}
\]
COST FORMS
FIRST PLAN
## Cost Sheet

- **Processed Stock**: From May 1, 1928, to May 1, 1929, incl.

### Production Time

<table>
<thead>
<tr>
<th>STOCK</th>
<th>POUND</th>
<th>FEET</th>
<th>TOTAL GUM</th>
<th>PROD</th>
<th>NON-PRD</th>
<th>TOTAL</th>
<th>SECONDARY LABOR OVRHD</th>
<th>PRIMARY LABOR OVRHD</th>
<th>TOTAL LABOR OVRHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 OSNA</td>
<td>241</td>
<td>157</td>
<td>824.2</td>
<td>21.2</td>
<td>25.5</td>
<td>46.7</td>
<td>2.05</td>
<td>1.09</td>
<td>3.14</td>
</tr>
<tr>
<td>2.95-261</td>
<td>214</td>
<td>156</td>
<td>761.8</td>
<td>38.0</td>
<td>47.8</td>
<td>85.8</td>
<td>4.50</td>
<td>3.78</td>
<td>8.28</td>
</tr>
<tr>
<td>1-80Z DUCK</td>
<td>141</td>
<td>83</td>
<td>239.7</td>
<td>12.0</td>
<td>14.5</td>
<td>26.5</td>
<td>1.39</td>
<td>1.77</td>
<td>3.16</td>
</tr>
<tr>
<td>39 YELLOW</td>
<td>144</td>
<td>102</td>
<td>709.9</td>
<td>57.4</td>
<td>65.1</td>
<td>126.5</td>
<td>6.63</td>
<td>5.77</td>
<td>12.40</td>
</tr>
<tr>
<td>36 TRIANGLE</td>
<td>71</td>
<td>51</td>
<td>341.5</td>
<td>27.6</td>
<td>33.2</td>
<td>60.8</td>
<td>3.19</td>
<td>2.68</td>
<td>5.87</td>
</tr>
<tr>
<td>IMIT. LEATHER</td>
<td>141</td>
<td>50</td>
<td>152.3</td>
<td>11.4</td>
<td>13.7</td>
<td>24.1</td>
<td>1.26</td>
<td>1.06</td>
<td>2.32</td>
</tr>
<tr>
<td>11 OZ GRAY WOOL</td>
<td>128</td>
<td>63</td>
<td>190.7</td>
<td>4.8</td>
<td>5.8</td>
<td>9.6</td>
<td>0.50</td>
<td>0.42</td>
<td>0.92</td>
</tr>
<tr>
<td>#11 CASH</td>
<td>134</td>
<td>73</td>
<td>234.5</td>
<td>5.8</td>
<td>7.0</td>
<td>12.8</td>
<td>0.67</td>
<td>0.56</td>
<td>1.23</td>
</tr>
<tr>
<td>GUM ROUGHBACK</td>
<td>206</td>
<td>95</td>
<td>344.0</td>
<td>25.8</td>
<td>31.1</td>
<td>56.9</td>
<td>2.98</td>
<td>2.50</td>
<td>5.48</td>
</tr>
<tr>
<td>360 WHITE</td>
<td>50</td>
<td>39</td>
<td>46.5</td>
<td>0.2</td>
<td>0.2</td>
<td>0.4</td>
<td>0.02</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>14 ROUGHBACK</td>
<td>491</td>
<td>390</td>
<td>820.0</td>
<td>40.8</td>
<td>49.1</td>
<td>89.9</td>
<td>4.71</td>
<td>3.96</td>
<td>8.67</td>
</tr>
</tbody>
</table>

\[ 9 \times 60 = 540 \text{ min} \] \quad \text{Total Time}

\[ \frac{245}{295} = 0.83 \text{ Productive Time} \]

\[ \frac{295}{245} = 1.20 \text{ Non-Productive Time Factor} \]

FORM 9A
# COST SHEET

**BOOT UPPER STOCK**

**FROM APRIL 26 TO MAY 1, 1926 INCL.**

<table>
<thead>
<tr>
<th>STOCK GA</th>
<th>PRODUCTION</th>
<th>TIME</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>REELS</td>
<td>SHEETS</td>
<td>FEET</td>
</tr>
<tr>
<td>175</td>
<td>3</td>
<td>2</td>
<td>440</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0</td>
<td>880</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>440</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>0</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>107</td>
</tr>
<tr>
<td>187</td>
<td>3</td>
<td>2</td>
<td>440</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0</td>
<td>1760</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>4</td>
<td>880</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>4</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>1</td>
<td>48</td>
</tr>
<tr>
<td>173</td>
<td>5</td>
<td>9</td>
<td>1580</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>2</td>
<td>440</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>11</td>
<td>2420</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>5</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>8½</td>
<td>32</td>
<td>352</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>8</td>
<td>88</td>
</tr>
<tr>
<td>150</td>
<td>6</td>
<td>6</td>
<td>1320</td>
</tr>
<tr>
<td>164</td>
<td>7</td>
<td>3</td>
<td>660</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>0</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>8½</td>
<td>10</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>32</td>
<td>352</td>
</tr>
<tr>
<td>X133</td>
<td>7</td>
<td>4</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>8½</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>152</td>
<td>3</td>
<td>12</td>
<td>2640</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2</td>
<td>440</td>
</tr>
</tbody>
</table>

**6000 MIN. = TOTAL TIME**

**719 = PRODUCTIVE TIME**

**5291 = NON-PRODUCTIVE TIME**

**5291 ÷ 7.36 = NON-PRODUCTIVE TIME FACTOR**

**FORM 98**
FORMS

SECOND PLAN
<table>
<thead>
<tr>
<th>Unit No.</th>
<th>P. O. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Start</td>
<td>Time Stop</td>
</tr>
</tbody>
</table>

Description of Work
# Material Requisition Form

<table>
<thead>
<tr>
<th>Storekeeper</th>
<th>No. ________</th>
<th>Deliver the following to ________ Dept.</th>
<th>Date ________</th>
<th>For order No. ________</th>
<th>Process ________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>Description</td>
<td>Scrap Returned</td>
<td>Material Used</td>
<td>For office use</td>
<td>Price</td>
</tr>
<tr>
<td>Charge Acct.</td>
<td>Entered on Summary</td>
<td>Signed ________</td>
<td>Entered on Stock</td>
<td>Approved ________</td>
<td>Entered record</td>
</tr>
<tr>
<td>Credit Acct.</td>
<td>________</td>
<td>________</td>
<td>________</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>QUANTITY</td>
<td>DESCRIPTION</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**APPROVED BY** ____________________________
<table>
<thead>
<tr>
<th>Description</th>
<th>P.O. No.</th>
<th>Stock</th>
<th>Scrap</th>
<th>Cloth</th>
<th>Machine Cost</th>
<th>Total Cost to Produce</th>
<th>Cost per 100lbs Delivered</th>
<th>Scrap Allowance</th>
<th>Cost per 100lbs Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# SUMMARY OF FINISHED PRODUCT COST

<table>
<thead>
<tr>
<th>Product</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>P.O No.</th>
<th>Date</th>
<th>Cost per 100lb Delivery</th>
<th>Cost per 100lb Used.</th>
<th>P.O No.</th>
<th>Date</th>
<th>Cost per 100lb Delivery</th>
<th>Cost per 100lb Used.</th>
<th>Remarks</th>
</tr>
</thead>
</table>

Average Period (Present) ______  ______  ______  ______
Do. (Last) ______  ______  ______  ______
Checked by ______  ______  ______  ______

FORM 5.
<table>
<thead>
<tr>
<th>Description</th>
<th>P.O. No.</th>
<th>Cost of Mat.</th>
<th>Cost of Opening Cleaning</th>
<th>Cost of Dry &amp;</th>
<th>Storage</th>
<th>Pre-crackly</th>
<th>Sifting</th>
<th>Dry Stage</th>
<th>Total Cost</th>
<th>Cost per 100 lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FORM 6**
Plan of New Mill Room, Converse Rubber Company.

1st Floor.
Plan of New Mill Room (Cont'd)
Plan of Old Mill Room, Converse Rubber Company.
MACHINE RECORD CHART