

APR 26 1924

DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
George K. Burgess, Director

TECHNOLOGIC PAPERS OF THE BUREAU OF STANDARDS, No. 253
[Part of Vol. 18]

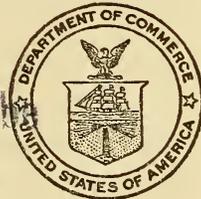
STANDARDIZATION OF HOSIERY BOX DIMENSIONS

BY

CHARLES W. SCHOFFSTALL, Assistant Physicist
Bureau of Standards

E. M. SCHENKE, Research Fellow
National Association of Hosiery and Underwear Manufacturers

March 1, 1924



Reference book not to
be taken from the Library.

PRICE, 10 CENTS

\$1.25 PER VOLUME ON SUBSCRIPTION

Sold only by the Superintendent of Documents, Government Printing Office
Washington, D. C.

WASHINGTON
GOVERNMENT PRINTING OFFICE
1924

STANDARDIZATION OF HOSIERY BOX DIMENSIONS.

By Charles W. Schoffstall and E. M. Schenke.

ABSTRACT.

Hosiery boxes in use at the present time are represented by photographs and a series of graphs which show waste, defects in packing, breakage, etc. A list of the proposed standard dimensions is given for men's, ladies', and children's hosiery boxes. It is estimated that a reduction of 76 to 83 per cent of the number of present sizes will result from the adoption of these standards. A new method of packing men's hosiery is shown. The results to be obtained from the adoption of standard hosiery boxes are discussed.

CONTENTS.

	Page.
I. Introduction.....	157
II. Purposes of the investigation.....	158
III. General survey.....	158
IV. Method of obtaining standard.....	163
V. New method of folding for men's hosiery.....	164
VI. Proposed standards.....	165
VII. Results to be obtained from standard hosiery boxes.....	168
1. Waste materials.....	168
2. Storage space.....	168
3. Size of shipping case.....	168
4. Cost of boxes.....	168
5. Crushing and breaking reduction.....	169
6. Display of hosiery boxes on retail shelves.....	169

I. INTRODUCTION.

Hosiery manufacturers, judging from their present boxes, seem to have given little consideration toward obtaining a full measure of utility from their hosiery boxes. Manufacturers who have spent years of effort in improving their hosiery product have overlooked the important part which the box plays in presenting the product to the ultimate consumer. The waste of paper materials from oversized boxes, the effect of broken boxes on the hosiery and on its appearance, brought about by improperly designed boxes have been overlooked or disregarded in a large number of instances.

However, the trend of research and standardization has been felt in the hosiery industry, and, accordingly, through its organization, the National Association of Hosiery and Underwear Manufacturers, there was established at this bureau a fellowship to

consider hosiery problems. One of the first research problems was the one considered in the present paper.

The extent of the use of hosiery-box material can be realized by considering that the approximate consumption per year of box board and cover paper is 165,300,000 pounds.

II. PURPOSES OF THE INVESTIGATION.

The purposes of the investigation were: (1) To make a survey of hosiery boxes in use at the present time. (2) To design a box which would (a) incase the hosiery properly without permitting waste space and (b) have the hosiery serve to brace the box and protect it from crushing. (3) To enable the hosiery to be presented to the customer to its best advantage when the lid of the box is opened.

III. GENERAL SURVEY.

The research fellow of the National Association of Hosiery and Underwear Manufacturers stationed at the bureau sent out to manufacturers of hosiery a request for hosiery packed in the styles of boxes they used in their mills. A total of 450 boxes was received, including 58 children's, 39 men's, and 98 ladies' hosiery boxes of different dimensions, representing the stock of 21 of the largest manufacturers. Although this did not represent the entire field, it was thought that sufficient data could be obtained from these to complete the problem.

The great variety of sizes of these submitted boxes is shown in Figure 1. On the left are shown the children's hosiery boxes, the center group shows men's hosiery boxes, and the right-hand group shows the ladies' hosiery boxes. This permits some idea of what the retailer has to consider in arranging on his shelves a number of brands of hosiery.

Measurements of the linear dimensions were recorded. These results are represented on Figure 2, with the longest measurement in each dimension first and the remainder in order. For convenience there has been added to this graph a linear representation of the proposed standards which were later developed. The variety and confusion which exists is shown on this graph. It was found that there were 50 different widths, 55 different lengths, and 39 different heights represented in the various boxes.

The space occupied by the hosiery was then measured, and to more clearly represent the waste space resulting a typical graph was prepared, taking men's hosiery as an example (fig. 3).

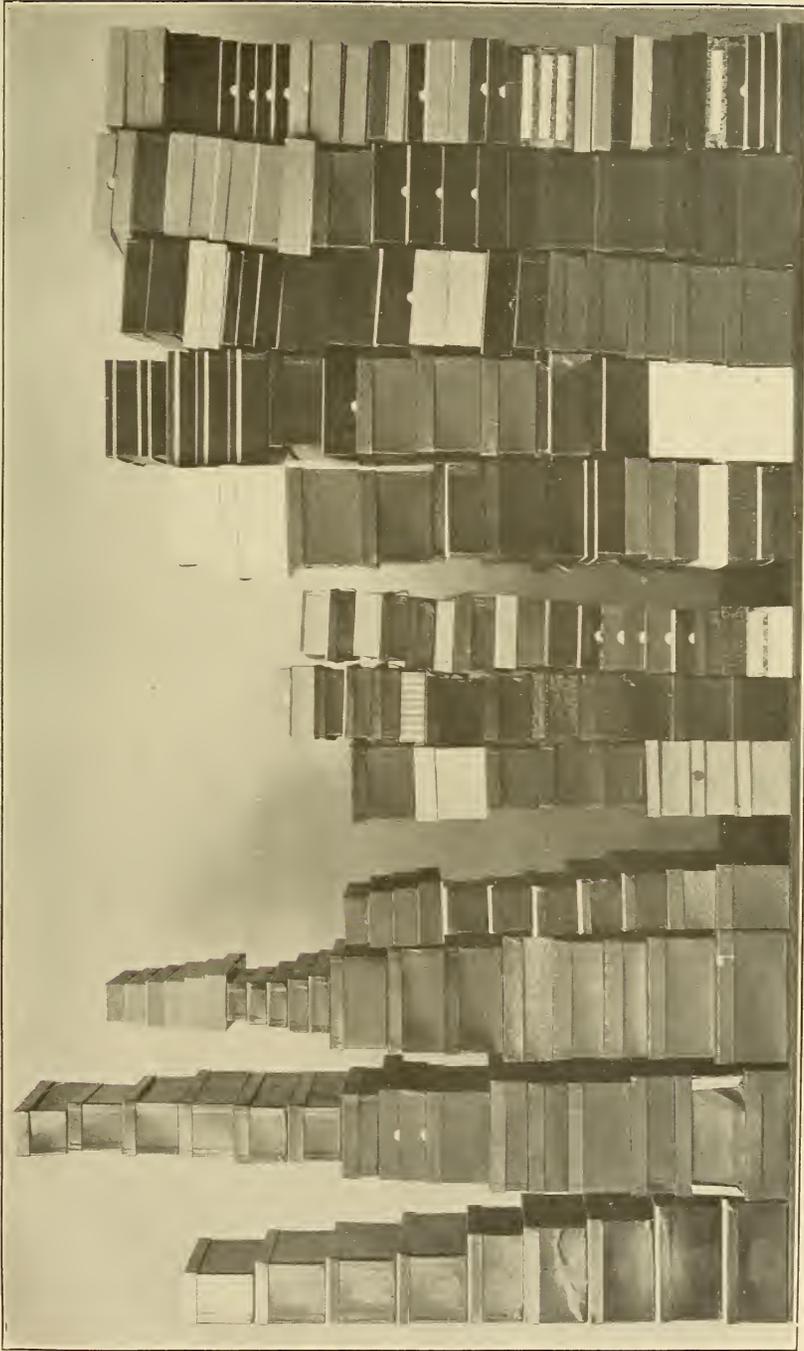


FIG. 1.—The submitted hostery boxes, showing the large variety of sizes.

Grouped: Children's boxes, left; men's, center; ladies', right.

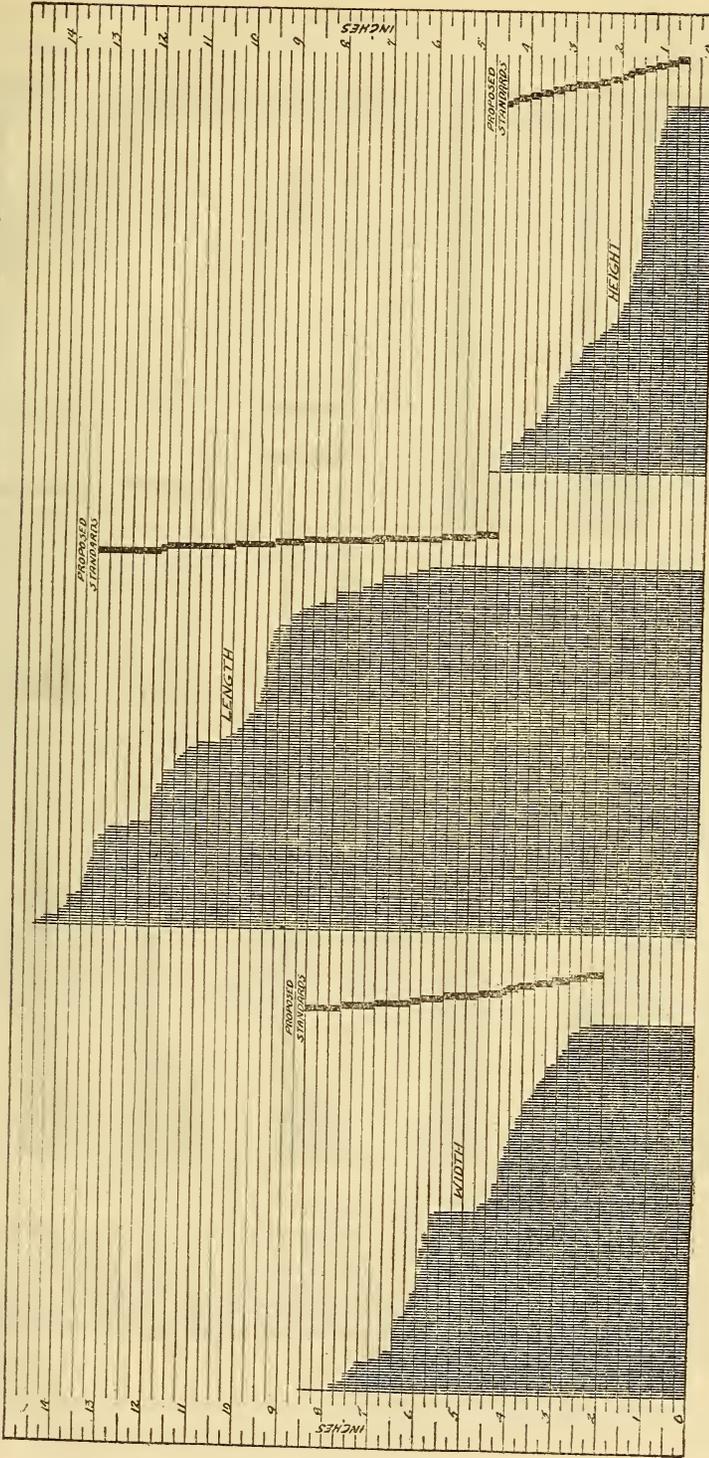


FIG. 2.—Linear representation of all the hosiery boxes arranged in order, the longest dimension first. The proposed standards developed later are placed for comparison. Inside dimensions used in each case.

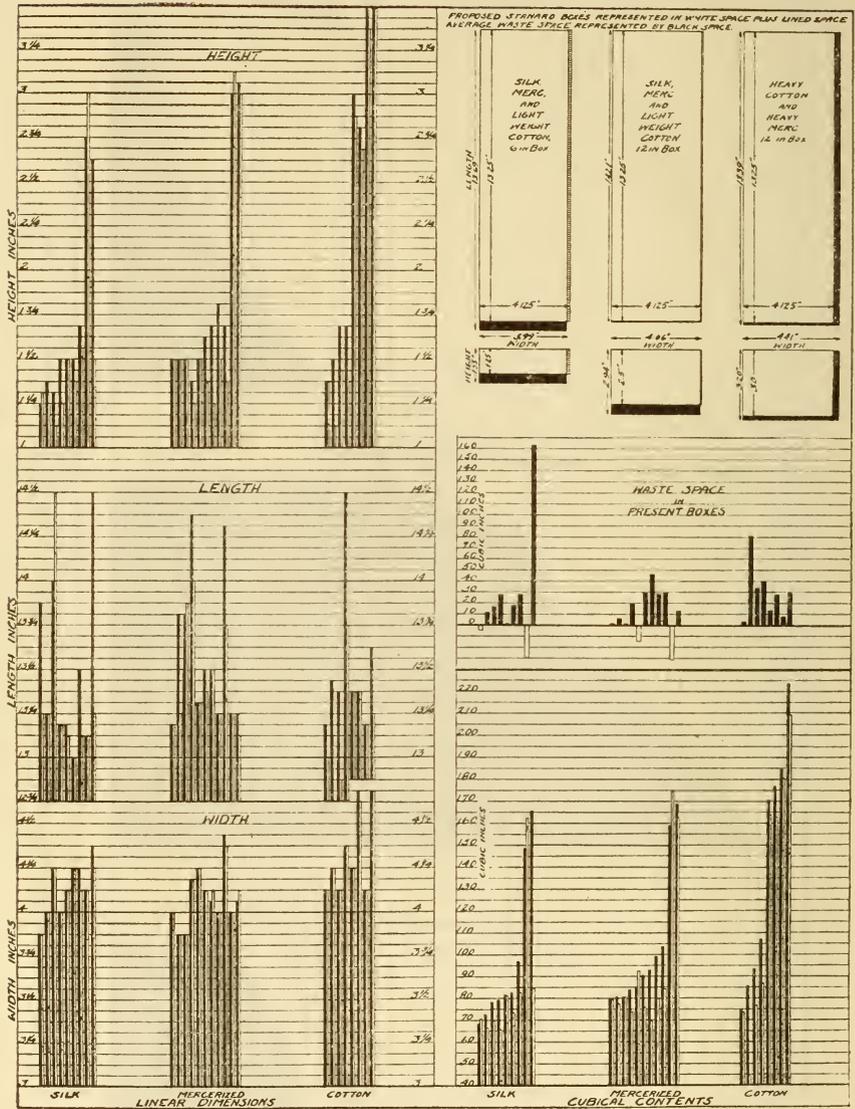


FIG. 3.—Study of inside dimensions of men's boxes.

On left the dimensions of the submitted boxes (arranged in ascending order of cubical contents) represented by black columns, the dimensions of the hosiery in the box shown in the column beside it. At lower right is the cubical contents so represented. Immediately above the latter is the representation of the difference between the hosiery dimensions and the box dimensions, the black columns representing waste space, the white showing where the hosiery had been compressed. At the right top is the proposed standard dimensions superimposed on the average of the boxes here shown. The black space represents waste space, the lined space shows where the proposed standards are slightly larger than the average of these boxes. Inside dimensions used in each case.

It will be evident that although in several instances one of the dimensions of the hosiery itself equals the box dimensions the other two do not. Several cases are shown where the hosiery dimensions are greater than the box dimensions. As will be shown later, this is desirable as a compression feature if properly proportioned, but in the majority of instances these appeared to be simply misfitted. In the waste space representation in four cases this feature has caused the waste space to be negative; that is, it

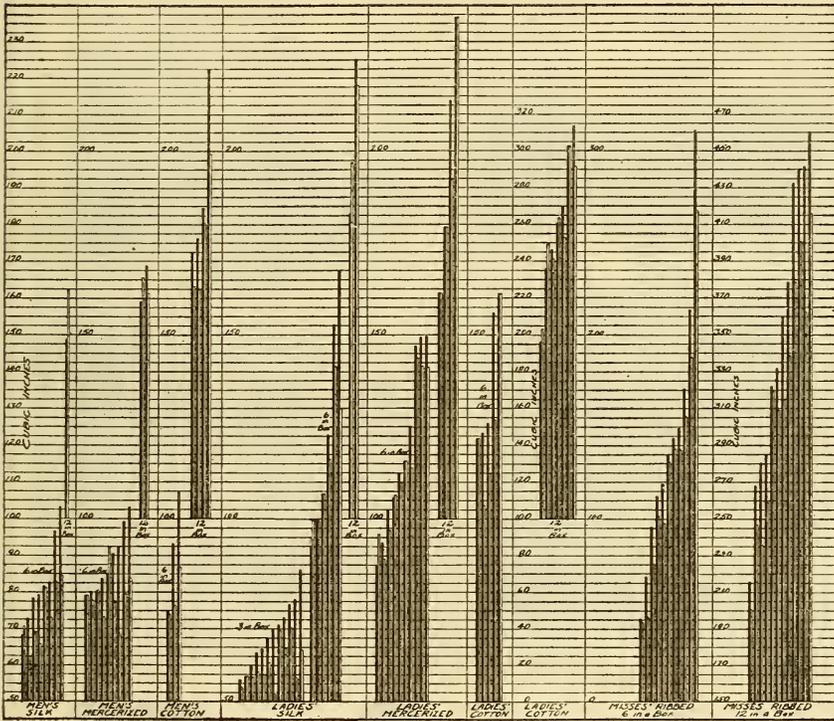


FIG. 4.—Representation of cubical contents of hosiery boxes.

Inside dimensions used as basis of calculation.

would appear that the hosiery was compressed. This compression caused by the overlength of any dimension other than the height is not desirable, for it has been found that it detracts from the appearance of the hosiery upon opening the box for display to the customer.

The number of different dimensions for each class is explained by the fact that different sizes of hosiery are made different widths and lengths. As men's hosiery at present are folded at the heel gore, this makes a number of different lengths for each dimension. The box dimensions are even more varied, because each manu-

facturer approximated the hosiery dimensions to formulate his box dimensions. Standardization of box dimensions will have some influence in reducing the departures from the regular dimensions of hosiery by bringing them to the attention of the packers.

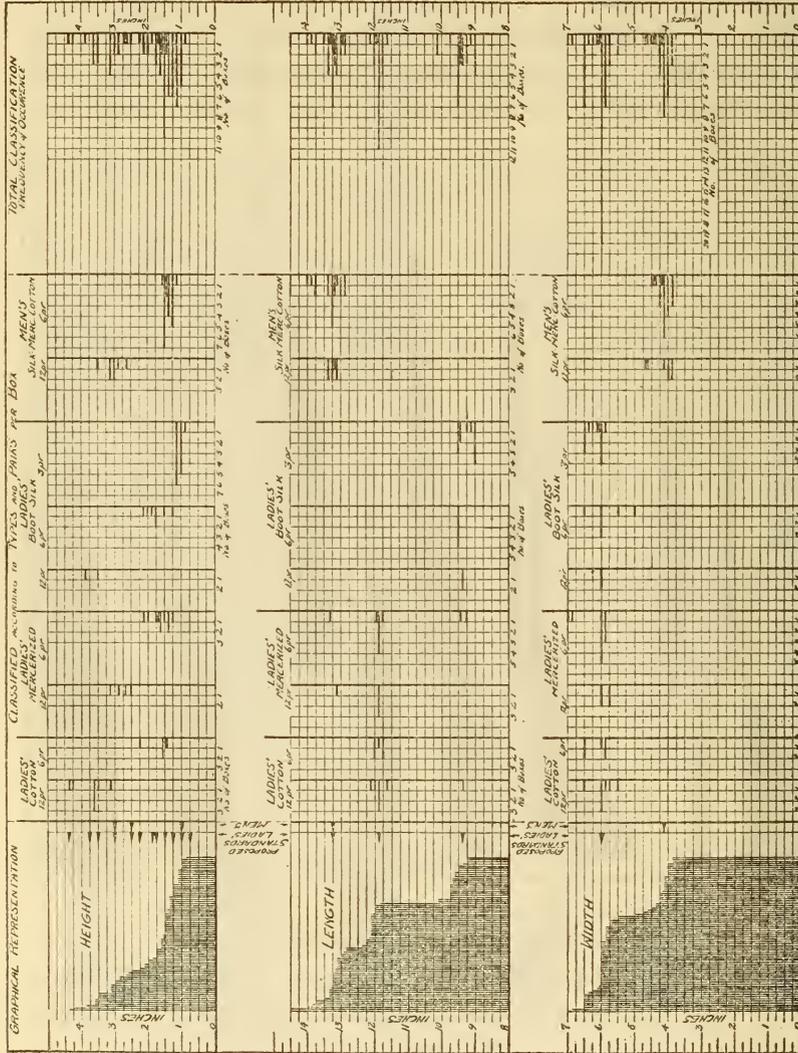


FIG. 7.—A study of men's and ladies' hosiery boxes as submitted. This shows a graphical representation, a frequency of occurrence graph for each type, and for each different number of pairs per box, and a total frequency of occurrence graph. Inside dimensions used in each case.

The presentation of the cubical contents of men's, ladies', and children's hosiery boxes is shown in Figure 4, grouped according to number of pairs in a box and arranged in order of magnitude. This graph, as in the preceding one, also shows the variety of dimensions of hosiery and of boxes.

Figure 5 shows proper packages alongside those in which the hosiery is poorly packed of incorrect dimensions. The waste

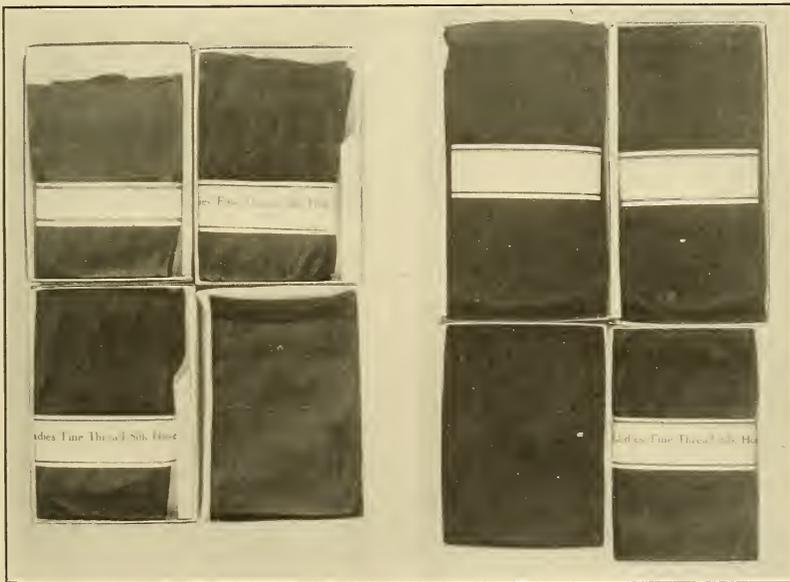


FIG. 5.--*Examples of hosiery packing.*

(Left) Improper method of packing in boxes which are not of correct dimensions. (Right) Proper method of packing in boxes of correct dimensions, so as to increase the strength of the hosiery box and preserve the original shape of the hosiery.



FIG. 6.—*Broken and damaged condition of hosiery boxes as received.*

These boxes were made too large, and the unoccupied space increases the liability of crushing.

space is shown and also the crumpled condition from handling. An attempt is made to fill in the waste space by placing a pasteboard guard in two of the boxes. This is an additional expense which is unwarranted. In the proper package attention is called, first, to the smooth appearance of the hosiery; second, that the entire box is filled; and, third, that a slight compression exists which will tend to strengthen the box by using the hosiery as a support, and thus preserve the box from breaking.

The broken and damaged condition of hosiery boxes as received by the retailer is shown in Figure 6. From the shipment to the bureau were selected these examples which show the conditions of the boxes as they were taken from the packing case. In each of these cases there was waste space in the box. The white slips of paper were placed for photographing to prevent revealing manufacturers' trade-marks.

Figures 7 and 8 show studies of men's, ladies', and children's hosiery boxes, showing the frequency of occurrence for the various types grouped into classes according to the number of pairs per box. The proposed standards which were later developed were placed for comparison.

IV. METHOD OF OBTAINING STANDARD.

The method employed in formulating the standards for hosiery box sizes was as follows: The measurements of the boxes and the hosiery contents were worked up for interpretation in the form of graphs as described. This permitted consideration of the customs in use at present and their results. It was noted that any extra space in the box caused the hosiery to crumple when thrown from side to side during shipment. This is undesirable, for the hosiery box is supposed to be the means of placing hosiery before the customer in a presentable condition. Extra space in the box resulted also in careless folding, which has equally undesirable features. Another condition noticed was that the box was frequently damaged, either broken or creased from bending, which would make it necessary for the retailer to replace the box or else, what is most undesirable, to place the boxes under the sales counter, where the advertising through display is lost.

To eliminate this waste space feature, the hosiery was carefully folded, and from these measurements the proposed standards were formulated. Since experience has shown that waste space caused the boxes to be pressed in, it was planned to not only eliminate the waste space but actually make the boxes lower in height by a

sufficient amount to permit an upward pressure. Care was taken to make this allowance small enough so that the lid would not be forced open, thus not marring the appearance of the retailers' shelves.

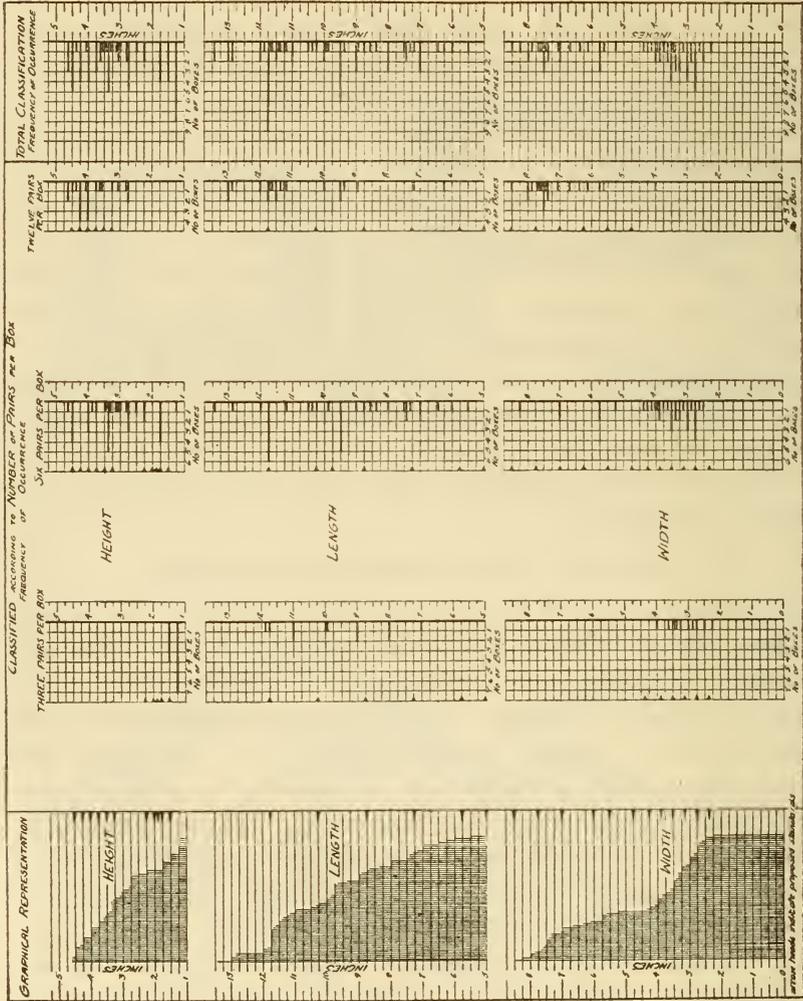


FIG. 8.—A study of children's hosiery boxes, as submitted. This shows a graphical representation, a frequency of occurrence graph for each different number of pairs per box, and a total frequency of occurrence graph. Inside dimensions used in each case.

V. NEW METHOD OF FOLDING FOR MEN'S HOSIERY.

In considering men's hosiery it was found that excess space always results where the tops of men's hosiery are placed in the box. This, it was found, impairs the strength value of the box and detracts from the appearance of the hosiery. As men's hosiery is made with an elastic ribbed top, finished considerably

smaller in width at this point, this unoccupied space is unavoidable. Accordingly, a new method for folding was devised, which is illustrated in Figure 9.

This method is described as follows: (1) Fold the toe of the hose over the leg, breaking it at a point where the break or fold will be slightly below the joining point of the ribbed top of the leg of the hose. (2) Fold the elastic-ribbed top over the end of the folded part of the toe.

Using this method of folding and laying three pairs with the heels in one direction and three pairs with the heels in the opposite direction (fig. 9 C), there is obtained a uniform compression which will insure a neat, compact box.

The advantage of the improved method is readily noticeable by reference to Figure 9 D, which shows the six pairs in the box presenting a very neat appearance. The box (fig. 9 E) is not only increased in strength, but produced a saving of 14 per cent in box space over the present method of packing. It will be noticed, however, that the dimensions for these are not included in the proposed standards. A change in methods of packing means a decided change in mill practice, so lest this standard would hinder the adoption of others it has not been included. It is given below for use if desired.

TABLE 1.—Proposed Improved Method of Packing Men's Hose.

Number.	Width.	Length.	Height.	Number of pairs in box.	Description of hosiery.
	Inches.	Inches.	Inches.		
1.....	3 $\frac{3}{4}$	8 $\frac{1}{2}$	1 $\frac{1}{4}$	6	Silk hose.
2.....	3 $\frac{5}{8}$	8 $\frac{1}{2}$	2	6	Mercerized and cotton hose.

VI. PROPOSED STANDARDS.

There are listed below the standards which have been formulated for men's, ladies', and children's hosiery boxes.

TABLE 2.—Dimensions of Boxes Proposed as Standards for Ladies' Hosiery.

Number.	Width.	Length.	Height.	Number of pairs in box.	Number of folds of hosiery.	Description of hosiery.
	Inches.	Inches.	Inches.			
1.....	6	9 $\frac{3}{4}$	3 $\frac{3}{4}$	3	3	All silk hose.
2.....	6	9 $\frac{3}{4}$	1	3	3	Boot silk hose.
3.....	6	9 $\frac{3}{4}$	1 $\frac{1}{2}$	6	3	Mercerized and boot silk.
4.....	6	9 $\frac{3}{4}$	3 $\frac{3}{4}$	12	3	Do.

TABLE 2.—Dimensions of Boxes Proposed as Standards for Ladies' Hosiery—CON.

HOSE FOLDED IN ANKLE.

Number.	Width.	Length.	Height.	Number of pairs in box.	Number of folds of hosiery.	Description of hosiery.
5.....	6	11 $\frac{1}{4}$	1 $\frac{1}{2}$	6	2	Sheer mercerized hose.
6.....	6	11 $\frac{3}{8}$	1 $\frac{1}{2}$	6	2	Boot silk, mercerized, and lightweight cotton.
7.....	6	11 $\frac{1}{4}$	1 $\frac{3}{4}$	6	2	Medium-weight cotton.
8.....	6	11 $\frac{1}{4}$	2 $\frac{1}{4}$	6	2	Heavy-weight cotton.
9.....	6	11 $\frac{1}{4}$	2 $\frac{1}{2}$	12	2	Mercerized and boot silk.
10.....	6	11 $\frac{1}{4}$	3	12	2	Lightweight cotton.
11.....	6	11 $\frac{1}{4}$	3 $\frac{1}{2}$	12	2	Medium-weight cotton.
12.....	6	11 $\frac{3}{8}$	4 $\frac{3}{8}$	12	2	Heavy-weight cotton.

HOSE FOLDED IN GORE OF HEEL.

13.....	6	13 $\frac{1}{2}$	1 $\frac{1}{2}$	6	2	Sheer mercerized hose.
14.....	6	13 $\frac{1}{2}$	1 $\frac{1}{2}$	6	2	Boot silk, mercerized, and lightweight cotton.
15.....	6	13 $\frac{1}{2}$	1 $\frac{3}{4}$	6	2	Medium-weight cotton.
16.....	6	13 $\frac{1}{2}$	2 $\frac{1}{4}$	6	2	Heavy-weight cotton.
17.....	6	13 $\frac{1}{2}$	2 $\frac{1}{2}$	12	2	Boot silk and mercerized.
18.....	6	13 $\frac{1}{2}$	3	12	2	Lightweight cotton.
19.....	6	13 $\frac{1}{2}$	3 $\frac{1}{2}$	12	2	Medium-weight cotton.
20.....	6	13 $\frac{1}{2}$	4 $\frac{3}{8}$	12	2	Heavy-weight cotton.

TABLE 3.—Dimensions of Boxes Proposed as Standards for Men's Hosiery.

Number.	Width.	Length.	Height.	Number of pairs in box.	Description of hosiery.
	Inches.	Inches.	Inches.		
1.....	4 $\frac{1}{2}$	13 $\frac{1}{2}$	1 $\frac{1}{4}$	6	Silk, mercerized, and lightweight cotton.
2.....	4 $\frac{1}{2}$	13 $\frac{1}{2}$	2 $\frac{1}{2}$	12	Do.
3.....	4 $\frac{1}{2}$	13 $\frac{1}{2}$	3	12	Heavy mercerized and cotton.

TABLE 4.—Dimensions of Boxes Proposed as Standards for Children's Ribbed Hosiery.

BOXES DESIGNED FOR MEDIUM-WEIGHT HOSIERY.

Number.	Size of hose.	Width.	Length.	Height.	Number of pairs to a box and method of packing.
		Inches.	Inches.	Inches.	
1.....	4	2 $\frac{3}{8}$	5	1 $\frac{1}{2}$	3 pairs in box; narrow box.
2.....	5	2 $\frac{3}{8}$	5 $\frac{3}{8}$	1 $\frac{3}{8}$	
3.....	6	3 $\frac{1}{4}$	7 $\frac{1}{4}$	1 $\frac{7}{8}$	
4.....	7	3 $\frac{3}{4}$	8 $\frac{3}{8}$	2	
5.....	8	3 $\frac{7}{8}$	10 $\frac{1}{4}$	2	
6.....	9	4 $\frac{1}{4}$	11 $\frac{3}{8}$	2 $\frac{1}{2}$	
7.....	4	4 $\frac{3}{8}$	5	1 $\frac{1}{4}$	6 pairs in box; 2 layers of 3 pairs; wide box.
8.....	5	5 $\frac{1}{8}$	5 $\frac{3}{8}$	1 $\frac{3}{8}$	
9.....	6	6 $\frac{1}{4}$	7 $\frac{1}{4}$	1 $\frac{7}{8}$	
10.....	7	7	8 $\frac{3}{8}$	2	
11.....	8	7 $\frac{3}{8}$	10 $\frac{1}{4}$	2	
12.....	9	8 $\frac{1}{2}$	11 $\frac{3}{8}$	2 $\frac{1}{2}$	
13.....	4	2 $\frac{3}{8}$	5	3 $\frac{1}{4}$	6 pairs in box; narrow box.
14.....	5	2 $\frac{3}{8}$	5 $\frac{3}{8}$	3 $\frac{3}{8}$	
15.....	6	3 $\frac{1}{4}$	7 $\frac{1}{4}$	3 $\frac{3}{8}$	
16.....	7	3 $\frac{3}{4}$	8 $\frac{3}{8}$	4	
17.....	8	3 $\frac{7}{8}$	10 $\frac{1}{4}$	4 $\frac{1}{2}$	
18.....	9	4 $\frac{1}{4}$	11 $\frac{3}{8}$	4 $\frac{3}{8}$	
19.....	4	4 $\frac{3}{8}$	5	3 $\frac{1}{4}$	12 pairs in box; 2 layers of 6 pairs; wide box.
20.....	5	5 $\frac{1}{8}$	5 $\frac{3}{8}$	3 $\frac{3}{8}$	
21.....	6	6 $\frac{1}{4}$	7 $\frac{1}{4}$	3 $\frac{3}{8}$	
22.....	7	7	8 $\frac{3}{8}$	4	
23.....	8	7 $\frac{3}{8}$	10 $\frac{1}{4}$	4 $\frac{1}{2}$	
24.....	9	8 $\frac{1}{2}$	11 $\frac{3}{8}$	4 $\frac{3}{8}$	



FIG. 9.—Suggested method for folding and packing men's hosiery.

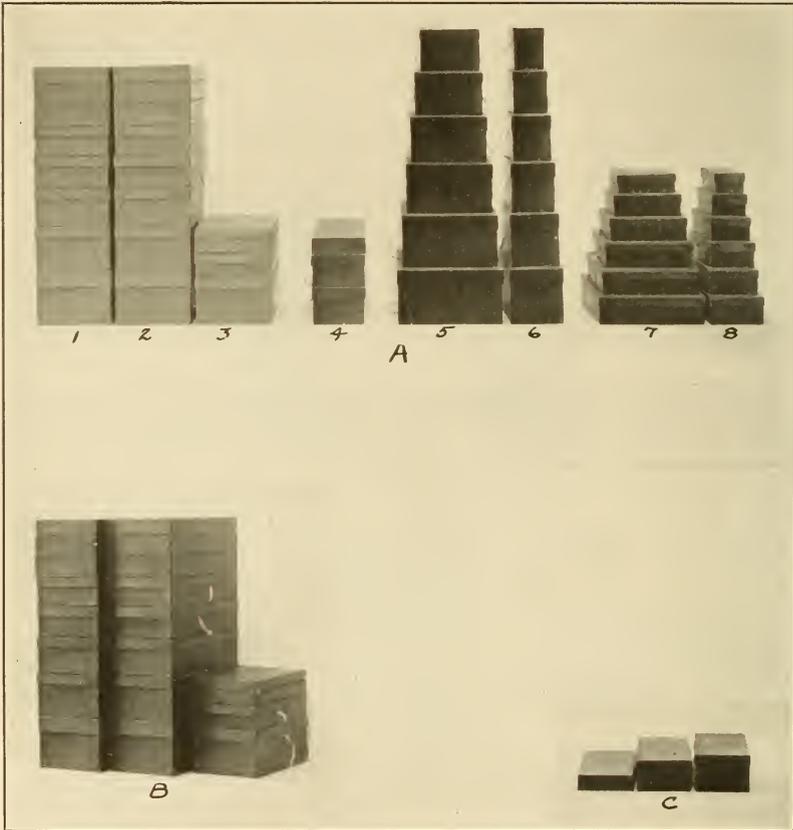


FIG. 10.—Hosiery boxes.

A, Proposed standard boxes; B, side view of ladies' hosiery boxes, showing difference in length; C, men's hosiery boxes, showing difference in height

Through the cooperation of a large hosiery box manufacturer several sets of these boxes were constructed, with the dimensions as given here.

These are shown in Figure 10, as follows: Column 1, ladies' hosiery boxes for hosiery, two fold, broken at heel gore; column 2, ladies' hosiery boxes for hosiery, two fold, broken at ankle; column 3, ladies' hosiery boxes, three fold; column 4, men's hosiery boxes; column 5, children's hosiery boxes, wide box, 12 pairs, 2 layers of 6 pairs; column 6, children's hosiery boxes, narrow box, 6 pairs, 1 layer; column 7, children's hosiery boxes, wide box, 6 pairs, 2 layers of 3 pairs; and column 8, children's hosiery boxes, wide box, 3 pairs.

Below this set is shown a side view of the ladies' hosiery boxes which illustrates the difference in length; also, there is shown (below right) the men's hosiery boxes to illustrate difference in height. These boxes are, left to right, for 6 pairs silk, mercerized, or light-weight cotton; for 12 pairs of silk, mercerized, or light-weight cotton; for 12 pairs of heavy mercerized or heavy cotton.

It is hoped that the boxes in columns 1 and 7 will be eliminated from the list of standards. In column 1 these boxes contain 6 and 12 pairs of different weight hosiery, each box having a length measurement of $13\frac{1}{4}$ inches. The hosiery is folded twice and broken at the heel gore. In column 2 we have the same condition, except that the hosiery is broken at the ankle in folding. This method of folding requires a box of only $11\frac{7}{8}$ inches, which is a saving of $1\frac{3}{8}$ inches in length. This is shown in the figure below the set.

In column 7 the boxes are designed to hold 6 pairs of children's hosiery piled in 2 rows, a form known as a wide box for 6 pairs of children's hosiery. This is intended to be replaced by column 6, which is a narrow box for holding 6 pairs of hosiery in 1 row. The elimination of the wide box and the adoption of the narrow box will insure a firmer package.

The adoption of the set as shown above will result in a 76 per cent reduction of the present sizes of boxes. If the boxes in columns 1 and 7 are eliminated from the standards, a reduction of 83 per cent will result.

Shortly after these boxes were made an exhibit of hosiery standardization work was sent to Philadelphia. Included in this exhibit was a complete set of these boxes packed with hosiery. This served as a service test, for the material arrived in excellent condition, with no boxes crushed, and the hosiery itself upon opening the boxes presented a fine appearance.

VII. RESULTS TO BE OBTAINED FROM STANDARD HOSIERY BOXES.

1. WASTE MATERIALS.

The reduction in the size of the box will permit a large saving in box board and paper materials. To approximate this, the consumption of hosiery boxes was estimated from the production of the total number of machines, full-fashioned and circular, in the hosiery mills of the United States. This is estimated to be as follows:

Approximate Consumption of Box Board and Cover Paper.

	Box area.	Weight.
	Square feet.	Pounds.
Present boxes.....	499,800,000	165,300,000
Standard boxes.....	467,500,000	154,500,000
Waste.....	32,300,000	10,800,000

This represents a waste of 6 per cent of materials.

2. STORAGE SPACE.

The waste of materials is not the only result of this excess space, for there is to be considered the storage space taken up by the unoccupied space in the hosiery boxes. It is difficult to estimate the saving which will result from this elimination.

3. SIZE OF SHIPPING CASE.

Reduction in the size of the hosiery box will permit a reduction in the size of the shipping case, which will reduce the cost of the case and the weight of the case, which will reduce transportation charges. Using the proposed standards will tend to make a firm case, for the reason that all the space is taken up by the hosiery. This will avoid crushing of the case.

4. COST OF BOXES.

Standard boxes will permit the hosiery box manufacturer to plan his consumption to better advantage. It will enable him to buy materials in larger quantities and to be prepared for rush orders by concentrating his storage facilities on the few sizes included in the proposed standards. The advantage of manufacturing these in large-quantity production will permit a reduction in operating costs.

The various widths of box board now used for hosiery boxes can be standardized for use on the proposed sizes, and this will result in a saving by permitting large storages for rush orders and by decreasing waste in cutting the box.

5. CRUSHING AND BREAKING REDUCTION.

As shown before, the chief cause of crushing and breaking of hosiery boxes is the pressure on the space not occupied by the hosiery. This breakage may occur in various places, for the hosiery may slide in the box, or the box be made too high, allowing the cover to crush the box when pressure is applied. The proposed standard boxes are designed to take care of this feature by permitting the hosiery to be pressed slightly in the box, insuring a more compact package.

6. DISPLAY OF HOSIERY BOXES ON RETAIL SHELVES.

There have been many complaints by manufacturers that retailers remove the hosiery from the original boxes and place them in boxes of uniform length and width, or in some cases odd-size boxes are placed under the sales counter, hidden from the view of the customer. This loses the tremendous advertising value which the display of the manufacturer's trade-mark and wares would effect. The adoption of the proposed standards would relieve the retailer of any trouble, and the shelves could be arranged to hold all manufacturers' products on the same basis.

The bureau acknowledges the cooperation and efficient assistance of John Nash McCullaugh, National Secretary and Industrial Manager of the National Association of Hosiery and Underwear Manufacturers. Mr. McCullaugh was helpful in the formulation of the plan of this investigation and secured, through his association, valuable assistance in its development.

WASHINGTON, October 18, 1923.

