This invention relates to improvements in methods and apparatus for the handling, dyeing, inspection and stripping of stockings.

The primary object of this invention is the provision of an improved method and apparatus for the facile dyeing and finishing of stockings in groups wherein the stockings are individually separated.

A further object of this invention is the provision of improved means for dyeing of stockings in movable masses wherein the stockings are individually separated.

A further object of this invention is the provision of improved means for automatically stripping stockings from a group mass wherein the stockings are individually separated.

A further object of this invention is the provision of improved means for mounting stockings for dyeing.

A further object of this invention is the provision of an improved boarding device for stockings.

A further object of this invention is the provision of improved means for the unit mounting of stockings in groups wherein the stockings are individually boarded and separated so that the stockings are in condition for facile performance of some operation, such as dyeing, drying, inspection, stripping, etc.

Other objects and advantages of this invention will be apparent during the course of the following detailed description.

In the accompanying drawings, forming a part of this specification, and wherein similar reference characters designate corresponding parts throughout the several views,

Figure 1 is a diagrammatic view representing the different devices and steps in the method of boarding, dyeing, drying and stripping stockings.

Figure 2 is a side elevation of a spider-like arrangement whereon are disposed a plurality of stocking mounted forms in radial relation upon a hub.

Figure 3 is a sectional view, showing an improved device whereon the forms shown in Figure 2 are assembled in predetermined numbers.

Figure 4 is a cross-sectional view showing a dye tank, and improved means for dyeing and extracting dye liquor from the stockings while mounted in the grouped assemblage shown in Figure 3.

Figure 5 is a fragmentary view showing the means for automatically stripping stockings from their forms.

Figure 6 is a view showing the improved stripping mechanism as it is used for stripping the stockings from a group of the forms.

Figure 7 is a side elevation of one of the improved boarding devices wherein the stocking is placed and tensioned for efficient dyeing.

Figure 8 is a fragmentary view of the upper end of the boarding device of Figure 7 showing the preferred method of holding the upper end of the stocking on the form.

Figures 9 and 10 are cross sectional views taken substantially on their respective lines in Figure 7 of the drawings.

In the drawings, wherein for the purpose of illustration is shown only a preferred embodiment of the invention, the letter A may generally designate the entire apparatus used for treating the stockings according to the herein described method. Spider-like units B are used for radially supporting a plurality of the boarding forms of devices C, and a plurality of these spider-like forms B are intended to be placed upon a supporting shaft C' to form an assembled group in unitary arrangement. These group assemblages may be generally designated at D and are elevated and lowered and moved from place to place by hoists E which are movable along an overhead trolley system F.

As shown in Figure 1 of the drawings the apparatus used for efficient handling, dyeing and finishing of the stockings includes a dyeing and extracting apparatus G; drying apparatus H, and means K for automatically stripping the stockings from the groups D.

The following method of preparing stockings for dyeing, finishing and sorting, has been in vogue for many years and is still universally practiced:

The stockings are received from the knitting machine, shaken apart, and preferably in dozen pairs are put into muslin bags which are closed with a numbered pin. These bags with their stockings are delivered to the dye house and boiled and rinsed, taken from the machine, and the liquor extracted. The stockings in their bags are then dried in a machine where the bags are dumped in haphazard fashion, and subsequently the stockings are rinsed and the liquor extracted. The stockings then go to a sorter who assembles them in identified fashion by numbered pins and are then delivered to the boarding department. Prior to boarding, the stockings are straightened and placed in damp bags and in a moist environment until ready to board. After the boarding the stockings are placed on trays and delivered to the pairers.
In the above described method, it is customary to put in goods in excess of 10% of those desired, as allowance for damage done during the present day dyeing methods. The dyeing is notoriously unsatisfactory with this method due to rubbing and striking of the stockings against each other as they are contained in the bags, and the dyeing is very seldom uniform throughout the entire batch of the stockings dyed, due to the compacted mass in which the stockings are packed together for dyeing.

In the new method I prefer to employ a metal boarding form or device C which consists of a flat metal body 10 shaped in the contour of a person's leg, except that the form body is flat, as is usual with such forms. The foot portion 11 of the form C is provided with a detachable toe 12 similar to that shown in U. S. Patent 1,583,631, so that the number of forms required to be used in the dyeing plant may be held to a minimum inasmuch as the toe portions 12 are interchangeable upon the various boarding forms C.

An improved feature of my form C I have provided at the upper end of the body portion 10 and in each of the flat sides thereof stocking supporting members 15 which are strip-like in form and provided with hooks, pins, or projections 16 in any desired shape. They are arranged in rows and comprise the upper end portion of the stocking, preferably a waste portion which will be subsequently described. These supporting members 15 are mounted upon a longitudinally slidable support 17, as shown in Figures 7 to 10 inclusive, mounted within an elevated slot 19 provided in the upper end of the form and dove-tailed with the body 10, in a V-shaped arrangement, as shown in Figure 9, so that the support 17 is always located within the slot 19 and its surfaces lie flush and in the same plane with the outer surfaces of the body 10. Some means is provided for normally urging the slide 17 towards the top end of the boarding form C, and this preferably is in the nature of a spring 20 which is secured at one end to the upper end of the body 10 and at its other end to the slide 17.

Another improved feature of the form C is the provision of a groove 21 extending from the top edge of the body 10 along the rear thereof and downwardly in continuance along the calf and ankle of the leg, around the heel and the sole portion of the foot and along the removable toe 12, as shown by the dotted lines in Figure 7 of the drawings. This groove 21 is to accommodate the seam of the stocking and hold the stocking against twisting. The seam is shown in position in the groove 21 in Figure 9 of the drawings.

The stocking B is preferably of special construction so as to be adapted to the improved form C, but of course the boarding form C may be used for supporting any stocking. Accordingly the stocking B includes the usual leg portion 25 and it has a welt 26 of any predetermined nature. The stocking leg and welt are of course knitted of any predetermined number of courses, one of which constitutes a picot designated at 27 in Figure 8 of the drawings. While on the machine, to the picot course 27 is knit a waste section 28 preferably of cheap cotton yarn, of any desired length, but preferably just sufficient to enable the supporting members 15 to properly grip the same without injuring any portion of the fabric used in the finished stocking. The adjacent course of the waste portion 28 is of course knitted with the picot course 27 by a pull thread designated at 29 in Figure 7 of the drawings. Removal of this pull thread separates the waste portion 28 from the defective portion of the stocking. Dyeing of the stocking in this condition prevents the picot edge to be held straight during the dyeing operation, and the construction of the stocking tensioning device with the waste section 28 enables stockings of uniform length to be knitted and uniformly tensioned during the dyeing operation so as to insure uniform dye shades.

The spider shaped units B comprise a ring-shaped hub 35, preferably of metal and provided with a central opening 36 to receive supporting shaft C therein. The hub has a suitable T-slot to receive the key 36 of the shaft device C'. The periphery of the hub 35 is recessed or slotted to receive the upper ends of the boarding forms or devices C. The hubs 35 are preferably arranged 20 to receive twelve of the boarding forms C and they are clamped rigidly, but preferably detachably, in slots in the periphery of the hub by means of screws or detachable bolts 37. The periphery of these boarding forms C may be rigidly affixed permanently to the hub. The spider-like arrangement of the completed form B is shown in Figure 2.

In Figure 3 the group D comprises the supporting shaft C wherein a plurality of spider-like units B are mounted. This shaft device C' includes a shaft proper 37 having the key 36 longitudinally thereof. It is provided with a plurality of retaining rings 38 which may be held or fixed in desired position upon the shaft body 37 by means of set screws 39, as shown in Figure 3. At one end of the shaft body 37 is provided with an eye or hook 40 attached swivelly to the end of the shaft by anti-friction means 41. This eye or hook 40 is intended to be releasably gripped by the hoist B in order to lift the group assembling D and move it from place to place, or support it while in working position.

The spider-like units B are assembled upon the shaft C' as shown in Figure 3 and clamped in position between the rings 38 so that they cannot move longitudinally along the shaft.

Describing the cycle of steps will be the best method of describing the rest of the apparatus.

In Figure 1 is shown the board operation which consists of mounting the units B separately upon some support such as 55, shown in Figure 1, and the border then assembles the stockings on the individual boarding forms C as above described, and as shown in Figure 7 of the drawings. As the boarding is completed the spider forms B are assembled upon the shaft C', as shown in the "assembling" step shown in Figure 1, and in this position the extreme end of the shaft C' is clamped upon a support 51 by means of a mortise 52, so that only one end of the shaft C' may be supported and the operator is free to slip the hubs 35 of the spider units B into position, as shown in Figure 1.

The next step is preferably the dyeing and liquor extracting step. A single tank is used for performing these two operations. This tank 53 preferably includes a circular body wall and a bottom 53. A perforated false bottom 56 is provided in the tank slightly spaced from the bottom 53, such false bottom a step bearing 55 is located for detachably receiving the rotatable end of the shaft C'. The dye liquor is heated by steam which enters the compartment between the bottom 53 and the false bottom 54 through 56.
a steam pipe 56. The steam is controlled by means of a valve 61 extending above the floor 63. The hoist E may be supported on traveling carriages 64 which travel overhead along a track 65. This hoist trolley apparatus may be of any approved type and the hoist cable may be elevated above the floor by the hoist. The end 67 may engage the swivel eye 40 of the shaft C' in order to elevate and lower the stockings supported on the spider forms B.

The tank G includes a removable closure 70 which is only diagrammatically illustrated in Figures 1 and 4. It may be hinged or otherwise secured to the tank and provided with hooks or other means so that the hoist may lift it in order to assemble it upon the shaft C'. As shown in Figure 4 of the drawings the closure 70 is provided with a rotatable sleeve 72, preferably centrally located therein which is provided with an annular groove into which the end of a key pin 73 extends to permit rotation of the sleeve 72 in the closure 70 and prevent its longitudinal removal. The sleeve 72 has a gear 75 connected therewith.

In association with the dyeing and liquor extracting apparatus there is a change speed gear box 77 having a gear 78. Any suitable chain of gears 79 may be provided to mesh the gear 75 with the gear 78 so that the closure 70 may be removed. The drive speed gear 71 is provided in order that the group assembly D may be rotated at slow speeds while the stockings are immersed in the dye liquor, and at higher speeds in order to centrifugally remove the liquor.

As shown in Figure 4 the shaft C' is assembled in the sleeve 72 and keyed therewith, since a keyway is provided in the sleeve 72. The hoist mechanism E of course elevates and lowers the shaft C' which forms a part of the group assembly D. Normally, the end of the shaft C' rests in the step bearing 55 and in this position the stockings on the units B are immersed in the dye liquor and the latter is heated as above described. After the dyeing operation the liquor may be drained from the tank as by means 80 and the change speed gearing set in order to speed up rotation of the shaft C' for the centrifugal removal of excess dye liquid from the stockings on the forms C of the forms B. In event the dye liquor is not to be removed from the tank, or as an alternative way of centrifugally dehydrating the stockings, the hoist E may support the assembly D in the position shown in Figure 4 and the change speed gearing arranged to rotate the stockings on the assembly D at the proper speed with the forms B arranged above the level of the liquid, as shown in Figure 4.

After the liquid extracting operation above described, the hoist E moves the group assembly D to the operator for straightening of the stockings on the boards which have been disarranged during the dyeing operation. The shaft C' in this operation is horizontally supported upon standards 88 and 91, as shown in Figure 1 of the drawings.

The hoist E then transports the assembly D to the drying tank 92, which is similar in all respects to the tank G, except that a pipe 93 is provided for heating the compartment in the tank 92. The closure 94 is removable and supports a motor 95 for driving the shaft C' at desired speeds.

The hoist E next moves the group assembly D to a position for inspection of the stockings.

In this position the shaft C' is supported upon standards 97. It is during this operation that the operator will inspect the stockings for defects and seconds. The pull cords 29 on "perfects" are pulled by the operator during this operation so that the "perfects" may be subsequently stripped from the forms C without the waste portion 28 attached thereto. Of course if an automatic stripper is used the inspector will also have to release the stocking engaging and tensioning members 15 on imperfect stockings but the waste portion 28 is not detached from the stockings.

The stripping operation may be effected by hand. In the preferred arrangement, shown in Figures 1, 5 and 6 of the drawings, the stripper K is arranged to automatically strip each of the stockings from each of the boards C; an intermittent movement being given to the assembly D to permit successive removal of the stockings from each of the spider units B, and the stripper K itself being given a preferably vertical movement so that it will move from one spider B to the next spider B as the stockings are removed.

The stripper K may generally be of the construction set forth in U. S. Patents Nos. 1,126,619; 1,141,777; 1,312,236, and 1,711,334.

Since the stripping mechanism K is rather conventional in nature it will suffice to say that it includes a movable arm 100 having grippers 101 which engage the stockings at the foot. Tracks or guide rails 102 define a path of movement of the arm 100. The latter is moved through gearing 104 of well known construction operating off of a shaft 105. This drive shaft 105 extends into a gear box 106 wherein gearing is provided for properly rotating the shaft 105 and permitting it to drop longitudinally from one spider form B to the other as the stockings are stripped therefrom.

In the stripping set-up the assembly D is rotatably mounted in a step bearing 118 and driven by gearing 113 which operates out of the gear box 106, as shown in Figure 1.

If desired the stripping operation may be done manually, or the spider units B separately arranged for the stripping operation, which may be accomplished as set forth in the above described stripping patents.

From the foregoing description of this invention it is apparent that an improved method for the efficient dyeing of stockings or other articles has been provided wherein economy of space, time, and expense are of prime consideration. The stockings are appreciably more efficiently dyed than with present methods, with a consequent minimum loss of the product as "seconds."

Among other advantages the improved method and apparatus have the following:

The merchandise being placed on the boards in the raw state instead of after dyeing saves a great many "seconds" caused by the present method of handling. An infallible count is maintained, thus eliminating losses due to mistakes and thefts.

The use of nets and other containers and consequent loss of time in bundling the stockings therein are all eliminated and likewise the use of transportation trucks.

At the present time a varied assortment of dyeing machines are necessary to handle various sized lots. This is all standardized in the present method, since the group assembly may
accommodate as many stockings as necessary or as few as desired.

The production in dyeing is greatly increased due to quick processing and the elimination of re-dyes, since tangling and distorting of fabric is entirely eliminated.

With the present method 1 to 2% of what is necessary, since the average with present used methods is approximately 10%.

From a merchandising standpoint the finish produced from the improved apparatus and method is vastly superior to finishes obtained upon stockings dyed according to present methods, in that it is possible to keep the wale of the stocking straight during the dyeing operation; the thread or yarn stitches are maintained in their normal condition and chafing and rubbing of the stockings is entirely eliminated. In fact the stocking dyed according to the improved method has the appearance of an ingrain stocking, or one manufactured from previously dyed yarns.

Miscellaneous other advantages are speeding up of the dyeing operation; maintenance of uniform lengths; reduction in mending operation, and elimination of weaknesses throughout the stocking.

Various changes in the steps of the method herein set forth and changes in the apparatus may be made to the herein described method and forms of invention without departing from the spirit of the invention or the scope of the claims.

I claim:

1. In a device for the grouping of individually boarding stockings and the like for compactly performing operations such as dyeing and finishing, the combination of a plurality of units each including an apertured hub having a plurality of boarding forms peripherally extending therefrom, a shaft for receiving the hubs thereon for disposal of the units in compact parallelism, and means on the shaft for accommodating a varying number of said units and clamping the same in securely and compactly attached relation thereon.

2. In apparatus for the dyeing of stockings and the like, the combination of a tank adapted to receive a dye liquor bath, means for boarding and supporting a plurality of stockings in a grouped relation, and means for rotatably supporting the said group of stockings while boarded in the tank for rotation at different levels within the bath or above the bath.

3. In apparatus for dyeing and finishing stockings, the combination of a plurality of thin flat relatively detachable supporting discs, a peripheral series of stocking boarding forms around each of said flat discs and lying in the same plane therewith, and means to detachably hold said discs with the forms thereon together as a group with the forms out of relative contact and with the discs in axially aligned stacked relation.

4. Apparatus for dyeing stockings comprising a support, means for positioning stocking boarding forms detachably on said support in individual closely spaced relation, a tank for receiving a dye liquor solution, and means mounting the support in the tank together with the stocking boarding forms thereon on a rotatable vertical axis.

HARRY EDGAR BREWIN.