Nov. 29, 1938. R. LITTLE ET AL 2,138,383

COP TUBE AND METHOD OF MANUFACTURING THE SAME

Filed April 1, 1936

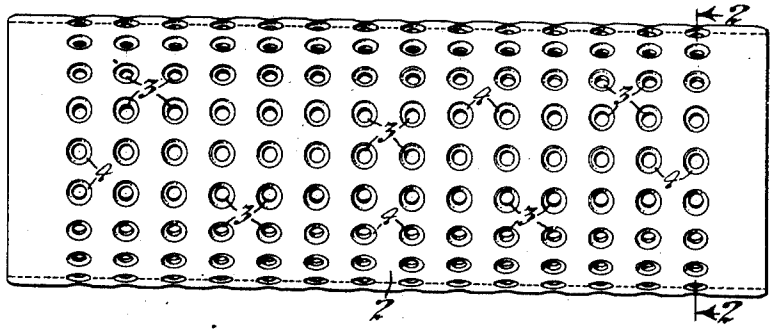


Fig. 1.

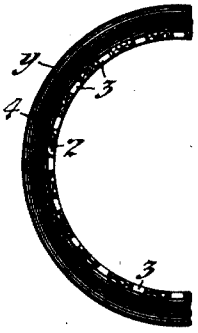


Fig. 2.

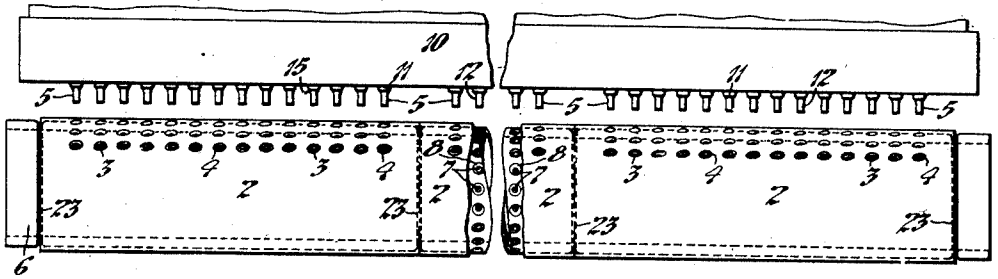


Fig. 3.

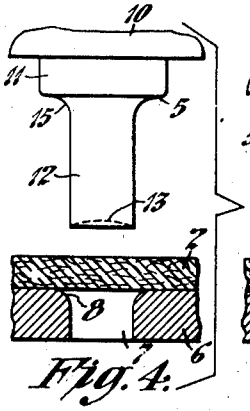


Fig. 4.

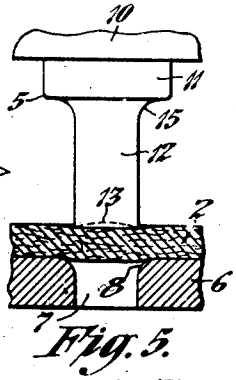


Fig. 5.

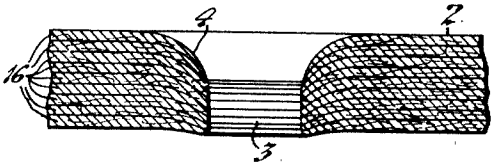


Fig. 7.

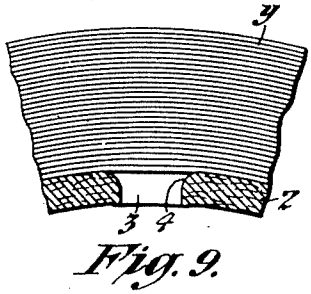


Fig. 9.

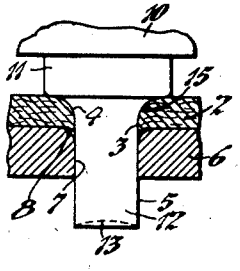


Fig. 6.

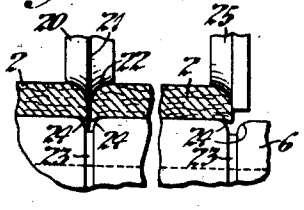


Fig. 8.

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UNITED STATES PATENT OFFICE

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COP TUBE AND METHOD OF MANUFACTURING THE SAME

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Application April 1, 1936, Serial No. 72,138

4 Claims. (Cl. 93—1)

This invention relates to improvements in perforated cop-tubes for use in supporting packages of yarn and other materials in dyeing, washing or other fluid-treatment processes; and to the method of manufacturing such tubes. In the following specification and claims the term "cop-tube" is used in a general sense to indicate any hollow core or support for yarn packages and the term "yarn" is intended to apply to other materials besides textiles.

One object of the present invention is to provide a cop-tube having perforations in its walls for the passage of the treating fluid therethrough and of such form as to prevent the yarn from catching on the edges of the perforations to injure the material in unwinding it from the tube.

Another object of the invention is to provide a cop-tube having perforations or openings therein with the surrounding portions of the openings countersunk below the peripheral surface of the tube or beveled at the edges to prevent the yarn from catching thereon.

Another object of the invention is to provide a paper or fiber cop-tube having the material thereof compressed around the edges of its perforations and also at the ends of the tube to increase its density whereby to prevent absorption of the dye liquor or other fluid at these points.

Another object of the invention is to provide a paper or fiber cop-tube having the outer layers of the material around the edges of its perforations rounded over into the openings and across the ends of the tube to seal the raw edges of the material and prevent the layers from separating and roughing up on the peripheral surface of the tube.

Another object of the invention is to provide an economical method of manufacturing perforated tubes of the type indicated to secure the advantages as above stated.

Further objects of the invention are set forth in the following specification which describes a preferred form of construction of the improved cop-tube and a preferred method of manufacturing the same, both by way of example only, as illustrated by the accompanying drawing.

In the drawing:

Fig. 1 is a side view of a cylindrical top-tube embodying the improved features of the present invention;

Fig. 2 is a fragmentary sectional view of the same taken on line 2—2 of Fig. 1 and illustrating several layers of yarn wound onto the tube;

Fig. 3 is a view illustrating a continuous paper or fiber tube held on a hollow mandrel with a series of punches for forming the holes in the tube;

Fig. 4 is an enlarged view showing a portion of the mandrel or arbor in section with the wall of the tube overlying the same and illustrating a preferred form of punch for perforating the tube;

Fig. 5 is a similar view showing the punch at the start of the perforating operation;

Fig. 6 is a similar view showing the punch at the completion of the perforating operation;

Fig. 7 is a greatly enlarged sectional view of the wall of the tube taken through one of the perforations and illustrating the manner in which the paper or fibrous material is compressed around the edge of the perforation to form a recess or bevel with the outer layers of the material rounded over into the perforation to seal its raw edges;

Fig. 8 is an enlarged view illustrating the method of dividing or parting off the continuous tube to form a plurality of cop-tubes and also the method of sealing the ends of the tube; and

Fig. 9 is a fragmentary sectional view similar to Fig. 2 but greatly enlarged thereover.

Perforated paper and fiber cop-tubes have heretofore been used for supporting wound masses of yarn during dyeing, bleaching, washing and other processes in which the material is treated with liquids, but unless they are constructed with thick walls they are not capable of repeated use. A particular object of the present invention is to provide an inexpensive, thin-walled, paper tube which, when properly impregnated with a moisture-proof and chemical-resistant material, is capable of repeated use in dyeing and other processes. In some cases cop-tubes of metal or other materials more permanent than paper have been adopted so that the tubes may be used over and over again in different treating processes, but the cost of such permanent tubes is quite high and their weight is considerable which renders it expensive to ship the tubes with the yarn packages and then return the bare tubes to the location where the material is dyed. The yarn is usually processed at localities at a distance from the location of the plants in which it is later used for knitting or weaving into fabrics so that the weight of the metal tubes adds to the shipping cost and the tubes must be afterward returned to the dyeing plant, entailing a further expense.

The present invention provides a light-weight perforated cop-tube of the type indicated which may be used repeatedly for supporting yarn packages in different batches during fluid treatment

of the material and which may be either retained at the dyeing plant or shipped to and returned from the mill to which the yarn is supplied. To attain this and other objects as above noted the present invention contemplates a method of manufacturing perforated cop-tubes with the perforations so formed that the edges thereof will not catch the yarn when it is unwound from the tubes and further, with the raw edges of the paper or fiber at the perforations and the ends of the tube compressed and sealed with a suitable impregnation to prevent the absorption of liquids used in the treating processes.

The improved cop-tube may take various shapes as required for different types of packages and may be constructed of materials other than those herein specified, all within the scope of the present invention. In the preferred embodiment of the invention, as herein illustrated, the tube is in the form of a hollow cylinder having relatively thin walls of overlying laminations of paper or fiber sheets. Fig. 1 illustrates a tube 2 of this type having numerous relatively small perforations 3 arranged in rows extending substantially throughout its length. The holes 3 may be formed by suitable punches 5 which cut away the paper or fiber and, in accordance with the present invention, the perforations 3 are beveled at their edges or countersunk with rounded depressions 4, shown most clearly in the enlarged view, Fig. 7. The countersinking or recessing around the rims of the holes is accomplished by compressing the material of the tube at these points and forcing the outer layers of the paper down into the openings, thereby securing several important advantages: first, the prevention of sharp edges with fins or burrs projecting above the peripheral surface of the tube; secondly, densifying the fibrous material of the tube to assist in sealing the raw edges around the holes to prevent the treating fluids from permeating thereinto; thirdly, consolidating the layers of the material to prevent them from separating and roughing up around the edges of the holes; and fourthly, by turning the outer layer of the paper into the perforations and over the ends of the tube providing a finished instead of a raw edge around the holes and at the ends of the tube which renders the material less permeable at these points.

Heretofore, perforated paper tubes manufactured by punching holes therein have been open to the disadvantage that the punches leave sharp edges and sometimes rough burrs around the rims of the holes which catch or "snag" the yarn as it is unwound from the tube, thereby tearing the filaments or abrading the material to injure its quality. It will be understood that the coils of yarn wound on the tube lie across the holes and tend to sink thereinto, as indicated in Fig. 9; that is to say, a length of the yarn extends in a chord across the arc of the tube, so that even though the rims of the holes are free from burrs their edges, which are left quite sharp by the punch, will cut into the yarn. Attempts have been made to avoid this deficiency by buffing and polishing the outer surface of the tubes but such treatment has proved only a partial remedy for the condition. In accordance with the present invention, the holes are countersunk around their rims so that the yarn cannot draw across sharp edges as will be observed by reference to Fig. 9 of the drawing which shows a magnified cross-sectional view of the tube through one of the perforations and illustrates the manner in which the yarn *y* is wound thereon.

As a preferred method of punching and countersinking the holes in the tube, punches with filleted shoulders such as shown in Figs. 4, 5 and 6 are employed. A group or gang of these punches may be assembled on a drop-press to perforate the tube with a complete row of holes at each operation; and to further economize in the cost of manufacture it is preferable to punch the holes in a plurality of tubes at one time. For this purpose a tubular arbor or mandrel 6 is employed as a support for the paper or fiber cop-tube, the tube 2 being formed on the mandrel in the usual way by wrapping a sheet of paper therearound to build up a laminated wall with the plies pasted or cemented together. Usually, a sheet several feet in length is wrapped on the mandrel to form a continuous tube which is later cut into shorter lengths. For example, if six-inch cop-tubes are to be produced, a standard length, then the sheet used may have a length of twelve, twenty-four or thirty-six inches or any other multiple of six.

The arbor or mandrel 6 is of greater length than the continuous tube and is provided with series of holes 7 arranged in conformity with the order of the perforations to be produced in the several cop-tubes. As shown in Figs. 4 and 5, the holes 7 in the wall of the mandrel 6 have their outer edges or rims rounded over at 8 to adapt the material of the tube to be compressed slightly thereinto. The punches 5 are arranged in a row projecting downwardly from the ram 10 of the punch-press, as indicated in Fig. 3. Referring to Figs. 4, 5 and 6, each punch 5 is constructed with an enlarged shank 11 having a smaller cylindrical cutting portion 12 projecting therefrom and of a diameter corresponding to the size of the holes to be punched. The end of the punch 5 is ground to a slight concavity as shown at 13 to provide a sharp peripheral cutting edge for the tool, and where the cutting portion 12 joins the enlarged shank 11 the shoulder is filleted to a rounded contour as indicated at 15. It is this filleted shoulder 15 of the punch which compresses the wall of the cop-tube 2 to form the countersunk depressions 4 at the rims of the holes 3 to round them over and assist in sealing the raw edges of the paper stock. It will be understood that the arbor or mandrel 6 is rotated step-by-step between punching operations and as the punches 5 descend they cut through the material as indicated in Fig. 5 with their terminal portions passing through the alined openings 7 in the wall of the mandrel 6. As the punches finish their stroke the material around the edges of the holes is compressed and countersunk as shown in Fig. 6 and a slight portion of the paper stock is forced down into the countersink 8 of each hole 7 in the mandrel 6. Impregnated paper tubes made by this method when tested for two hours in water at one hundred and ninety-two degrees F. were found to absorb a very substantial lower percentage of their total weight than identical tubes without countersunk edges and compressed ends.

Fig. 7 illustrates graphically the manner in which the tube is punched and countersunk and the material compressed around the edges of the perforations. In this view 16 designates the several layers of paper or fibrous material forming the wall of the tube 2 and it will be noted that the upper and bottom layers are compressed to a considerable degree adjacent the circumference of the hole 3. Moreover, the outer layers 16 of

the paper are stretched to exceed the length of the inner layers at the circumference of the hole 3 and forced down into the hole at the rim thereof while all of the layers 16 are more or less compressed so that the fibrous material is compacted and rendered more dense in structure. It has been demonstrated that by thus densifying the material at the raw edges of the holes and at the ends of the tube and then impregnating the paper or fiber with a suitable moisture-proof and chemical-resistant solution it may be rendered practically impervious to the absorption of liquids so that the tubes may be used repeatedly in dyeing and like processes without becoming softened and disintegrated. Moreover, it has also been determined that due to the fact that the outer layers of paper or fiber are forced down into the openings the plies are consolidated and prevented from separating to rough up around the edges of the holes. This also prevents the formation of interstices or air-pockets between the layers which would collect and hold the dye liquor during one dyeing operation and discharge it into another bath of a different shade with consequent staining of subsequent batches of yarn around the holes and at the ends of the tubes.

After the continuous tube has been perforated in the manner as hereinbefore explained it is cut into lengths in accordance with the required dimensions of the finished cop-tubes as indicated by the dot-and-dash lines in Fig. 3. The cutting or parting off operation may be performed by a rotary or other cutter or knife such as indicated at 20 in Fig. 8. The knife 20 is preferably formed with a narrow central blade 21 and concave shoulder portions 22 at the sides thereof which act to round over and compress the ends of the tubes as they are cut apart in somewhat the same manner as the material at the edges of the perforations is compressed and densified. For this purpose the arbor or mandrel 6 may be formed with grooves 23 at proper intervals of its length, the grooves having rounded or beveled shoulders 24 to adapt the ends of the tubes to be compressed thereover. The terminal portions of the continuous length of tube may be trimmed off by the tool 20 or if the original tube is of accurate length in accordance with the dimensions of the cop-tubes to be cut therefrom, a rolling tool 25 may be used in place of the knife 20 as shown in Fig. 8. This type of tool will simply roll over the edges of the paper tube to compress the layers to assist in sealing the ends against absorption of liquids. After the tubes have been perforated and cut apart in the manner explained they are coated or impregnated with a moisture-proof and chemical-resistant material as before noted.

It will be observed from the foregoing that the present invention provides a novel and improved perforated cop-tube for use in dyeing or otherwise treating yarn and similar materials with fluids and an improved method of manufacturing tubes of this type. As before noted, the perforations in the tube are countersunk at their rims to prevent burrs or sharp edges liable to catch and injure the yarn wound on the tube; and the paper or fibrous material at the raw edges of the perforations and the ends of the tube is densified by compressing and compacting the layers so that after impregnation the tube is proof against absorption of the liquids to which it is subjected in use. As a further important feature, the outer layers of the paper are drawn down over the edges of the holes and the ends of the tube to prevent the edges from roughing up and to eliminate crevices in which the dyeing or other treating fluid might collect. This outer surface of the paper being less permeable reduces the area of raw surface which otherwise would remain exposed. The improved tube is thus well adapted for use as a support or carrier for fine textile materials such as silk, rayon or the like without danger of injury to the yarn when it is wound on or unwound from the tube. Further, the invention provides a very inexpensive dye tube which may be used repeatedly without disintegration or change in shape; and without staining the yarn or "marking off" when used repeatedly in dyeing different batches.

While the improved cop-tube is herein shown as of cylindrical form it is obvious that it may be made in other shapes and its perforations may be of varied contour and of different arrangement. Further, other materials such as vitreous, plastic or phenolic condensation products may be used in the manufacture of the improved tube. Therefore, without limiting ourselves to the exact form of the invention as herein shown and described, we claim:

1. A cop-tube for use in dyeing and otherwise treating textile materials comprising a tubular body composed of overlying layers of fibrous material, the tubular body having perforations and the material surrounding the perforations being compressed and forced down into the holes to bevel the rims thereof and seal the raw edges of the material against penetration by fluids.

2. A cop-tube for use in dyeing and otherwise treating textile materials comprising a laminated tubular body having a series of holes formed therein, the other laminations around said holes being stretched and forced down into the holes and the material of the tube compressed to seal the raw edges at the peripheries of the holes against penetration by fluids.

3. An improved method of manufacturing cop-tubes for use in dyeing and otherwise treating textile materials with fluids which comprises forming a tubular body of overlying laminations of paper or the like, perforating the wall of the tubular body to form a plurality of holes, stretching the outer laminations of the material around the holes and forcing the material down into the holes to form smooth countersunk rims for the holes, and compressing the material at the rims of the holes to seal the edges thereof against penetration by fluids.

4. An improved method of manufacturing cop-tubes for use in dyeing and otherwise treating yarn with fluids which comprises winding a sheet of fibrous material on a suitable mandrel to form a laminated tubular body, perforating the wall of the tubular body to form a plurality of holes, stretching and drawing the outer laminations of the material surrounding the holes down into the holes to form smooth countersunk rims for the holes, and compressing the material at the rims of the holes to seal the peripheries thereof against penetration by fluids.

ROYAL LITTLE.
FREEMAN W. FRAIM.

4

CERTIFICATE OF CORRECTION.

Patent No. 2,138,383. November 29, 1938.

ROYAL LITTLE, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 40, claim 2, for the word "other" read outer; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of January, A. D. 1939.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.