May 23, 1961 J. E. TROY 2,985,004

YARN DYE AND WIND SPINDLE

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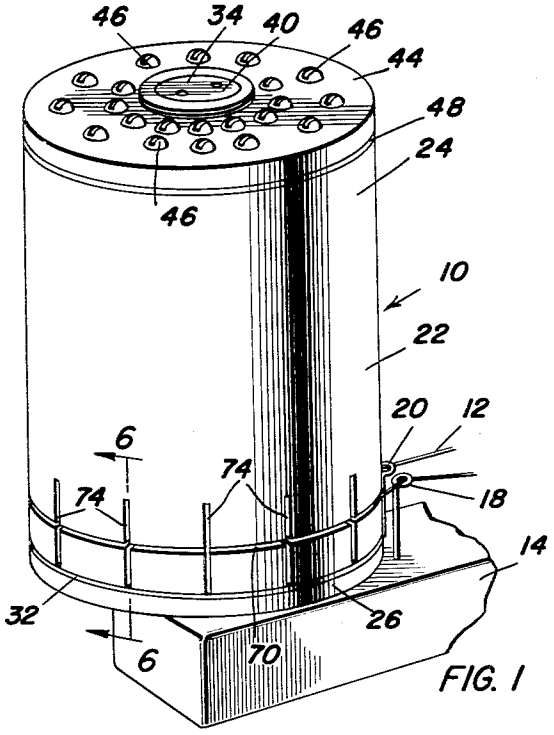


FIG. 1

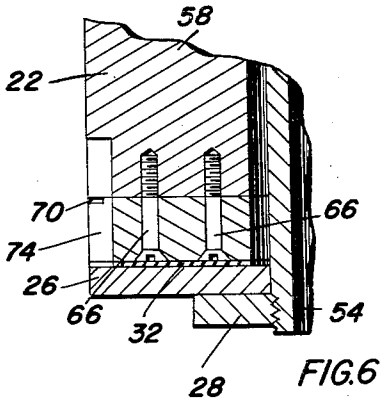
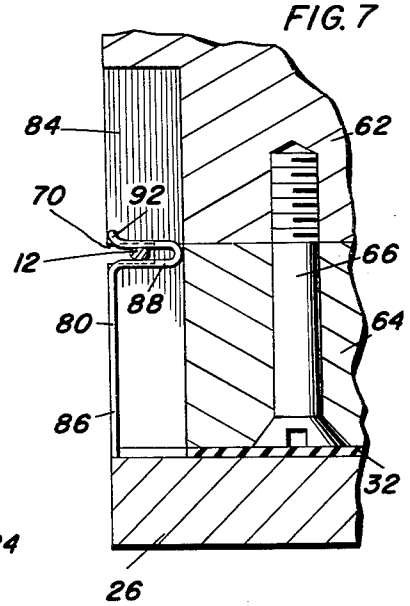


FIG. 6

FIG. 7



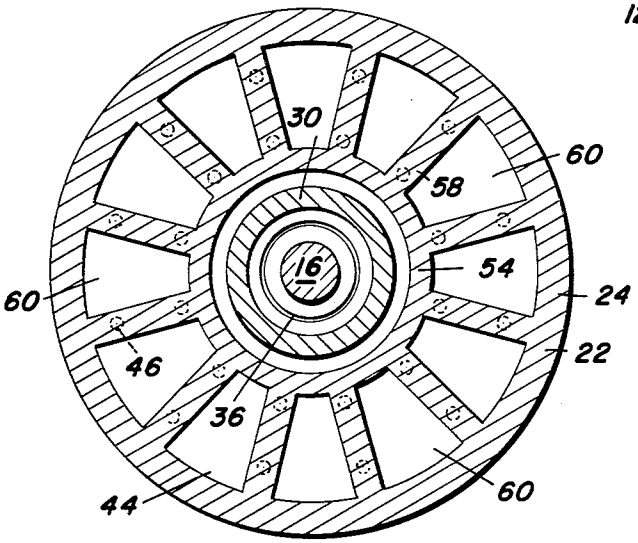


FIG. 4

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FIG. 2

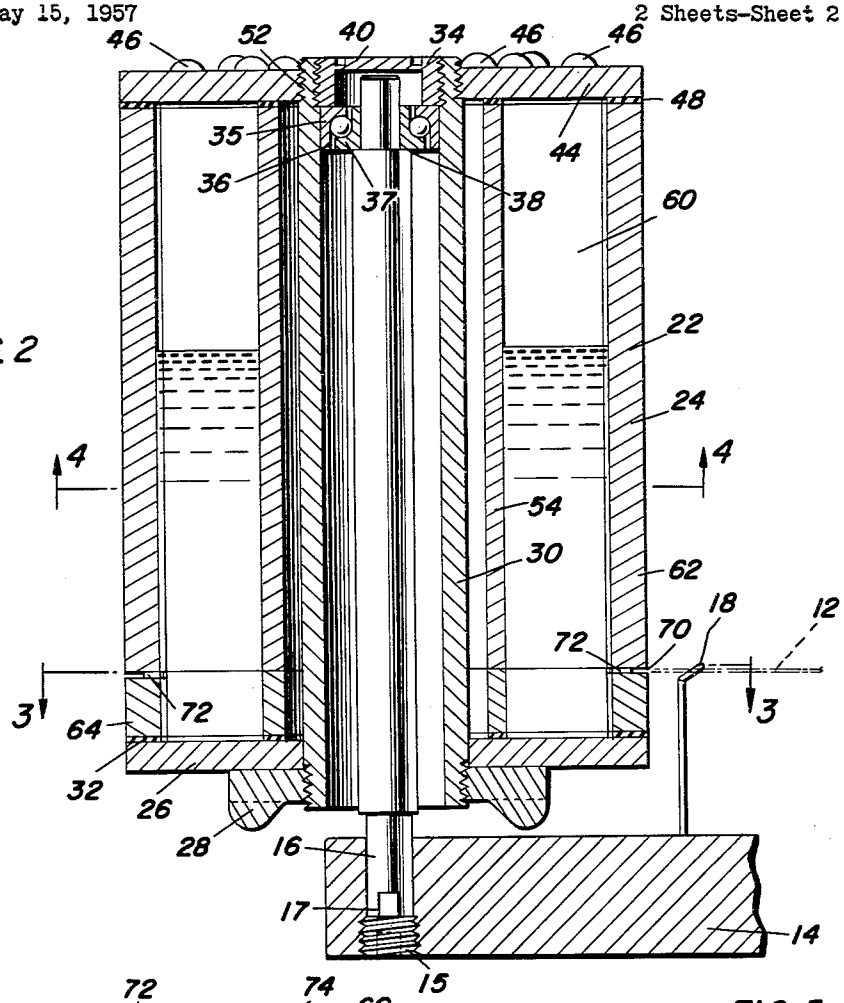


FIG. 3

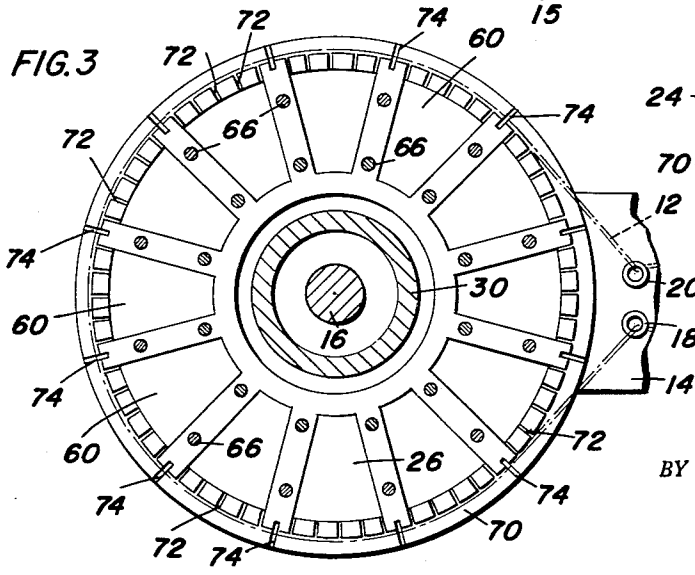
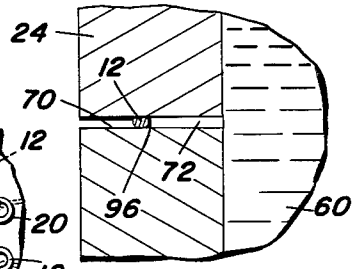


FIG. 5



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United States Patent Office 2,985,004 Patented May 23, 1961

2,985,004

YARN DYE AND WIND SPINDLE

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Filed May 15, 1957, Ser. No. 659,266

10 Claims. (Cl. 68—200)

This invention relates to a device for subjecting filamentary material to treatment with liquids and is particularly concerned with the application of liquid to running filaments which are flexible and somewhat anhydrous.

There is a large variety of liquids used in treating a number of filamentary materials. For example, many colors of dyes, treating chemicals, oils or inks are capable of being handled by my device. The filamentary material may be in the form of a single strand, a bundle of strands or filaments that are twisted or non-twisted, spun yarns, cords and I am explicitly including herein stretch-type yarns. The device is capable of being used especially in the field of coating and dyeing and therefore the subsequent description will refer to the problem of dyeing yarn, but it is understood that various liquids and various types of filamentary materials are intended to be within the comprehension of my invention even though for the purpose of simplicity, the subsequent description uses yarn and dye as typical examples of manners of practicing the principles of the invention.

It is an object of the invention to provide a device capable of more efficiently treating running yarns uniformly by the application of one or more colors of dye. The invention dispenses with contact pads, all absorbent materials such as felt, wicks, etc., and mechanical valves that have moving parts, and relies on surface tension between the liquid and the walls of the chambers for the liquid for a valving function. As the yarn is drawn through the device for the application of dye, the device rotates and in so rotating, the yarn is brought in contact with the discharge orifices for the dye and becomes impregnated with it. The yarn moves in unison with the device without slippage, and to assure that there will be no slippage, the yarn may be wrapped around the device one or more times to give better traction and impregnation.

Valves having adjustable parts are used in existing equipment. Others use wicks, other absorbent materials, and some use a combination of both. Regardless of the adjustment, there is a considerable problem in the prevention of migration of one color dye or one shade of dye to the next shade or color and this results in smearing and far less than optimum color separation in the yarn. It is a further object of my invention to correct this problem by a novel structure which has no adjustable valve provisions and which, to my knowledge, relies on a principle which is new in the field of yarn dyeing or coating to apply the dye to the yarn.

A particularly difficult problem is encountered in variegating the stretch type yarn which are becoming increasingly popular. Mechanically adjustable, vented type dye applying devices will not cope satisfactorily with the problems introduced by stretch yarns. An object of this invention is to provide a device for applying dye to stretch-type yarn and to experience success in so doing in that the quantity of liquid discharged from each liquid chamber varies in direct proportion to the demands of the type, cross-sectional area, and liquid content of the

yarn that is being dyed. An inherent property of my yarn dyeing device is that only the amount of dye demanded by the yarn is withdrawn from the dye chambers. Therefore, even under continual operation there is little excess dye to contend with and hence, problems of migration of dye from one chamber to the next are materially reduced. Problems attributable to irregularities in the requirements of dye for various types of yarn are automatically solved.

Other objects and features of importance will become apparent in following the description of the illustrated forms of the invention.

In the drawings:

Figure 1 is a perspective view of a device constructed and operated in accordance with the principles of the invention;

Figure 2 is a central, vertical or longitudinal sectional view of the device of Figure 1;

Figure 3 is a transverse sectional view taken on the line 3—3 of Figure 2;

Figure 4 is a transverse sectional view taken on the line 4—4 of Figure 2;

Figure 5 is an enlarged fragmentary sectional view showing yarn passing through the device and its relationship with the part of the device that applies dye to the yarn as shown in Fig. 2;

Figure 6 is an enlarged fragmentary vertical sectional view taken on the line 6—6 of Figure 1, and;

Figure 7 is an enlarged fragmentary sectional view similar to Fig. 6 but of a modification of the invention wherein additional means to prevent dye migration are applied in the device.

In the accompanying drawings there is a device 10 for applying dye to yarn 12, the device exemplifying the principles of the invention. It is illustrated as being mounted above a support 14 from which vertical shaft 16 rises. The yarn guides 18 and 20 are attached to support 14 to compel the yarn 12 to conform to or fit within the device 10. As the yarn is translated by equipment (not shown), it passes about and thus rotates the casing 22 which is mounted on shaft 16.

The casing 22 has a cylindrical side wall 24, an open bottom and an open top. The open bottom, see Fig. 2, is closed by bottom wall 26 that is held in place by nut 28 threaded on the hollow shaft 30. Gasket 32 is interposed between the mating surfaces of the bottom of the casing 22 and bottom wall 26. Hollow shaft 30 is concentrically mounted around shaft 16 and has an internal plug 34 threaded in the upper end. The internal plug bears against one race 35 of ball bearing 36, while the other race 37 of the ball bearing 36 seats upon shoulder 38 at the upper extremity of shaft 16. This enables the casing 22 to be supported and journaled solely upon the shaft 30 and to be rotated with an application of a very small force. It is appreciated that bearing 36 could be located at the bottom of shaft 30 or, two such bearings could be used. Dust cap 40 is fitted in plug 34 or forms a part thereof.

The open top of the cylindrical side wall 24 is closed by removable top wall 44, held in place by a plurality of screws 46 which pass through holes in top wall 44 and which are disposed in tapped bores formed in the body of the casing 22. Gasket 48 is interposed between top wall 44 and the open top end of the casing. It is necessary to have access to the plurality of cells or chambers (Figure 4) in casing 22 and therefore the top wall 44 is made removable. It is securely attached in place by external threads 52 at the top part of hollow shaft 30.

The casing has an inner cylindrical wall 54 in addition to the outer side wall 24 and there are a plurality of vertical partitions 58 extending from the open top of casing 22 to the bottom of the casing. These parti-

tions cooperating with side walls 24 and 54 form a plurality of individual cells or chambers 60 in which to accommodate different colors of dye or any other liquid substance which is to be applied to the yarn 12. The lower end of the casing 22 is cut completely through in order to separate it into an upper part 62 and a lower part 64. However, partitions 58 fit snugly and tightly against each other when the parts 62 and 64 are assembled by screws 66. The mating ends of parts 62 and 64 are precisely machined so that all walls and partitions will fit snugly and tightly against each other to eliminate the possibility of leakage of liquid from one chamber to another avoiding contamination and intermingling of liquids.

The upper surface of the bottom part 64 is cut away at its periphery in order to form a smooth surfaced groove 70 that is circular, extending completely around the casing 22 and extending only partially through the thickness of the cylindrical outer wall 24. One or more turns of yarn 12 are fitted in the groove 70 and while in this groove, dye from the chambers 60 is applied to the yarn. Dye passageways 72 are radially arranged with respect to the axis of rotation of casing 22. They register groove 70 with the interior of each of the chambers 60 inasmuch as they extend the remaining distance across the thickness of the cylindrical side wall 24, that is, the distance that was not penetrated in forming groove 70. The cross sectional shape of passageways 72 is polygonal, as would be formed by saw cuts or formed in some other way, however, these passageways may be formed by drilling in which case their cross section would be circular.

In forming variegated yarns with longitudinally spaced colors, the individual chambers 60 will contain liquids of different colors in accordance with the variegated cycle wanted in the yarn. Where natural or uncolored spaces are desired in the yarn the appropriate chambers will be filled with a colorless liquid, as water, or left empty. It is especially important when using a multicolored scheme, to prevent migration of liquid from one chamber 60 to the region of the adjacent chamber. Considerable difficulty is encountered in the yarn groove since the liquid dye tends to creep or migrate along the surface of the groove. My device has means to prevent this, the means consisting of openings 74 that intersect the groove 70, extending vertically downward in side wall 24 and extending endwise partially within partition 58. Each opening 74 is constructed in the form of an elongated slot and may extend upwardly (Figure 6) in cylindrical side wall 24 as well as downwardly requiring an exceedingly long path of travel for migrating dye.

The device of Figure 7 differs from that of Figure 1 by the inclusion of spring clamp 80 which is located in slot 84, this slot corresponding in both construction and function to the opening or slot 74. The spring clamp 80 is made of a wire shank 86 that has an outwardly opening U-shaped hook 88 at the upper extremity thereof which is fitted in registry with the circular groove 70. There is enough inherent resiliency in the U-shaped upper part 88 of the clip to pinch the yarn 12 as it passes through it. The outer end 92 of the U-shaped part of the clamp is bent to form a cam and guide the yarn 12 into the jaws formed by the U-shaped part of the clip. Not only do slots 84 function as means to prevent migration of dye from one chamber to the next chamber along the surfaces of groove 70, but there is a positive locking or gripping of the fibrous material of yarn 12 to inhibit the absorption and travel longitudinally along the yarn 12.

In order to fill the chambers 60, the casing with its shaft attached are lifted from support 14. The casing is turned end-for-end and wall 44 rested on a supporting surface. Nut 28 is removed along with wall 26 and gasket 32, giving access to chambers 60. After filling the casing is reassembled and returned to support 14. The notched screw plug 15 is threaded in support 14 and engages the slot 17 in shaft 16 insuring correct positioning of groove 70 in line with guides 18 and 20. The top wall 44 is screwed down tight with gasket 48 between the top wall and the mating surface of the upper end of the casing in order to assure that the chambers 60 are airtight. They are unvented and, therefore, the dye does not flow freely through passageways 72.

After wrapping the yarn 12 around casing 22 one or more times and making certain that each of the one or more turns fit neatly within groove 70, the yarn is set into motion thereby rotating the casing 22 with it. The dye does not flow onto the yarn but rather is applied or physically pulled by surface tension through passageways 72 and onto yarn 12 (see Figure 5). The combination of surface tension along with the partial vacuum in chambers 60 above the liquid act to form a meniscus at the outer ends 96 of passageways 72 in groove 70. But, the meniscus is broken by the yarn and a small quantity of dye extracted from the ends of the passageway 72 when the yarn 12 touches the meniscus of the liquid.

Migration of the dye is prevented by the action of slots 74 or 84 and/or the clips 80 located therein. Although only a few forms of the invention are described it is understood that certain modifications and variations may be made without departing from the claimed invention. For example, the surfaces of parts 62 and/or 64 may be made by various machine and/or hand operations including drilling. It is also possible to cut groove 70 and passageways 72 in the lower end of casing 22, dispensing with gasket 32, then when wall 26 is put in place it would serve as the third wall for groove 70.

What is claimed as new is as follows:

1. In a device for applying dye to arn, the combination of a rotary casing in which there are a plurality of unvented chambers, said casing having a yarn receiving circumferential groove, a plurality of passageways at the inner wall of said groove and extending through said side wall and opening into said chambers thereby establishing registry between the interior of said chambers and the inner wall of said groove, the surface tension of the liquid coupled with the unvented condition of said chambers preventing the dye from flowing freely through said passageways but enabling the dye to be extracted by the yarn which passes thereover in response to rotation of said casing, and means including slots formed in the side wall of said casing and located between individual chambers for preventing migration of the dye from the region of one chamber to the region of the next adjacent chamber in said groove.

2. The combination of claim 1 wherein said migration preventing means also includes a resilient clip adapted to embrace the yarn, there being one clip in each of said slots.

3. A device to apply liquid to a filament, said device comprising a rotary casing having a plurality of chambers, said casing having a side wall with a circumferential filament receiving groove, and a plurality of passageways which are of a dimension dissimilar to the thickness of said groove, said passageways extending between said groove and said chambers and establishing communication therebetween, means including resilient clips located in said groove and between adjacent chambers to inhibit absorption and travel of said liquid longitudinally along the yarn.

4. A device for applying dye to yarn and in amounts proportional to that demanded by the yarn, said device comprising a rotary casing in which there are a plurality of dye chambers, means closing the tops of said chambers above the liquid level of the dye, said casing having a yarn receiving groove provided with an upper surface, a lower surface and an inner surface and with the distance between the upper and lower surfaces being such

as to snugly engage yarn disposed therewithin and at least partially around the casing whereby longitudinal movement of yarn will impart corresponding rotary motion to the casing, a plurality of passageways interconnecting said groove with said chambers and opening through the surface of said groove and into said chambers so as to apply dye to discrete portions of yarn received within said groove during at least a portion of one complete rotation of the casing, and means for preventing migration of dye along at least one surface of said groove so as to prevent comingling of dye between adjacent of the discrete portions of yarn, partitions in said casing which separate the casing into said chambers and said dye migration preventing means comprises a plurality of slots arranged at approximately right angles to the plane of said groove and opening through the upper and lower surfaces of said groove and extending endwise partially within the partitions which define said chambers.

5. The combination of claim 4 wherein there are resilient clamps in said slots to embrace the yarn as it is moved thereinto.

6. In a device for applying dyes of various colors to yarn at different points along the length thereof, a rotary casing having a series of dye-receiving chambers therein, said casing having openings therethrough communicating with individual ones of said chambers, said openings being circumferentially spaced around said casing and contained within a common plane, means carried by said casing for gripping yarn in such a fashion as to be wound therearound in overlying relation to said openings for application of dye thereto from said chambers, said means including elements disposed intermediate said openings pinching the yarn to grip the same for rotation with the casing and for preventing migration of dye along the yarn beyond those discrete areas thereof bounded by adjacent pinching elements.

7. In a dye applying device for applying dyes of different colors to discrete areas along the length of the yarn and to prevent comingling of dye between such discrete areas, a rotary casing having its interior provided with a number of isolated chambers for containing dyes of different colors, said casing having a circumferential groove therein for receiving the yarn and said casing having a plurality of openings therein disposed in circumferentially spaced relationship and opening from said grooves into separate ones of said chambers whereby dye from the several chambers will be applied to yarn contained within said groove in discrete areas along the length thereof, and means within said groove causing yarn to be gripped by the casing so as to be carried thereby as the casing rotates and simultaneously isolating the discrete areas of the yarn to prevent comingling of the dyes.

8. In a dye applying device for applying dyes of different colors to discrete areas along the length of the yarn and to prevent comingling of dye between such discrete areas, a rotary casing having its interior provided with a number of isolated chambers for containing dyes of different colors, said casing having a circumferential groove therein for receiving the yarn and said casing having a plurality of openings therein disposed in circumferentially spaced relationship and opening from said grooves into separate ones of said chambers whereby dye from the several chambers will be applied to yarn contained within said groove in discrete areas along the length thereof, and means within said groove causing yarn to be gripped by the casing so as to be carried thereby as the casing rotates and simultaneously isolating the discrete areas of the yarn to prevent comingling of the dyes, said means comprising gripping elements located in said groove intermediate said opening and serving to pinch the yarn.

9. In a device for applying dye to yarn, a rotary casing having a plurality of dye-receiving chambers therein and provided with a yarn-receiving circumferential groove, means communicating discreate areas of said groove with said individual ones of said dye-receiving chambers, and means intermediate adjacent of said discrete areas preventing migration of dye axially through associated yarn as applied by the first mentioned means, said means comprising gripping elements located in said groove intermediate said openings and serving to pinch the yarn.

10. In a device for applying dye to yarn, a rotary casing having a plurality of dye-receiving chambers therein, means constraining yarn to be applied at least partially around the circumference of said casing and to be carried therewith as said casing rotates, means communicating discrete areas of said portion of the casing contacting the yarn with separate ones of said dye-receiving chambers, and means on said casing intermediate said discrete areas to prevent migration of dye axially through the yarn, the last mentioned means comprising gripping elements serving to pinch the yarn at various points along its length.

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