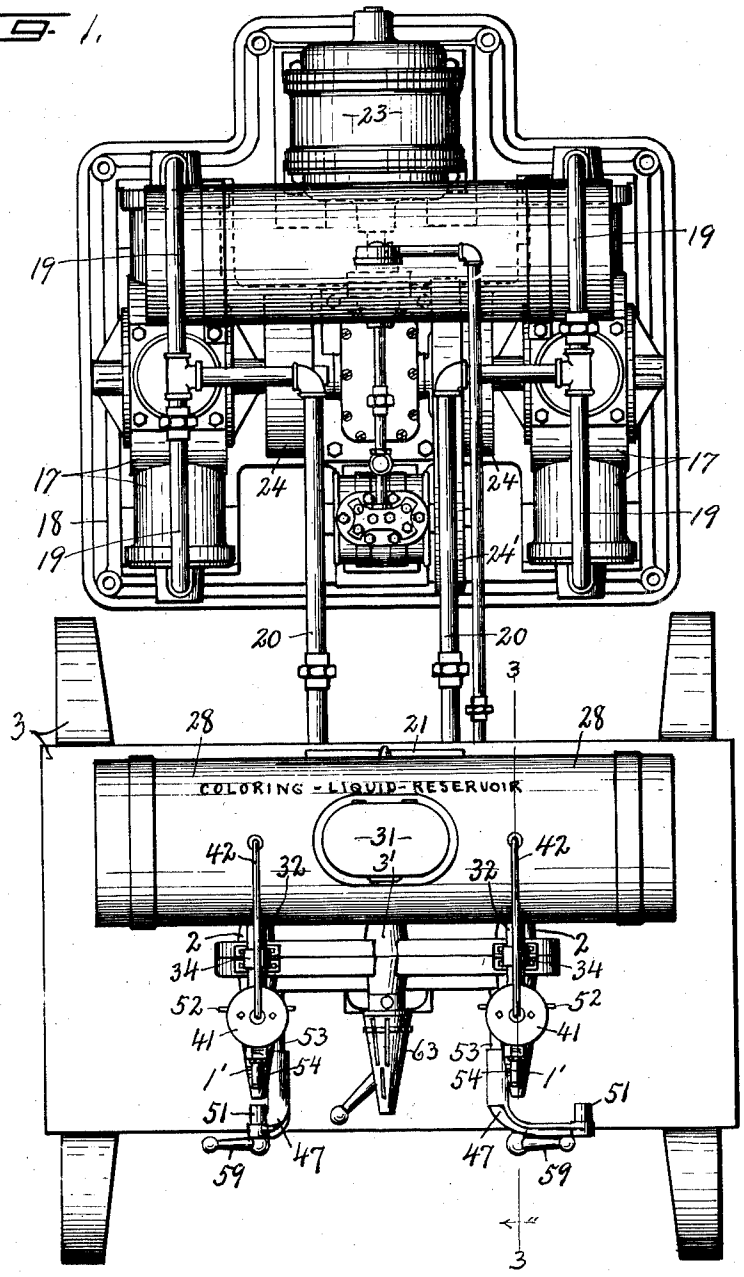
Jan. 28, 1930. J. S. JOHNSTON 1,745,097

APPARATUS FOR COLORING PORTIONS OF YARN IN MASS

Filed Nov. 20, 1924 3 Sheets-Sheet 1

Fig. 1.



WITNESS
H. W. Hurst

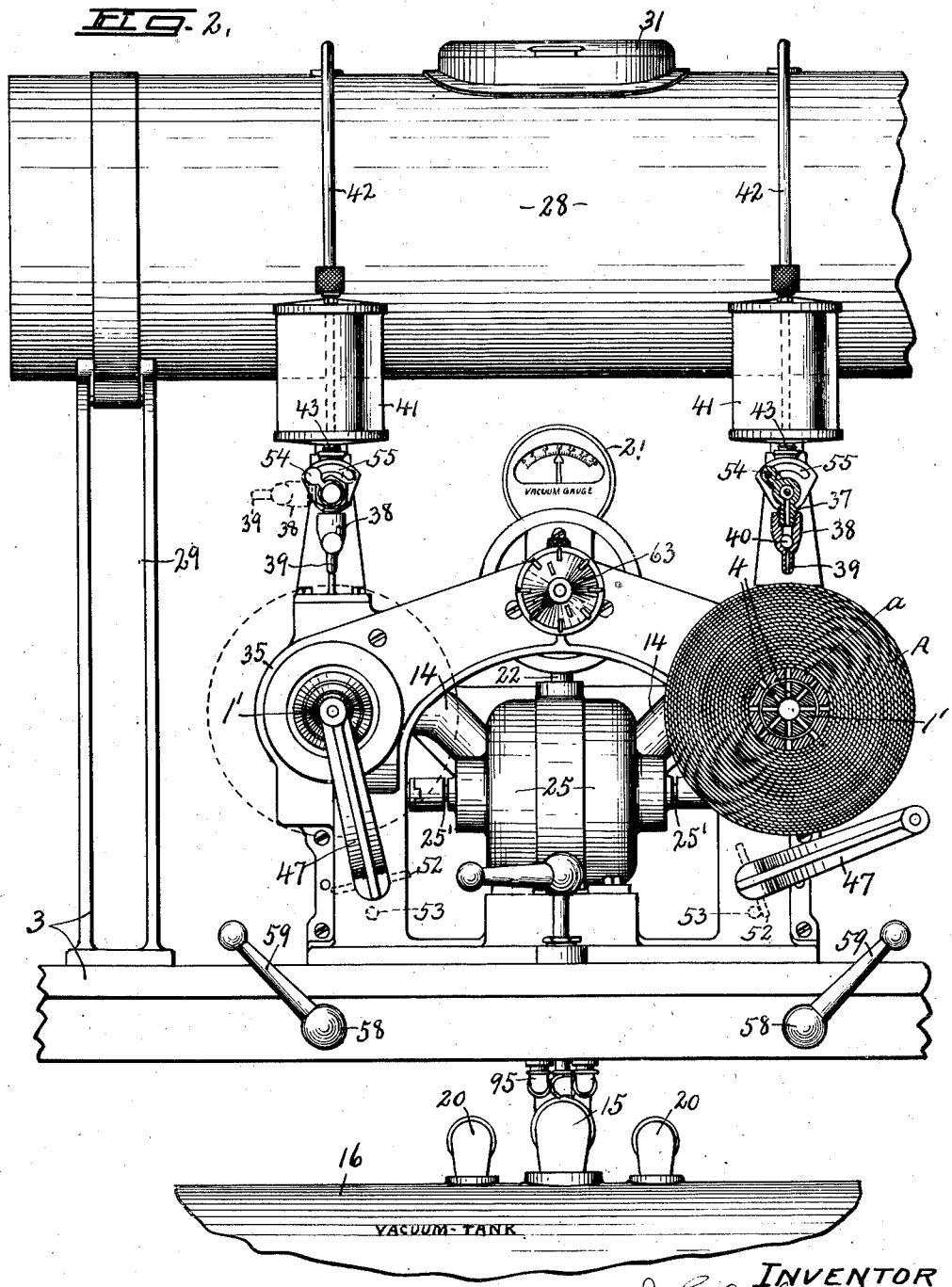
INVENTOR
J. S. Johnston
BY Dennison & Thompson
ATTORNEYS

Jan. 28, 1930. J. S. JOHNSTON 1,745,097

APPARATUS FOR COLORING PORTIONS OF YARN IN MASS

Filed Nov. 20, 1924 3 Sheets-Sheet 2

FIG. 2.



INVENTOR
J. S. Johnston
BY Dewson & Thompson
ATTORNEYS

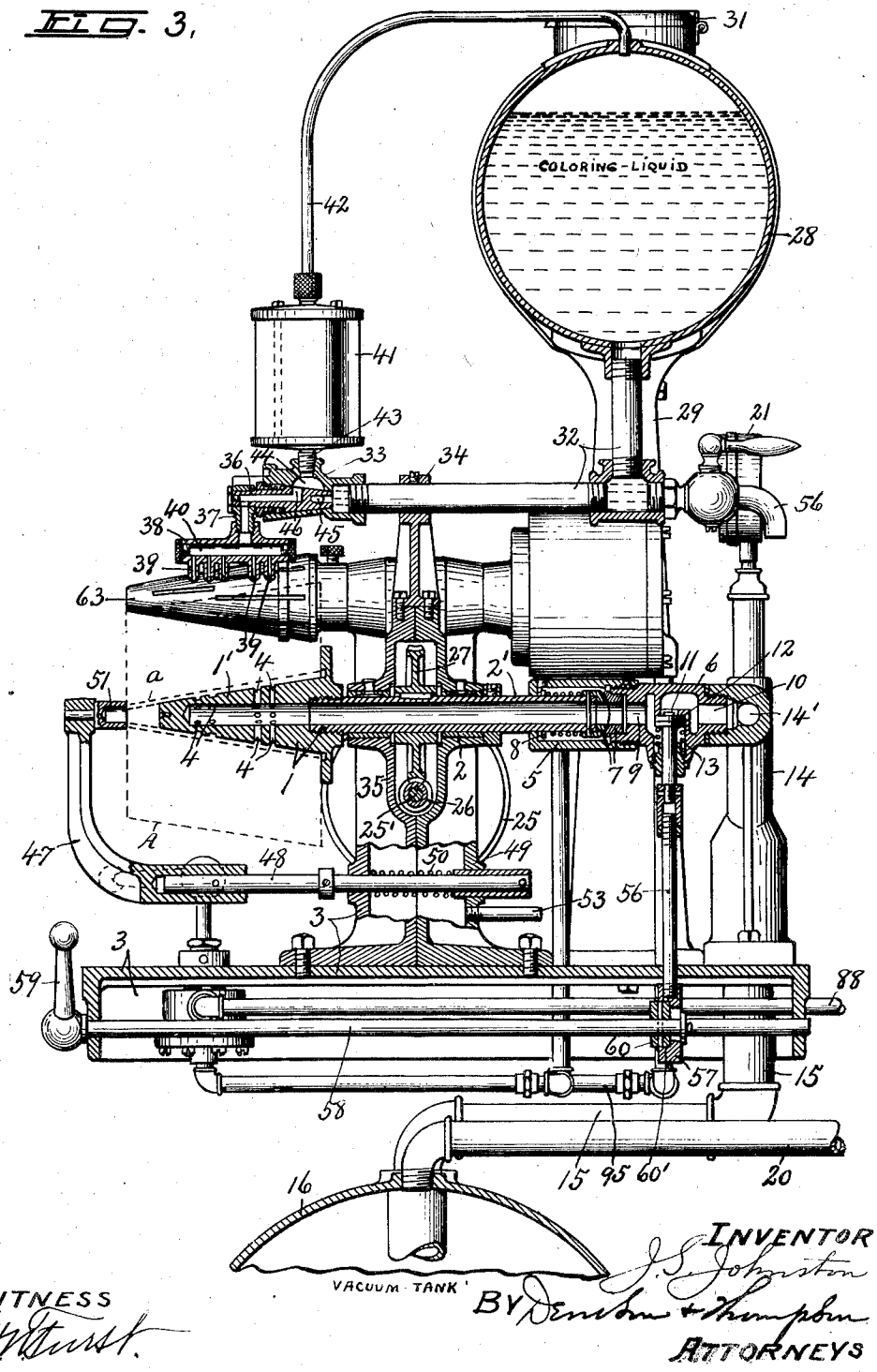
WITNESS
H. W. Hurst.

Jan. 28, 1930. J. S. JOHNSTON 1,745,097

APPARATUS FOR COLORING PORTIONS OF YARN IN MASS

Filed Nov. 20, 1924 3 Sheets-Sheet 3

FIG. 3.



WITNESS
H. W. Hurst.

INVENTOR
J. S. Johnston
BY Dewhurst & Thompson
ATTORNEYS

Patented Jan. 28, 1930 1,745,097

UNITED STATES PATENT OFFICE

JAMES S. JOHNSTON, OF UTICA, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO ECLIPSE TEXTILE DEVICES INCORPORATED, OF ELMIRA HEIGHTS, NEW YORK, A CORPORATION OF NEW YORK

APPARATUS FOR COLORING PORTIONS OF YARN IN MASS

Application filed November 20, 1924. Serial No. 751,070.

This invention relates to an apparatus for coloring portions of yarn in mass, as for example, when wound in bulk upon suitable supporting bobbins ready for use in knitting machines for making knit garments.

The bulk yarn, as usually wound upon bobbins, is found to be highly porous and air-pervious, as well as liquid-pervious, so that if a suction nozzle is applied to one part of the bulk and a liquid supply nozzle is applied to another part, the liquid will be drawn in a direct line from the liquid supply nozzle to the suction nozzle, and the main object of my present invention is to utilize this principle in coloring portions of the yarn in bulk leaving other portions uncolored so that when the yarn is unwound for knitting purposes it will produce the desired mottled or clouded effects in the fabric with a more perfect blend with the uncolored portions of the fabric than would be possible by the use of yarn which has been colored in spots, by reason of the fact that the latter produces colored streaks rather than color-blend.

In other words, I have sought to provide an apparatus in which portions of the bulk yarn on the bobbin may be easily and quickly colored by simply applying the coloring liquid in limited quantities to a portion of the surface of the wound yarn and simultaneously applying suction to another portion or inner surface of the same bobbin whereby the coloring is drawn in a direct line between the suction nozzle and the coloring nozzle.

Another object is to rotate one of the elements, such as the bobbin, relatively to the nozzles so that the coloring liquid will be caused to travel through different portions of the yarn during such rotation.

Other objects and uses relating to specific parts of the invention will be brought out in the following descriptions:—

In the drawings:—

Figure 1 is a top plan of an apparatus embodying the various features of this invention.

Figure 2 is an enlarged front elevation of the upper portion of the same apparatus.

Figure 3 is an enlarged transverse vertical sectional view taken on line 3—3 Figure 1.

The apparatus shown is designed for coloring portions of a bulk or mass of yarn —A— wound upon a hollow conical bobbin —*a*— of heavy paper or cardboard which, together with the body of yarn wound thereon, constitutes the standard form and size of cone to be used on knitting machines for making knitted fabrics, but it will be evident from the following description that the same machine may be used for coloring portions of any body of regularly wound yarn.

The mass of yarn as usually wound upon the bobbins is highly porous or pervious to air and liquid and the present invention makes use of this condition by applying a coloring liquid to one portion of the mass of yarn and simultaneously applying suction to another portion of the same mass in such manner as to draw the coloring liquid in a direct line between the point of application and the point of suction, whereby the interposed portions of the mass of yarn will be instantly and uniformly colored in transit from one point to the other so that when the yarn is knitted into fabric the colored portions thereof will be distributed more or less promiscuously but with a blending effect to produce the desired mottled or clouded appearance, as distinguished from the colored streaks incidental to the use of yarn which has been spotted at intervals by coloring matter throughout its length.

In practice, it is found to be more expeditious and efficient to apply the coloring liquid to the periphery of the mass of yarn on the bobbin and to apply the suction to the interior of the bobbin through perforations therein and then to rotate the bobbin, with the mass of yarn thereon, so as to draw the coloring matter through different portions of the mass of yarn by such rotation to produce uniform coloring of the portions of the yarn interposed between the points of application of the coloring matter and suction.

The bobbins upon which the yarn is wound are usually brought to the machine in an imperforate condition and, in order to increase the efficiency of the machine and to further expedite the coloring operations, suitable means is provided on the machine for perfo-

rating the bobbins to permit the more direct transit of the coloring matter from the point of application to the point of suction.

In carrying out these various objectives a pair of hollow mandrels —1— are rotatably mounted in suitable bearings —2— on a main supporting frame —3— to revolve about horizontal axes in parallel spaced relation with the apexes of the mandrels —1— facing in the same direction, or toward the front of the machine.

These mandrels are of substantially the same form and size to confrom as closely as possible to the conical taper and size of the interior of the bobbin —*a*— and thereby to permit the bobbin, with the mass of yarn wound thereon, to be easily and quickly placed upon either mandrel and to be held by friction thereon, to rotate therewith during the application of coloring matter to the periphery of the porous mass of yarn and at the same time to enable the bobbin with the colored yarn thereon to be easily and quickly removed by endwise withdrawal from the smaller end of the mandrel.

The object in employing two of these mandrels is to enable the operator to place an uncolored bobbin of yarn upon either mandrel while another bobbin of yarn on the other mandrel is receiving coloring matter, thereby permitting the machine to turn out more work than would be possible with the use of a single mandrel.

Each mandrel preferably consists of the tapered head —1′—, and a tubular shaft section —2′— screwed together end to end in coaxial relation, the tapered head —1′— being adapted to receive the bobbin and has its outer or smaller end closed, while its intermediate portion is hollow and is provided with radial apertures —4— to permit the passage of air therethrough and to the interior thereof which communicates with the lengthwise opening in the section —2′—.

The tubular shaft —2′— extends through and some distance beyond the bearing —2— and is adapted to revolve in a suitable gland —5— having screw connection with the adjacent end of a valve case —6—, the rear end of the tubular shaft —2′— and adjacent portion of the valve case —6— being provided with hollow end-thrust bearing members —7— spring-pressed together axially by a light coil spring —8— to form a substantially air-tight joint between the rotary shaft —2— and the non-rotating valve case —6—.

The valve case —6— is provided with an inlet —9— and an outlet —10—, connected by a port —11— which is controlled by a valve —12—, the latter being normally closed by a spring —13—.

The inlet —9— communicates directly with the interior of the hollow shaft —2′— and mandrel head —1′— to allow the air entering the apertures —4— to pass into the valve chamber.

The outlet ends of the valve casing —6— are screwed into the adjacent ends of branch pipes —14—, Figures 2 and 3, and communicate therewith through branch passages —14′—, said branch pipes —14— merging into a single pipe —15— which is connected to a vacuum tank —16—, Figures 2 and 3. A partial vacuum is maintained in the tank —16— by means of a pair of double acting vacuum pumps —17—, of any well known type, mounted in spaced relation upon a supporting frame —18— and each connected by pipes —19— and —20— to the vacuum tank —16— as shown in Figures 1 and 3 so that either pump may be operated independently of or simultaneously with the other.

A vacuum gauge —21— is connected by a pipe —22— to the pipe —15— to indicate the degree of vacuum maintained in the tank —16—.

Both of the vacuum pumps —17— are adapted to be operated by an electric motor —23— through the medium of any suitable gearing and clutches contained in housings —24— Figure 1, for permitting either pump to be operated independently or both simultaneously.

The mandrel shafts—2′—are adapted to be driven by a separate electric motor —25— through the medium of worms —26— on the opposite ends of the motor shaft —25′— and worm gears —27— on the mandrel shaft sections —2′—, Figure 3.

Feed for coloring liquid

A tank or reservoir —28— is supported in a substantially horizontal position upon suitable standards —29— of a main supporting frame —3— some distance above the horizontal plane of the mandrels —1— and is provided with a lid —31— normally closing an opening in the upper side for filling purposes, the object being to permit the coloring matter to flow by gravity to the yarn on the bottom in a manner presently described.

Similar devices are employed for feeding and controlling the flow of the coloring liquid from the tank to each bobbin, each of said devices comprising a down-flow pipe —32— leading from the bottom of the tank —28— and discharging directly into a valve case —33—, the horizontal portion of a pipe —32— being supported by a bracket —34— on the upper portion of the gear case as —35— containing the adjacent gears —26— and —27—.

The valve case —33— is supported directly over the axis of the corresponding mandrel —1— and contains a valve —36— journaled therein for lateral rocking or oscillatory movement.

The front end of each valve —36— is pro-

vided with a radial nipple —37— carrying a distributing head —38— which is provided with a series of discharge nozzles —39— communicating with a common chamber —40— in the distributing head —38—.

Each valve case —33— carries a superposed supplemental reservoir —41— having its upper end connected by a pipe —42— to the top of the reservoir —28—, the lower end of each reservoir —41— being connected by a nipple —43— to a valve chamber —44— in the case —33— directly over the adjacent portion of the valve —36—.

The portion of the valve —36— registering with the chamber —44— is provided with two ports —45— and —46— one of which as —45— is in direct communication with the adjacent end of the liquid passage in the discharge pipe —32— and extends radially through the outer wall of the valve so that when the valve is turned to one position, as shown in Figure 3, the port —45— will be closed, by the adjacent wall of the valve case thereby cutting off the supply of coloring liquid from the main reservoir —28— to the supplemental reservoir —41—, but when the valve is turned a quarter turn to register the port —45— with the chamber —44— communication will be established between the main reservoir —28— and the supplemental reservoir —41— for supplying the coloring fluid to said supplemental reservoir.

When the valve —36— is adjusted to the position shown in Figure 3 with the supply of coloring fluid to the supplemental reservoir cut off, the port —46— will be registered with the chamber —44— which communicates through a branch passage in the nipple with the chamber —40—, thus permitting the flow of the coloring fluid from the supplemental reservoir to the distributing head —38— and thence through the nozzles —39— to the surface of the mass of yarn wound upon the bobbin —*a*—.

The front end of each head —38— constitutes a handle by which said head and valve —36— may be rocked laterally through an arc of approximately 90 degrees to control the flow of the coloring liquid from the main reservoir —28— to the supplemental reservoir —41— and also to control the flow of said liquid from the supplemental reservoir to the mass of yarn on the bobbin and at the same time shifting the nozzles —39— from a discharging position in close proximity to the periphery of the bobbin of yarn to a cut-off position away from the yarn.

Any suitable means may be employed for perforating the conical bobbin —*a*— either before or after the yarn is wound thereon and in such manner that its perforations will register with the radial passages —4— in the mandrel head —1′— when the bobbin with the yarn wound thereon is placed upon said mandrel head to enable the coloring liquid applied to the periphery of the mass of yarn to be drawn by suction in a direct line toward the passages —4— by reason of the porosity or air and liquid pervious condition of said yarn.

When the perforated bobbin —*a*— with the mass of yarn wound thereon is placed by hand upon the tapered mandrel head —1′— it is temporarily held in this position by means of a follower —47— having one end provided with a rearwardly extending rod —48— guided in suitable bearings —49— in the frame —3— and spring pressed rearwardly by a coil spring —50—, Figure 3.

The other end of said follower is provided with a socketed cap —51— adapted to engage the small end of the conical bobbin —*a*— to effectively close the same in case it should be open and also to frictionally hold said bobbin upon the mandrel head —1′— to rotate therewith.

In addition to the axial movement of the followers —47— it is also journaled in the bearings —49— to permit it to be rocked laterally into and out of registration with the filled bobbin on the mandrel, thus permitting the bobbin with the yarn wound thereon to be placed in operative position or removed when the follower is shifted to one side thereof, the rear end of the follower shaft —48—, being provided with lateral offset pins —52— adapted to engage a stop —53— for limiting said lateral rocking movement.

The front end of the valve —36— is also provided with a stop pin or bolt —54— movable in a concentric slot —55— to engage the end walls of said slot for limiting the lateral rocking movement of the distributing head —38— and also the rocking movement of the valve about its axis.

A drainage faucet —56— is connected to the pipe —32— for removing the coloring liquid from the reservoirs —28— and —41— when desired as, for example, in changing the liquid from one color to another or to permit the cleansing of the liquid distributing system.

The head —38— and its nozzles —39— may for convenience of description be generally termed a "liquid discharge nozzle" for applying the coloring fluid to a portion of the mass of yarn on the bobbin, while the tapered head —1′— of the mandrel —1— may for the same reason be termed a "suction nozzle" for drawing the coloring fluid in a more or less direct path from the discharge nozzle through the highly porous mass of yarn toward the suction nozzle, under which conditions the rotation of the bobbin with the yarn thereon will obviously cause an even distribution of the coloring matter around the entire mass as different portions thereof are registered with a direct path between the two nozzles, it being understood that the

flow of the coloring matter is regulated to supply just such an amount as will be absorbed by the portions of the mass of yarn traveling between said nozzles.

It is found to be preferable to discharge the coloring fluid directly onto the periphery of the revolving mass of yarn in small jets and to revolve the mass a relatively small number of turns at moderate speed so as to assure a uniform distribution and saturation of the coloring matter to all of the portions of the yarn moving between the discharge nozzle and suction nozzle.

As previously explained, the suction in each nozzle —1'— is produced by the pumps —17— and controlled by the valve —12— which closes with the suction aided by the spring —13— and is provided with a pendent sectional stem —56— having its lower end provided with a yoke —57— surrounding an operating shaft —58— which extends forwardly to the front end of the machine and is provided at its front end with an operating handle —59—.

Secured to each of the operating shafts —58— is an eccentric collar —60— operating in a circular socket —60'— in the adjacent end face of the yoke —57— so that by turning the operating shaft —58— in one direction from its normal position will effect a corresponding turning movement of the eccentric collar —60— in the yoke —57— for opening the valve —12— against the action of its retracting spring —13— thereby placing the suction nozzle in direct communication with the vacuum tank —16— for drawing the coloring matter from the corresponding nozzle —38— through the mass of yarn on the mandrel.

It will be evident from the foregoing description that the supply of the coloring fluid to the mass of yarn on a bobbin is under the control of the operator by simply rocking the head —38— into and out of proximity to the surface of the yarn and that the suction is also under the control of the operator by the shifting movement of the operating handle —59— from one position to another and that the control of the coloring liquid and suction for each bobbin is independent of the control of the coloring matter and suction of the other bobbin.

For example, when the machine is in operation the members —47— are shifted by hand to one side of the axis of their respective mandrels sufficiently to permit a bobbin with the yarn wound thereon to be placed upon either of the mandrels —1'— after which the member —47— is returned to bring its part —51— into contact with the outer small end of the bobbin to hold the latter upon the mandrel. The adjacent head —38— is then rocked by hand into position to allow the coloring fluid to flow from the supplemental reservoir —41— to the yarn and at about the same time the operating member —59— is shifted to open the valve —12— for producing suction in the corresponding nozzle —1'— during which operations the mandrel carrying the bobbin with the yarn thereon is rotated to allow the coloring matter to be distributed to all portions of the yarn traveling between the two nozzles.

While the coloring matter is being applied to the yarn on the bobbin, another bobbin with the mass of yarn thereon is placed upon the other mandrel and held in place by its corresponding member —47— similar operations being repeated for permitting the flow of the coloring matter to that bobbin and causing the same to be drawn through the yarn by suction and as soon as each bobbin is placed in operative position for receiving the coloring matter, the one on the other mandrel is removed and replaced by an uncolored bobbin, these operations being repeated in rapid succession as long as required.

The paper cores or bobbins upon which the yarn is wound must, of course, be perforated before being placed upon the mandrels and in such manner that the perforations will register with the passages —4— in the suction nozzles in order to effect a more rapid transit of the coloring matter through the yarn by suction and inasmuch as these bobbin-cores are usually imperforate when delivered to the user, it becomes necessary to perforate them with the yarn wound thereon.

It has been found convenient to perforate the core on the same frame as that carrying the coloring apparatus. A device 63, for this purpose is shown in the drawing between the nozzles 39, but this perforating device is the invention of Charles E. Skelton, patented June 8, 1926, No. 1,588,200 and is, therefore, not claimed herein.

The perforated bobbin with a mass of yarn thereon is then placed upon one of the mandrels —1'— and the follower —47— is then adjusted to frictionally hold the bobbin on the mandrel to rotate therewith, after which the head —38— and valve —36— are adjusted to bring the nozzles —39— into close proximity to the periphery of the wound yarn and allow the coloring fluid to flow through the nozzles onto the yarn bobbin while the latter is rotating.

At about the same time that the head —38— is adjusted in the manner just described, the valve —12— is opened by the proper adjustment of its operating member —59— to connect the suction nozzle —1'— with the vacuum chamber —16— whereby the suction produced in the nozzle —1'— draws the coloring fluid through the mass of yarn, while the latter is rotating.

During the application of the coloring fluid to the yarn on the suction nozzle just described, another imperforate bobbin with the

yarn wound thereon is subjected to the same perforating operation as previously described, is then withdrawn and placed upon the other suction nozzle —1'—, at which time the corresponding valve —36— is opened and the last named suction nozzle is connected to the vacuum chamber —16— by the proper adjustment of its valve —12— to cause the coloring fluid to be drawn into the yarn on the second named bobbin in a manner similar to that previously described.

While the yarn on the second named bobbin is being colored the controlling valve for the coloring matter and suction valve for the first named bobbin are closed and the colored bobbin is then removed and replaced by another perforated yarn bobbin, these operations being repeated alternately from one bobbin to the other as each core has been perforated.

What I claim is:—

1. In a yarn-coloring device, a suction nozzle engaging one surface of a mass of yarn and a color supply nozzle directed toward a limited area of the opposite surface of the mass.

2. In a yarn-coloring device, a suction nozzle, a color supply nozzle and means for moving a mass of yarn between said nozzles.

3. In an apparatus for partially coloring yarn in mass, a color-applying element discharging against a portion of the mass, a suction element applied to another portion of the mass, and means for moving one of said elements relatively to the other element to form a continuous band of coloring matter in said mass.

4. In an apparatus for partially coloring yarn in mass, a perforated tube around which the mass of yarn is wound, a liquid-color supply nozzle discharging against the outer layer of yarn, and a suction device connected to said tube for drawing the coloring liquid through the yarn toward said perforation, and means for rotating the tube with the mass of yarn thereon to cause the coloring matter to travel through different portions of the mass of yarn.

5. Apparatus for spot-dyeing yarn in the mass, comprising an air-pervious supporting member engaging the inner surface of the yarn mass, means for applying suction to said supporting member, and a color-supply nozzle discharging against a limited area of the outer surface of the mass.

6. In an apparatus for partially coloring yarn in mass, a rotary hollow mandrel having perforated side-walls, means for supporting a mass of yarn on said mandrel to rotate therewith, means for applying a coloring liquid to a restricted area of the outer surface of the mass, and a suction device connected to said mandrel to draw the coloring matter toward the perforations.

7. In a yarn-coloring device, a color supply nozzle, means for rotating a mass of yarn across the discharge end of said nozzle and means for causing the coloring matter to pass from said nozzle through a restricted zone of said mass from one surface to an opposite surface thereof while the mass is rotating.

8. In a device for spot coloring a wound mass of yarn, means for rotating the mass, and means for causing a coloring matter to pass through a restricted section of said mass from one surface to an opposite surface thereof while it is rotated.

9. In a yarn-coloring device, a hollow conical suction-nozzle having radial apertures, a hollow perforated conical core slidable endwise upon and from the suction nozzle and upon which a mass of yarn is wound, a follower spring pressed against the small end of the core to hold it on the suction nozzle, means for applying coloring matter to a portion of the periphery of the yarn on the core while on the suction nozzle, and means for producing suction in said suction nozzle.

10. In an apparatus for partially coloring yarn in mass, a perforated tube around which the mass of yarn is wound, a liquid color supply nozzle discharging against the outer layer of yarn, an apertured mandrel supporting said tube, and a suction device connected to said tube for drawing the coloring liquid through the yarn toward said tube, means for rotating the mandrel with the tube and mass of yarn thereon, and a follower bearing on said tube during rotation.

11. In an apparatus for coloring yarn on the bobbin, means for applying the coloring matter to the yarn including a nozzle movable to and from the yarn, and a valve opened by the movement of the nozzle to the yarn and closed by the movement of the nozzle from the yarn.

12. In an apparatus for coloring yarn, means for applying coloring matter to the yarn including an oscillatory nozzle mounted so as to be movable toward and away from the yarn, a valve journalled to oscillate and fixed to said nozzle, said valve being opened by the movement of the nozzle toward the yarn and closed by the movement of the nozzle away from the yarn.

13. In an apparatus for coloring yarn, means for applying the coloring matter to the yarn including a nozzle movable to and from the yarn, and a valve structure having a movable member carrying said nozzle and thrown to open the valve by the movement of the nozzle toward the yarn and to close the valve by the movement of the nozzle away from the yarn.

14. In an apparatus for coloring yarn, a reservoir for coloring liquid, an auxiliary reservoir connected to said reservoir, a nozzle movable toward and away from the yarn, and valve means operated by the movement of the nozzle toward the yarn to connect the auxil-

iary reservoir with the nozzle and to cut off said first reservoir from the auxiliary reservoir and operated by the movement of the nozzle away from the yarn to cut off the nozzle from the auxiliary reservoir and to connect the auxiliary reservoir with said first reservoir.

In witness whereof I have hereunto set my hand this 5th day of November 1924.

JAMES S. JOHNSTON.