May 4, 1965 A. L. SANNIPOLI ETAL 3,181,233

MANUFACTURE OF PAINT ROLLERS

Original Filed Oct. 20, 1955 3 Sheets-Sheet 1

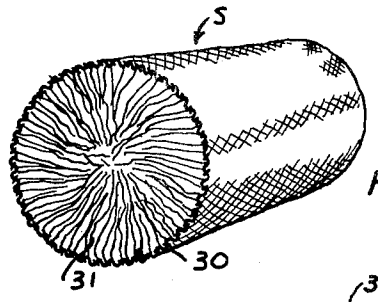


FIG. 1

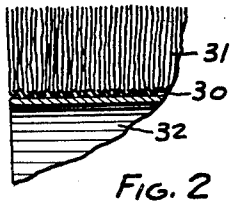


FIG. 2

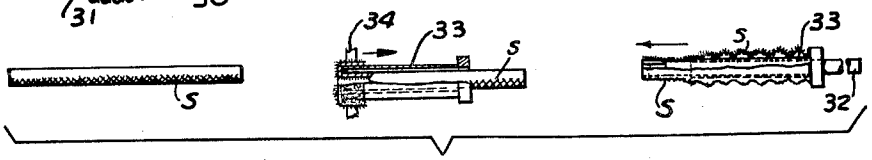


FIG. 3

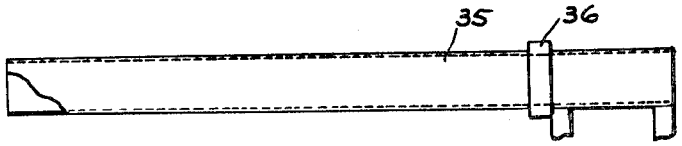


FIG. 4

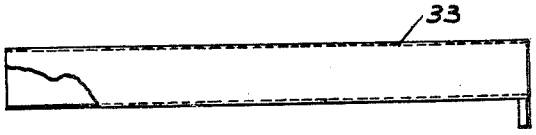


FIG. 5

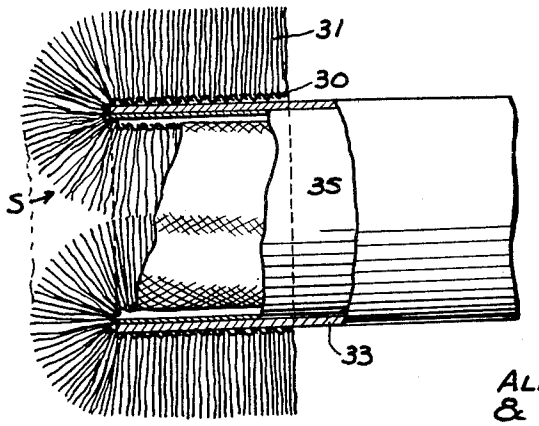


FIG. 6

INVENTORS
ALFRED L. SANNIPOLI
& EARL E THOMAS

BY Barnes, Kisselle, Raisch & Choate
ATTORNEYS.

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MANUFACTURE OF PAINT ROLLERS

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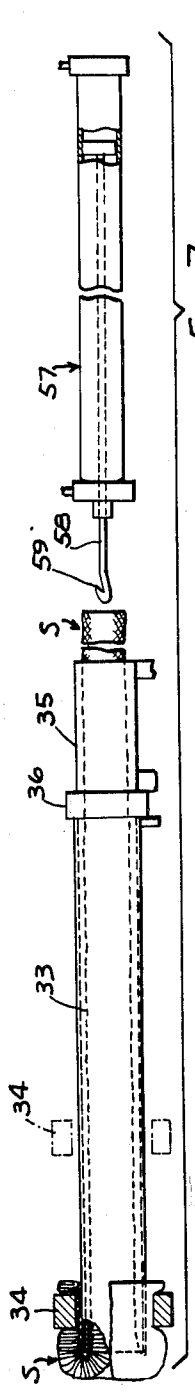


FIG. 7

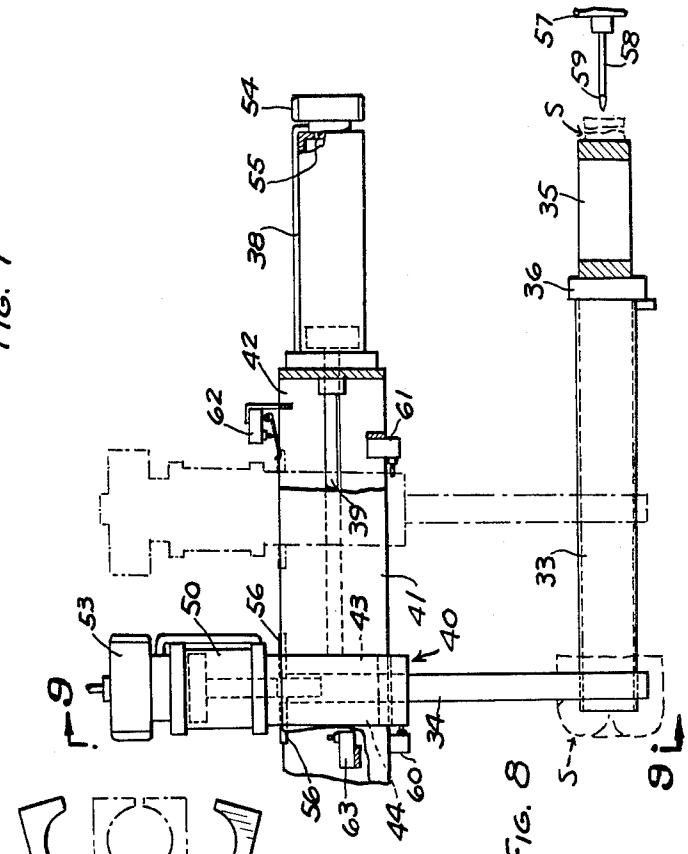


FIG. 8

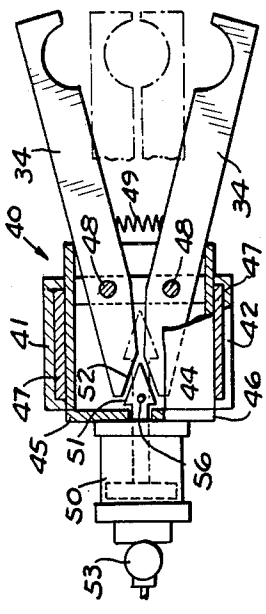


FIG. 9

INVENTORS
ALFRED L. SANNIPOLI
& EARL E. THOMAS
BY Barnes, Kisselle, Raisch & Choate
ATTORNEYS.

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MANUFACTURE OF PAINT ROLLERS

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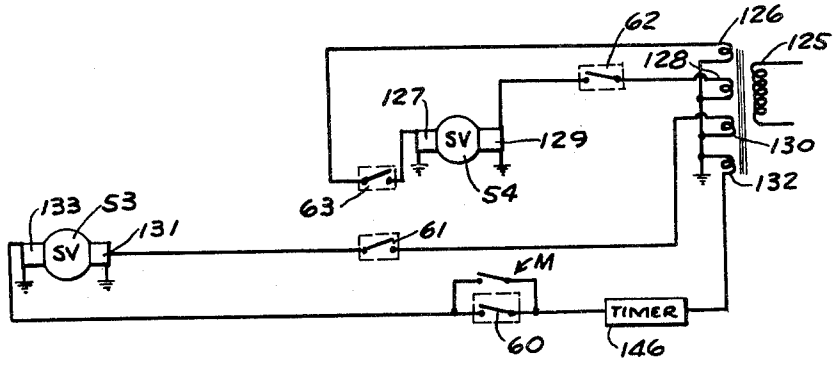


FIG. 10

INVENTORS
ALFRED L. SANNIPOLI
& EARL E. THOMAS
BY Barnes, Kisselle, Raisch & Choate
ATTORNEYS.

United States Patent Office 3,181,233 Patented May 4, 1965

3,181,233

MANUFACTURE OF PAINT ROLLERS

Alfred L. Sannipoli, Escondido, Calif., and Earl E. Thomas, Johnson City, Tenn., assignors to Seamless Covers, Inc., Johnson City, Tenn., a corporation of Tennessee

Application June 30, 1958, Ser. No. 745,632, now Patent No. 3,010,867, dated Nov. 28, 1961, which is a division of application Ser. No. 541,702, Oct. 20, 1955, now Patent No. 2,944,588, dated July 12, 1960. Divided and this application June 6, 1961, Ser. No. 115,255

10 Claims. (Cl. 29—235)

This invention relates to the manufacture of paint rollers and particularly to an apparatus for inverting and mounting the sleeves of knitted pile fabric onto hollow cores to form the paint rollers.

A common method used in the manufacture of paint rollers is to helically wind a strip of knitted pile fabric onto a hollow core which has been previously coated with adhesive. Such a procedure is not only costly and time-consuming but, in addition, may result in a non-uniform coverage of the core inasmuch as spaces may occur between the windings of the strip of knitted pile fabric. In addition, paint rollers made in this manner may cause uneven application of paint. It has been more recently suggested that a seamless tubular sleeve be used which has substantially the same diameter as the core. Such a roller is shown, for example, in the patent to Schmidt 2,704,877, dated March 29, 1955, titled "Process and Machine for Treating and Shearing Fabric Sleeves Having a Nap." The seamless knitted tubular sleeves may be made on machines such as that shown in the patent to Moore 1,849,466, issued March 15, 1932. The pile is formed by knitting fibers into the stitches of the base fabric as the fabric is being knitted. Sleeves knitted on such machines are formed with the nap or pile on the interior of the sleeve. The sleeves must therefore be inverted and mounted onto cores to provide paint rollers. In the handling of such sleeves numerous problems are presented because of the tendency of the knitted sleeves to grip the core when it is attempted to slide the sleeve over the core.

The base fabric of the pile sleeve is relatively elastic, and in the size under consideration, the fibers of the pile are quite long and intermingled so that substantially the entire interior of the sleeve prior to inverting is filled with pile fibers. Accordingly, it is difficult, if not impossible, to insert any tools or devices into the sleeve to facilitate inverting the sleeve without damaging the sleeve. After the sleeve is inverted, it must be mounted on a core and, unless the fibers are sealed to the base fabric, they may be easily pulled out of the base fabric. The sleeve under consideration may be approximately two inches in diameter and of any length, for example, forty-eight inches.

It is therefore an object of this invention to provide an apparatus for inverting the knitted sleeves.

It is a further object of the invention to provide apparatus which is semi-automatic in operation and requires a minimum of supervision by an operator.

Basically, the apparatus comprises an inverting machine comprising a hollow mandrel onto which a transfer tube is mounted and through which the knitted sleeve is initially passed. The means for successively pulling the sleeve onto the transfer tube comprises a pair of jaws which are reciprocated to alternately grip successive portions of the sleeve and move them along the tube. The passing of the sleeve through the hollow mandrel and the gripping and reciprocating movement of the jaws are controlled by automatic means.

In the drawings:

FIG. 1 is a perspective view of the knitted sleeve prior to inverting.

FIG. 2 is a fragmentary sectional view of the sleeve as mounted on a core.

FIG. 3 is a diagrammatic view showing the inverting of the sleeve and transferring of the sleeve onto the core.

FIG. 4 is a part sectional elevational view of the mandrel which is used in inverting the sleeve.

FIG. 5 is a part sectional elevational view of the tube which is used in inverting the sleeve.

FIG. 6 is a fragmentary part sectional view of the apparatus for inverting the sleeve, showing the position of the sleeve at the beginning of the inverting operation.

FIG. 7 is a part sectional elevational view of the apparatus for inverting the sleeve.

FIG. 8 is a part sectional plan view of the apparatus shown in FIG. 7.

FIG. 9 is a sectional view taken along the lines 9—9 in FIG. 8.

FIG. 10 is a diagrammatic wiring diagram of the circuit for controlling the operation of the apparatus for inverting the sleeve.

Referring to FIG. 1, the sleeve S has been knitted on a knitting machine as heretofore set forth and comprises a base fabric 30 and a pile 31. The base fabric 30 and the pile 31 may be made of natural or synthetic fibers such as wool, cotton, mohair, rayon, nylon, and the like, or mixtures thereof. As knitted, the pile fabric extends inwardly from the base fabric of the sleeve and is of such a length that it substantially fills the interior of the sleeve. The pile fibers are intermingled and invariably some of the fibers are unconnected to the base fabric. The entire sleeve is relatively limp and flexible and the base fabric has a substantial elasticity longitudinally and transversely. The pile fibers are mechanically held in the base fabric by the stitches of the knitted base fabric and may be pulled out of the base fabric unless they are locked into the stitches by a subsequent operation as presently described.

As shown in FIG. 2, after the sleeve S has been inverted, it is mounted on a paint roller core 32 of rigid or semi-flexible material such as plastic, paper, metal or cloth. A layer of adhesive is provided between the base fabric 30 and the core 32. The pile fabric may then be combed and sheared providing a uniform pile, which makes the roller satisfactory for use in the application of paint.

The basic operations required for inverting and transferring the sleeve are shown diagrammatically in FIG. 3. As shown in FIG. 3, the sleeve S is positioned within a hollow transfer tube 33 which is mounted so that the interior surface thereof is unobstructed to receive the sleeve S. The end of the sleeve S is turned over the end of the transfer tube 33 onto the outer surface thereof and the turned-over end of the sleeve is then pulled to thus invert the sleeve from the interior of the transfer tube 33 onto the outer surface of the transfer tube 33. In order to invert the sleeve, a pair of reciprocable jaws 34 are caused to grip and slide successive portions of the sleeve from the interior onto the outer surface of the transfer tube 33 in the direction of the arrow. The transfer tube 33, with the inverted sleeve thereon, is then positioned in the path of the core 32 and the core 32 caused to move relative to the tube 33 and through the tube 33. As the core 32 passes through the tube 33, a portion of the inverted sleeve S is pulled off the tube 33 onto the core 32, and thereafter the core 32 and the sleeve S are caused to move relative to the tube 33 to transfer the sleeve S from the tube 33 to the core 32. The core 32 is preferably coated with an adhesive on the outer surface thereof prior to its passage through the tube 33.

The knitted sleeve S, when in an untensioned condition, has a diameter less than the outer diameter of the tube 33 or the core 32 on which it is to be mounted. The tube 33 has an outer diameter greater than the outer diameter of the core 32. Thus, the sleeve S is tensioned or ex-

panded when it is inverted onto the tube 33, and thereafter caused to contract when it is pulled from the tube 33 onto the core 32.

Because of the inherent tendency of a knitted sleeve to grip a member positioned within the sleeve, it is preferable to gather the sleeve S onto the tube 33 as it is inverted so that the gathered length thereof is substantially less than the original length. For example, the sleeve S may be approximately forty-eight inches in length prior to inverting and may be inverted and gathered into a tube 33 of approximately eighteen inches in length. The inverted sleeve of this dimension in the gathered condition can then be slid onto a core of about forty-eight inches in length with much less difficulty than would be the case if the sleeve were not in a gathered condition.

As shown in FIGS. 4 and 5, the transfer tube 33 onto which the sleeve S is inverted is designed so that it can be removably mounted on the inverting apparatus and also on the transferring apparatus in such a manner that it is rigid and, in addition, the interior thereof is generally unobstructed. In order to accomplish this, a hollow mandrel 35 is provided which has approximately the same outer diameter as the inner diameter of the tube 33. The tube 33 is slipped over the mandrel 35 and held in position by a stop 36. The interrelationship of the sleeve S, tube 33 and hollow mandrel 35 during the inverting is shown in FIG. 6. The sleeve S fits loosely within the hollow mandrel 35 and the end thereof has been turned over and onto the tube 33. The pile 31 of the sleeve S fills substantially the entire interior of the sleeve.

As shown in FIG. 7, means is provided for positioning the sleeve within the hollow mandrel. This includes a pneumatic cylinder motor 57 positioned at one end of the hollow mandrel 35 with the piston rod 58 thereof extending coaxially of the mandrel 35. The end of the piston rod 58 is provided with a hook 59, whereby when the cylinder is actuated, the rod 58 moves through the mandrel 35 bringing the hook into position adjacent the opposite end of the mandrel. The end of the sleeve S is then attached to the rod by means of the hook 59, and when the cylinder is actuated to retract the rod, the sleeve is pulled through the mandrel 35 into proper position within the mandrel for inverting. The end of the sleeve S is then manually turned or pulled over the edge of the tube 33 onto the outer surface of the tube 33 (FIG. 6). In order to invert the sleeve onto the tube 33 and simultaneously gather the sleeve to provide a shorter effective length, there is provided in conjunction with the mandrel 35 a pair of jaws 34 which are mounted for reciprocating movement in a path parallel to the axis of the mandrel 35.

As shown in FIG. 9, the jaws are mounted at one end within a housing 40 which slides within upper and lower channels 41 and 42, respectively. Channels 41, 42 extend along one side of mandrel 35 in parallel spaced relation thereto. The housing 40 includes side plates 43, 44 which form the side walls thereof and upper and lower plates 45, 46 which form the top and bottom walls thereof. In addition, bearing blocks 47 are mounted on the plates 45 and 46 and are adapted to ride on the channels 41, 42 to guide the housing 40 in its movement along the channels. The jaws 34 are pivotally mounted in the side walls 43, 44 by pins 48. A spring 49 extends between the jaws and tends to maintain them in separated position. The opening and closing of the jaws is controlled by a fluid or pneumatic cylinder motor 50 positioned on the one end of the housing and having a piston rod with a bevelled end 51 thereon which when actuated engages bevelled ends 52 of the jaws 34 with a camming action and causes the jaws to close into gripping relationship around the tube 33 as shown in dotted lines in FIG. 9.

The operation of the motor 50 is controlled by a solenoid actuated valve 53 which is of the well-known type including two solenoids. The construction of the valve is such that a momentary electrical impulse will cause the valve to be actuated. Momentary energization of one solenoid will move the piston rod in one direction and momentary energization of the other solenoid will move the piston rod in the opposite direction. The movement of the housing 40 in guide channels 41, 42 along a path parallel to the axis of the mandrel 35 is provided by a fluid or pneumatic cylinder motor 38 mounted at one end of the channels 41, 42 and having the piston rod 39 thereof connected to the housing 40. The operation of the pneumatic cylinder motor 38 is controlled by a valve 54 similar to the valve 53. Air is supplied to the ends of the cylinders through suitable openings, for example, as shown at 55 in FIG. 8.

After the sleeve S has been placed in position within the hollow mandrel 35 and the end thereof has been turned over onto the transfer tube 33, the inverting mechanism is actuated causing the jaws 34 to grip the sleeve, as shown in FIG. 8, and the jaws are moved to the dotted line position shown in FIG. 8. By this movement, a portion of the sleeve S is inverted onto the transfer tube 33. The grip of the jaws 34 is then released, and the jaws are returned to the initial position wherein they are again caused to close and grip the sleeve and thereafter move to the dotted line position causing more of the sleeve to be inverted onto the tube 33. The successive opening and closing of the jaws and movement thereof axially of mandrel 35 is continued until the entire length of the sleeve has been inverted onto the tube 33. Each time the sleeve is gripped and moved by the jaws, an additional portion of the sleeve is pulled over onto the tube 33 and the portions of the sleeve previously inverted are pushed along the length of the tube causing them to gather.

As previously set forth, the length of the tube 33 is preferably less than the length of the sleeve S prior to inverting whereby the sleeve is gathered, as shown in FIG. 3, onto the tube 33. For example, the initial length of the sleeve S may be forty-eight inches while the length of the tube 33 is eighteen inches. The inverting operation could be accomplished, for example, in six successive eight-inch movements of the jaws.

In the apparatus shown, the entire movement of the jaws is automatic and is controlled by microswitches 60, 63 positioned at one end of the path of movement of jaws 34 and microswitches 61, 62 positioned at the other end of the path of movement of the jaws. At the beginning of the inverting cycle, a main switch (not shown) is closed which actuates the valve 53 causing the motor 50 to close the jaws 34 around the sleeve. The closing of the jaws causes a rod 56, mounted at the bevelled end 51 of the piston rod of motor 50, to contact the switch 63. This switch actuates valve 54 causing the motor 38 to move the jaw housing 40 along the length of the channels 41, 42. As the piston rod 39 which moves the housing 40 nears the end of its stroke, the housing 40 contacts switch 61 which actuates valve 53 to cause the jaws to open by actuating the motor 50. The opening of the jaws causes the rod 56 to contact switch 62 which actuates the valve 54 to cause the motor 38 to return the jaw housing 40 to its original position. As the jaw housing 40 returns to its original position, the housing contacts switch 60 which actuates valve 53 to again close the jaws. The cycle is then repeated by the operation of the switches until terminated by a timer which, in the case of the forty-eight inch length sleeve, stops the operation of the jaws after six successive movements.

The pneumatic motor which is used in the sleeve inverting apparatus is of the double-acting type.

A diagrammatic wiring diagram for the apparatus for inverting the sleeve is shown in FIG. 10. The circuit comprises a primary 125 and a multicity of secondary coils. The solenoid operated valve 54 for controlling the motor 38 which controls the movement of the jaws in a path parallel to the tube 33 has one of the solenoid coils 127 thereof connected in a circuit including secondary 126 and switch 63. The other solenoid 129 of the valve 54 is connected in a circuit including secondary 128 and

switch 62. The solenoid operated valve 53 which controls the opening and closing of the jaws has one solenoid coil 131 thereof connected in a circuit with secondary 130 and switch 61. The other solenoid 133 of the valve 53 is connected in a circuit including secondary 132, timer 146 and switch 60.

A main switch M is provided in parallel with switch 60. After the cylinder 57 (FIG. 7) has been operated to position a knitted tubular sleeve within the hollow mandrel 35 and the tube 33, and the end of the tubular sleeve has been turned over manually onto the tube 33, the switch M is temporarily depressed causing the solenoid 133 to be momentarily energized actuating the valve 53 to cause the motor 50 to close the jaws.

Closing of the jaws momentarily closes switch 63 which momentarily energizes solenoid 127 of valve 54 causing the motor 38 to move the jaws in a path parallel to the longitudinal axis of the tube 33. As the jaws reach the end of their movement, the switch 61 is closed momentarily energizing solenoid 131 to actuate the valve 53 causing motor 50 to open the jaws. The opening of the jaws momentarily closes switch 62, energizing solenoid 129 and actuating the valve 54 to cause the motor 38 to return to its original position. As the jaws return to their original position, the switch 60 is closed again causing the jaws to be closed and the cycle is repeated.

The timer 146 provided in the circuit of the switch 60 may be adjusted to permit a limited number of energizations of the circuit which includes the switch 60 as required by the length of the sleeve. For example, in the case of a forty-eight inch sleeve where the jaws move eight inches, the inverting would be accomplished by six reciprocations of the jaws; and after the circuit containing the switch 60 has been energized six times, the timer will prevent the circuit from being reenergized until the switch M has been again depressed when a new sleeve is in position for inverting.

The operation of the various mechanisms may be summarized as follows: A tube 33 is first mounted on tubular mandrel 35 and a sleeve S is positioned within the tubular mandrel 35 by the operation of the motor 57. The end of the sleeve S is thereafter turned over onto the tube 33 and the jaws 34 are caused to grip and move the sleeve along the length of the tube 33 in successive gripping and reciprocating movements to pull and invert the sleeve S onto the tube 33. The tube 33 with the sleeve inverted thereon is then in condition for transfer to a core 32 by an apparatus more fully shown and described in our copending application Serial No. 745,632, filed June 30, 1958, now Patent No. 3,010,867.

It can thus be seen that we have provided an apparatus for inverting. The apparatus is particularly suited to the handling of a tubular knitted sleeve which is knitted with the fibers of the pile formed on the interior of the sleeve and wherein the sleeve is relatively elastic and the fibers of the pile are quite long and intermingled so that substantially the entire interior of the sleeve prior to inverting is filled with fibers. The apparatus is also particularly suited to a tubular knitted sleeve wherein the pile fibers are not held within the base fabric in any other manner than by the knitting.

This application is a division of our co-pending application Serial No. 745,632, filed June 30, 1958, now Patent No. 3,010,867 entitled "Manufacture of Paint Rollers and the Like" which, in turn, is a division of our application Serial No. 541,702, filed October 20, 1955, entitled "Manufacture of Paint Rollers and the Like" now Patent 2,944,588.

We claim:

1. An apparatus for use in the manufacture of paint rollers from a knitted pile fabric sleeve wherein the sleeve initially has the pile on the inner surface thereof, comprising a tubular member having an outer diameter greater than the inner diameter of the tubular sleeve when in an untensioned condition, means for supporting said tubular member in position for receiving a knitted tubular sleeve therein and constructed and arranged to permit the end of said tubular sleeve to be turned over the end of said tubular member, means for gripping exteriorly of said tubular member the end of said tubular sleeve which has been turned over onto said tubular member, means for actuating said sleeve gripping means, and means for moving said sleeve gripping means in a path parallel to the longitudinal axis of said tubular member whereby said sleeve is moved along the length of said tubular member thereby inverting the full length of said sleeve onto said tubular member.

2. The apparatus set forth claim 1 wherein said means for supporting said tubular member comprises a hollow mandrel.

3. An apparatus for use in the manufacture of paint rollers from a knitted pile fabric sleeve wherein the sleeve initially has the pile on the inner surface thereof, comprising a tubular member having an outer diameter greater than the inner diameter of the tubular sleeve when in an untensioned condition, means for supporting said tubular member in position for receiving a knitted tubular sleeve therein and constructed and arranged to permit the end of said tubular sleeve to be turned over the end of said tubular member, a pair of jaws for gripping the end of said tubular sleeve which has been turned over onto said tubular member, means for opening and closing said jaws, and means for moving said jaws in a path parallel to the longitudinal axis of said tubular member whereby said sleeve is moved along the length of said tubular member thereby inverting the full length of said sleeve onto said tubular member.

4. The apparatus set forth in claim 3 wherein said means for moving said jaws comprises a motor and means connecting said motor and said jaws for reciprocating said jaws in a path parallel to the longitudinal axis of said tubular member.

5. The apparatus set forth in claim 4 including means controlled by the opening and closing of said jaws for actuating said motor for reciprocating said jaws.

6. The apparatus set forth in claim 4 including means controlled by the reciprocating movement of said jaws for opening and closing said jaws.

7. The apparatus set forth in claim 4 wherein said means for opening and closing said jaws comprises a fluid motor operatively connected with said jaws, a solenoid operated valve for controlling the operation of said fluid motor, said means for moving said jaws comprising a second fluid motor, a second solenoid operated valve for controlling said second fluid motor, means actuated by the movement of said jaws in a path parallel to the longitudinal axis for actuating said first mentioned solenoid operated valve which controls the operation of said first mentioned fluid motor for opening and closing said jaws, and means actuated by the opening and closing of said jaws for actuating said second mentioned solenoid operated valve for controlling said second mentioned fluid motor which moves said jaws in a path parallel to the longitudinal axis of said tubular member.

8. The apparatus set forth in claim 7 wherein said means actuated by the movement of said jaws comprises a pair of switches positioned one at each end of the path of reciprocating movement of said jaws.

9. The apparatus set forth in claim 7 wherein said means actuated by the opening and closing of said jaws comprises a switch adapted to be actuated in response to opening of said jaws and a second switch adapted to be actuated in response to closing of said jaws.

10. An apparatus for manufacturing paint rollers from a knitted pile fabric sleeve wherein the sleeve initially has the pile on the inner surface thereof, comprising a tubular member having an outer diameter greater than

the inner diameter of the tubular sleeve when in an untensioned condition, means for supporting said tubular member in position for receiving a knitted tubular sleeve therein and constructed and arranged to permit the end of said tubular sleeve to be turned over the end of said tubular member, a pair of jaws each pivotally mounted about an axis extending parallel to said tubular member, means for opening and closing said jaws, means for moving said jaws in a path parallel to the longitudinal axis of said tubular member, and said jaws being adapted to grip the end of said tubular sleeve which has been turned over onto said tubular member and move said sleeve along the length of said tubular member thereby inverting the full length of said sleeve onto said tubular member.

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WILLIAM FELDMAN, *Primary Examiner.*

ALEXANDER WYMAN, WHITMORE A. WILTZ, *Examiners.*