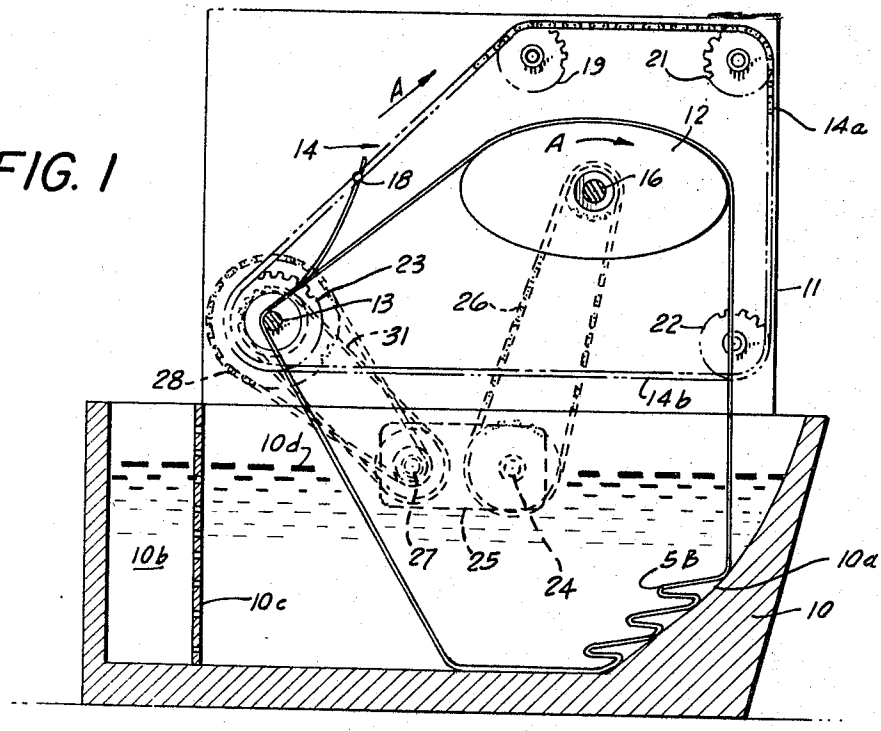
March 14, 1967 G. E. ZIEGLER ETAL 3,308,639

APPARATUS FOR THE FLUID TREATMENT OF FABRICS IN ROPE FORM

Filed Oct. 20, 1964 2 Sheets-Sheet 1

FIG. 1



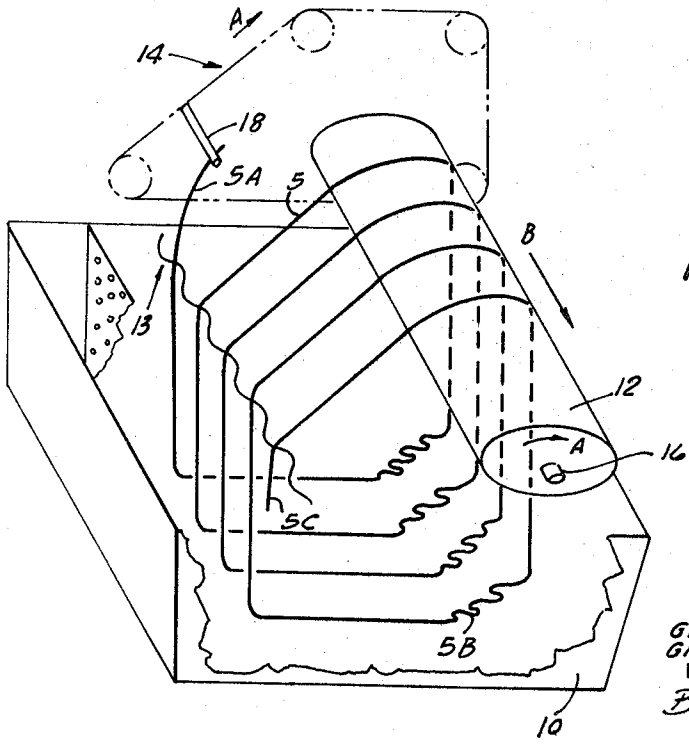


FIG. 3

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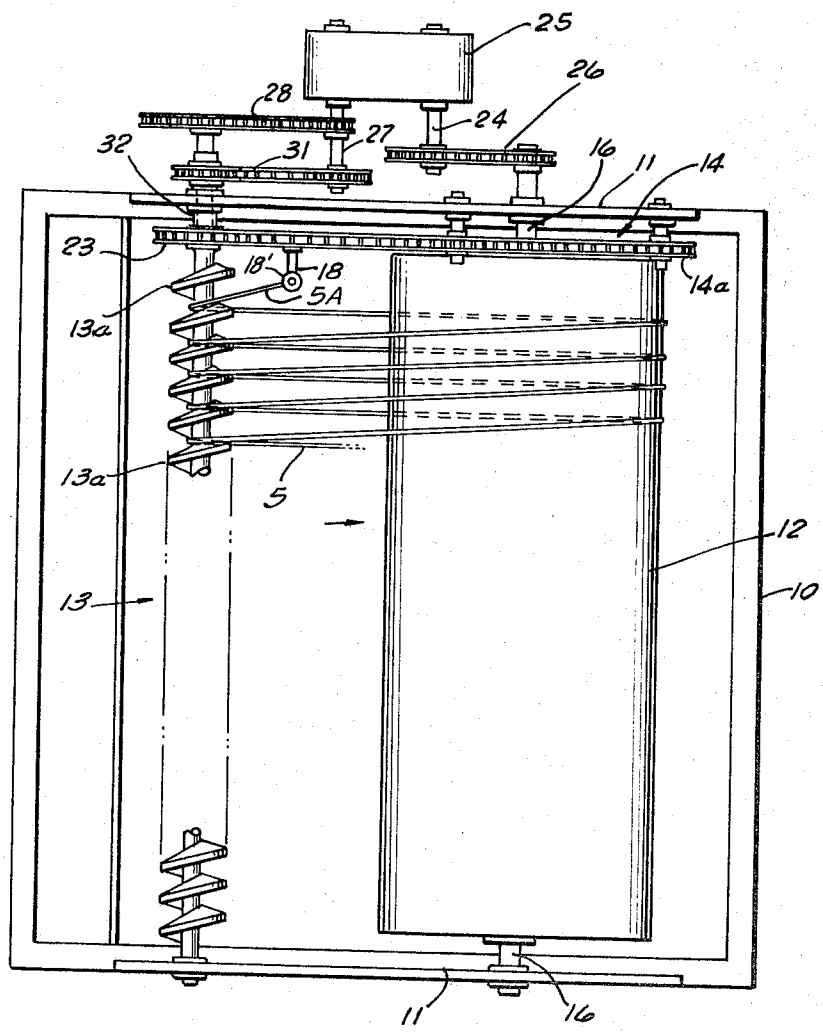

FIG. 2

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APPARATUS FOR THE FLUID TREATMENT OF FABRICS IN ROPE FORM

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5 Claims. (Cl. 68—176)

This invention relates to an apparatus for treating fabrics in rope-like form. This rope-like form of the fabrics, for the sake of brevity, is herein referred to as "rope form."

The treatment of textile fabrics in rope form by passage through a bath containing a scouring, bleaching, dyeing, or other treating medium, is known. Such apparatus is called a wince or winch machine. As heretofore constructed, winch machines were designed for treating the fabric in rope form with the opposite ends of each length of fabric treated, secured together and disposed over the winch roller and the peg rail in the form of an endless helix, with the lower portions of successive convolutions of the helix immersed in the bath of treating liquid. Both circular and elliptical winch rollers are known; the particular shape of roller used depends upon the fabric treated in the winch apparatus.

Winch apparatus as heretofore designed have a number of disadvantages, including the following. Loading of the machine involves a great deal of handling of the fabric, often wet fabric, until the whole amount of fabric to be treated has been installed over the winch roller and the cooperating peg rail with the two ends joined to form and endless strand which can be up to several thousand yards in length. The joining of the ends is usually effected by sewing them together. Unless the strands forming the convolutions are nearly equal in length and under equal tension, in operation of the winch machine involving rotation of the winch roller, one convolution of the helix may gain at the expense of the preceding or following convolution due to slippage between the fabric and the surface of the winch roller, and this even though the winch roller is covered or surfaced with a non-slip material. The length of the fabric constituting a single convolution of the helix may be from 20 yards or less to over 120 yards and the bulk of each convolution is at any given time packed in pleated formation along the sloping back and also along the base of the bath, with a relatively small proportion of the fabric situated above the surface or level of the treating liquid forming the bath. The force required to draw the fabric from the closely packed mass in the bath varies from one convolution to another and also depends on the physical form of the fabric, being less for smooth, fine fabrics than for rough, coarse fabrics. Variable slippage, i.e., when one convolution of the helix gains in length at the expense of another, requires larger forces to draw the longer convolutions of the helix up over the winch roller, with the consequent result that the whole operating system becomes unstable and entanglement of the convolutions of the fabric in rope form takes place.

Accordingly, winch apparatus as heretofore constructed, requires close attention by an operator to avoid dyeing defects and mechanical damage to the fabric. For satisfactory operation it is necessary to handle the fabric during its scouring, bleaching and dyeing so that the convolutions are wound and maintained at approximately equal length. Unless this is done, with some types of fabrics, when slippage occurs, with consequent unequal length of the convolutions of the fabric in rope form, the desired treatment of scouring, bleaching or

dyeing cannot be carried out and the fabric has to be treated by a multiple strand operation in which each length of fabric is sewn into a separate loop. Such procedure is, of course, time consuming, wasteful of material and generally unsatisfactory.

With the introduction of fabrics made partly or wholly of synthetic fibers, fabric processing temperatures have, in general, increased. Winch machines covered with hoods or supplied with live steam above the treating liquid are often required for processing such fabrics. In some cases, when dyeing temperatures in excess of 100° C. are required, the winch roller and its ancillary equipment is mounted within a completely closed vessel which can be pressurized. Under such circumstances, it is important that the convolutions forming the helix of fabric should be under control at all times; a departure from correct running with the successive convolutions of substantially the same length, may not be seen or be difficult, if not impossible, to correct without great inconvenience and risk both to the operator and to the fabric subjected to treatment.

It is among the objects of the present invention to provide an apparatus for treating textile fabrics in rope form in which the disadvantages aforesaid are obviated or mitigated.

Other objects and advantages of this invention will be apparent from the following detailed description thereof.

In accordance with this invention a method of treating fabrics in rope form is provided, in which the fabric in rope form is wound in a helix with successive convolutions of the helix in side-by-side relation, with the convolutions exposed to the treating fluid, for example, immersed in a bath of treating liquid or exposed to a steam atmosphere, and the fabric is drawn in rope form through the treating fluid by unwinding the helix at its trailing end and compensatingly rewinding the helix at its leading end while advancing the successive convolutions in a direction towards the trailing end. Thus the position of the successive convolutions of the helix remains constant axially of the winch roller and the helix is maintained at a constant length with the convolutions of equal length.

The apparatus for practicing the process of this invention comprises a container for the treating fluid which can be steam or any of the known scouring, bleaching or dyeing baths, a winch roller mounted for rotation and a convolution guide and feed member cooperating with the winch roller. For the sake of brevity this convolution guide and feed member will be referred to herein as a "guide." A carrier, desirably in the form of a conveyor chain, is provided to which the leading end of the fabric is secured and this carrier is constructed and arranged to be driven in a direction the same as the direction of rotation of the winch roller and the direction of operation of the guide. In operation, with the leading end of the fabric in rope form fastened to the carrier, upon its actuation, the secured or leading end of the fabric in rope form is moved in an orbital path, winding the fabric in the form of a helix with the convolutions of substantially equal length about the winch roller and the guide. The convolutions of the helix or only the lower portion thereof can be exposed to the treating fluid, e.g., immersed in a bath of treating liquid. After the fabric, in rope form, is thus wound the operation continues and the helix unwinds at its trailing end and compensatingly rewinds at its leading end, the guide being constructed and arranged to advance the convolutions of the helix along the winch roller in the direction of the trailing end, in timed relationship with the unwinding and rewinding, so that the position of the helix remains substantially constant axially of the winch roller and the helix is maintained at a constant length and with its convolutions of equal length.

In the accompanying drawings, forming a part of this specification, and showing, for purposes of exemplification, a preferred form of this invention, without limiting the claimed invention to such illustrative instance,

FIGURE 1 is an end view of a winch apparatus embodying this invention;

FIGURE 2 is a plan view of the apparatus shown in FIGURE 1; and

FIGURE 3 is a diagrammatic perspective view showing the winding of the fabric in rope form in a helix, with the convolutions thereof in side-by-side relation with the lower portions of the convolutions immersed in the bath of liquid and the upper portions of the convolutions disposed above the level of liquid in the bath, and also showing the carrier containing the clamp or finger to which the leading end of the fabric in rope form is fastened, the winch roller and the guide for simultaneously moving the successive convolutions of the helix in a direction toward the end of the fabric being unwound, i.e., the free or trailing end of the fabric.

Referring to FIGURE 1, **10** is a tank or container for the treating fluid, such as a bath of treating liquid shown for purposes of exemplification in FIGURE 1. Container **10** can be any conventional type of container having, in the case of the embodiment shown in the drawings, a sloping back **10***a* and a liquid supply portion **10***b* separated from the main body portion of the bath by a perforated partition or baffle **10***c*. While the tank **10** shown in the drawings is of the open type, a closed tank can be used, designed to maintain the treating fluid at elevated temperatures and/or under pressure. The tank **10** can be provided with a pump (not shown) for circulating the treating fluid from the main body portion into the supply portion **10***b* for return to the main body portion. The treating medium can be any of the known fluids employed in scouring, bleaching or dyeing fabrics.

Suitably mounted on tank **10**, on the opposite sides thereof, are supporting frames **11**, in which is journalled for rotation the winch roller **12**. The longitudinal axis of winch roller **12** extends in the same direction as the longitudinal extent of the body of treating liquid therebelow, shown in FIGURE 2. Spaced from the winch roller **12** and also journalled for rotation in the supporting frames **11** is a guide **13** which, in the embodiment shown, is in the form of a longitudinally extending spiral member or helical feed screw, containing spiral convolutions or flight **13***a*. A carrier **14** desirably in the form of an endless conveyor chain **14***a* is positioned at one side of the tank **10** with its lower run **14***b* disposed above the level of liquid in this tank.

Winch roller **12** shown in the drawings is elliptical in cross-section; however, it can be circular or of any other suitable cross-section. Winch roller **12** is carried by shafts **16** which are journalled for rotation in the supporting frame **11**. Guide **13** extends parallel to the winch roller **12**, is of the same length as winch roller **12**, its longitudinal axis is parallel to that of winch roller **12**, and, as clearly shown in FIGURE 1, is positioned to one side of and below winch roller **12** but above the level **10***d* of liquid in the tank **10**.

Conveyor **14** carries a finger **18** having means such as an eye, hook or clamp **18'** for attaching the leading end **5***a* of the fabric **5** thereto; this clamp **18'** is mounted for swivelling movement on finger **18**. In the drawings conveyor **14** is shown as an endless chain passing around a series of sprocket wheels **19**, **21**, **22** and **23** suitably mounted for rotation in supporting frame **11**. Conveyor **14** is located in a vertical plane at one end of tank **10** adjacent to one end of the winch roller **12** and helical feed screw **13**, as shown in FIGURES 2 and 3. The conveyor chain **14***a* travels in an orbital path in a vertical plane substantially at right angles to the axis of the winch roller **12** immediately adjacent the left hand end of the winch roller **12** and the guide **13**, viewing FIGURES 2 and 3. Conveyor **14** thus comprises upper and lower

passes connected at their ends to provide the endless orbital path of movement adjacent the left hand (viewing FIGURES 2 and 3) ends of the winch roller **12** and guide **13**. This endless orbital path passes above, beyond and under the outer periphery of the winch roller **12**, and under, beyond and above the outer periphery of the guide **13**.

Clamp **18'** on finger **18** projects from the conveyor chain **14***a* beyond the adjacent end of the winch roller **12** and beyond the first convolution **13***a* of the guide **13**, as shown in FIGURE 2.

The drive for the winch roller **12**, guide **13** and conveyor chain **14***a* consists of a motor, not shown, preferably an electric motor, which drives the winch roller **12**. The winch roller shaft **16** drives the input shaft **24** of an infinitely variable gear box **25** through a chain and sprocket wheel drive generally indicated at **26**. The gear box **25** has an output shaft **27** which drives the guide **13** through a chain and sprocket wheel drive **28**. The shaft **27** also drives the sprocket wheel **23** of the conveyor chain **14***a* through a chain and sprocket wheel drive **31** and a sleeve **32** fixed to the sprocket wheel **23**.

In operation, the leading end **5***a* of the fabric is attached to the finger **18** and the batch of fabric is placed in the tank **10**. The motor is then started and the winch roller **12**, guide **13** and finger **18** are driven in the same direction, which is indicated by the arrows A in FIGURES 1 and 3. During the first revolution of finger **18** around the path of chain **14**, a length of fabric in rope form is drawn over the guide **13**, over the winch roller **12**, partly around and below the latter and below the guide **13** back to the initial position of the finger **18**. This winding of the fabric continues, at the same time the winch roller **12** feeds the fabric down into the bath where it forms pleats **5***b* in each convolution of the fabric which is thus wound substantially in the form of a helix with each convolution extending around guide **13**, winch roller **12** and through the bath in tank **10**, as best shown in FIGURE 3. At the same time the guide **13** advances each convolution of the fabric as the convolution is formed and the convolutions already formed in a direction away from the conveyor **14**, that is, towards the trailing end of the fabric helix in a direction of the arrow B in FIGURE 3. Thus the fabric is wound into a helix with a relatively short end length of fabric **5***c*, FIGURE 3, at the trailing end of the helix.

With the winch apparatus thus loaded and with treating liquid in the bath, and the speed of rotation of the winch roller **12**, guide **13** and conveyor chain **14** selected to give the desired length and spacing of the successive convolutions of the helix for the particular treating operation to be carried out, as the operation continues the fabric is continuously drawn through its helical path, the helix unwinding at its trailing end **5***c* and rewinding at its leading end **5***a* with the convolutions being advanced towards the trailing end **5***c* by the helical guide **13** in timed relation with the unwinding and rewinding, so that the position of the fabric helix remains substantially constant axially of the winch roller **12**, and the helix is maintained at a constant length with its convolutions of equal length.

The following example of the practice of the process of this invention is given without, however, limiting the invention to this example. This example involved the dyeing of a polyester-cotton fabric, 1100 yards in length, in the wet state, in the winch apparatus shown in the drawings. The winch roller **12** was 72 inches in circumference and was driven at 36 r.p.m. giving a fabric speed of 72 yards per minute. The finger **18** made one complete revolution per minute and the helical feed screw or guide **13** also made one revolution per minute. When loading was complete fifteen convolutions were formed with a free end of approximately 20 yards extending beyond the last convolution. Successive baths were employed; one for scouring with a solvent detergent mix-

ture; another for bleaching with hypochlorite solution; and a third for dyeing with dispersed and direct cotton dyestuffs. These operations were carried out on this fabric without appreciable variation in the length of the convolutions of the helix and with the successive convolutions of the helix of equal length throughout the operation of the equipment.

By increasing or decreasing the speed of movement of the finger **18** relative to the speed of rotation of the winch roller **12** by suitable adjustment of the gear ratio in gear box **25**, the length of each convolution of the fabric helix can be correspondingly increased or decreased. The speed of movement of the finger **18** and the rate of rotation of the guide **13** should be regulated relative to that of the surface speed of the winch roller **12** to produce successive convolutions of the desired length. In operation, the relative rates of rotation of the winch roller **12** and the helical guide **13** to the rate of movement in its orbital path of the finger **18** should be maintained substantially constant for any chosen treatment of the fabric once the treatment is commenced. It will be appreciated, however, that other drive mechanisms can be used and the invention is not limited to the drive disclosed in which the gear box **25** is driven from the drive for the winch roller.

Instead of the helical feed screw guide **13** other forms of feed for the successive convolutions of the helix can be used, for example, a comb-like device through which the fabric convolutions pass and which is moved periodically axially of the winch roller to advance the successive convolutions of the helix, then releases these convolutions and returns and picks up the convolutions to repeat the movement can be used instead of the helical feed screw guide.

It will be noted the present invention obviates or mitigates the disadvantages of prior known winch apparatus. In the present invention once the leading end of the fabric has been attached to the finger **18**, no further handling of the fabric is normally necessary to effect the loading. Once loaded the apparatus requires little or no attention until the whole series of scouring, bleaching, dyeing and other operations carried out on the fabric, have been completed.

The length of the fabric convolutions can be adjusted exteriorly of the tank **10**. For example, this can be accomplished simply by a suitable adjustment of the gear box to change the relative speeds of movement of the finger **18** and guide **13** with respect to the speed of rotation of the winch roller **12** thus adjusting the length of each convolution.

Moreover, the present invention eliminates the necessity for connecting the ends of the fabric to form, as was heretofore the practice, an endless helix wound on the winch roller and the cooperating peg rail.

In the operation of the winch apparatus of this invention tension on the fabric is reduced. There is greater uniformity of treatment throughout the fabric because the fabric to liquid ratio is substantially constant throughout the full length of the helix. The present invention minimizes, if not completely eliminates, the possibility of mechanical damage to delicate fabrics or of the convolutions of a helix becoming entangled during treatment of the fabric in the treating liquids in tank **10**.

Since certain changes in the winch apparatus herein described or in carrying out the process involved in the use of this apparatus, which process and apparatus embody this invention, can be made without departing from the scope of this invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Winch apparatus comprising, in combination, a winch roller mounted for rotation, a convolution guide and feed member cooperating with the winch roller, a conveyor positioned near one end of the winch roller, means on the conveyor for securing thereto one end of the fabric in rope form, means for rotating the winch roller, means for driving the conveyor, and means for actuating the convolution guide and feed member to wind the fabric in rope form in helical convolutions in side-by-side relation over the winch roller and the convolution guide and feed member and to draw the fabric in rope form through the apparatus by unwinding the helix at its trailing end and compensatingly rewinding the helix at its leading end and simultaneously advance the successive convolutions in a direction toward said trailing end.

2. Winch apparatus comprising, in combination, a tank for a body of treating liquid, a winch roller mounted for rotation with its axis extending in the same direction as the longitudinal extent of said body of liquid, a longitudinally extending helical feed screw having its axis substantially parallel with the axis of said winch roller positioned below and to one side of said winch roller, a conveyor at one end of said winch roller and said helical feed screw, said conveyor being positioned for movement in an orbital path in a vertical plane substantially at right angles to the axis of said winch roller, means on said conveyor for fastening to said conveyor one end of the fabric to be treated in rope form, means for driving said conveyor, and means for rotating said winch roller and said helical feed screw in timed relation with the movement of said conveyor.

3. Winch apparatus as defined in claim **2** in which the winch roller is elliptical in cross-section.

4. Apparatus for treating textile fabrics in rope-like form, especially scouring, bleaching and dyeing fabrics, comprising, in combination, a container for a treating medium, a driven winch roller, a guide arranged so that the fabric to be treated passes from the winch roller through the treating medium and over the guide substantially in the form of a helix, a carrier adjacent one end of the roller and attachable to and for revolving the leading end of the fabric around the adjacent ends of the winch roller and guide, drive means for driving the carrier and winch roller in the same direction to effect unwinding of the helix at its trailing end and compensatingly rewinding the helix at its leading end, and means on said guide for advancing the convolutions of the helix along the winch roller and in the direction of said trailing end whereby the position of said helix as it unwinds and rewinds remains substantially constant axially of the winch roller.

5. Apparatus for treating textile fabrics in rope-like from, especially scouring, bleaching and dyeing fabrics, comprising, in combination, a container for a bath of treating medium, a winch roller, a helical feed screw spaced from said winch roller having its axis substantially parallel to the axis of said winch roller, and arranged so that the fabric to be treated extends over the winch roller, passes through the said bath of treating medium and around the helical feed screw in the form of a helix, a carrier adjacent one end of the winch roller and attachable to and for revolving the leading end of the fabric around the adjacent ends of the winch roller and the helical feed screw, means for driving the carrier and winch roller in the same direction, and means for driving said helical feed screw for advancing the convolutions of the helix along the winch roller in the direction of the trailing end of the fabric whereby the position of the helix as it unwinds and rewinds remains substantially constant axially of the winch roller.

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Notice of Adverse Decisions in Interferences

In Interference No. 96,389 involving Patent No. 3,308,639, G. E. Ziegler and G. I. Kilgour, APPARATUS FOR THE FLUID TREATMENT OF FABRICS IN ROPE FORM, final judgment adverse to the patentees was rendered Apr. 30, 1973, as to claims 1, 2, 4 and 5.

[*Official Gazette October 23, 1973.*]