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BUILDER CONTROL MECHANISM

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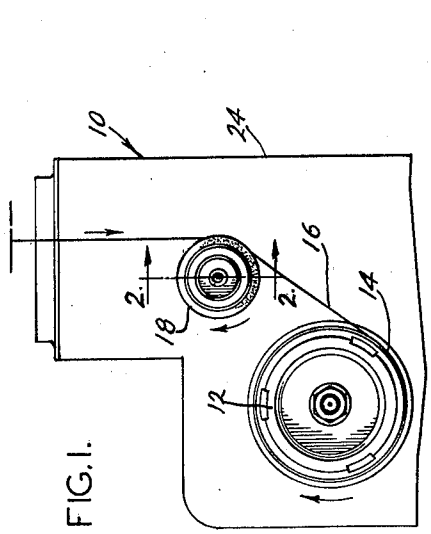


FIG. 1.

FIG. 2.

FIG. 4.

FIG. 3.

INVENTOR:
CORY P. GEEN

BY Howdon & Howdon

ATTYS.

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BUILDER CONTROL MECHANISM

Cory P. Geen, Philadelphia, Pa., assignor to Industrial Devices, Inc., Philadelphia, Pa., a corporation of Pennsylvania

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The present invention relates generally to control mechanisms for hydraulic cylinders for providing reciprocating movement having a varying predetermned stroke pattern. The invention is particularly adapted for use as a control mechanism for thread or fiber winder builders for producing taper ended packages.

In the winding of threads or fibers and particularly in the winding of glass fibers, it is desirable for reasons well known in the winding art to build packages having tapered ends. A principal advantage of such a package shape is the permissible building of packages of substantially larger diameter than would otherwise be practical on a given size winding tube since the taper ended package shape insures against the collapsing of the package ends during shipping or during unwinding of the package.

Certain winding operations, such as the winding of glass fibers, are carried out at high winding speeds, which high speeds create the problem of an uneven buildup of fibers at the package ends should the builder dwell even slightly at the ends of its strokes. Dwell of the builder is magnified by high speed winding and the resultant humping of the package ends causing uneven tension can severely limit the size of the commercially acceptable package. It is thus essential that a builder mechanism intended for high speed winding be capable of providing an instantaneous strand reversal to produce a level wound package.

Accordingly it is a primary object of the present invention to provide a builder control mechanism for the winding of taper ended packages which provides an instantaneous builder reversal at the end of each stroke.

A further object of the invention is to provide a builder control mechanism as described which may be readily adjusted to vary the package size and shape.

An additional object of the invention is to provide a builder control mechanism as described combining electrical and hydraulic control circuits to effect an accurate, positive builder control.

Another object of the invention is to provide a control mechanism for hydraulic cylinders for effecting a varying predetermined cylinder stroke pattern.

Additional objects and advantages of the present invention will be more readily apparent from the following detailed description of an embodiment thereof when taken together with the accompanying drawings in which:

FIG. 1 is an end elevational view of a winder assembly illustrating the type of winding apparatus for which the present invention is particularly adapted;

FIG. 2 is a schematic view showing the builder of the winder as viewed partly in section along line 2—2 of FIG. 1 provided with a control mechanism in accordance with the present invention;

FIG. 3 is a view taken along line 3—3 of FIG. 2 showing a face of the rotary switch wheel; and

FIG. 4 is a sectional view taken along line 4—4 of FIG. 3 showing the switch wheel construction.

Referring to the drawings, FIG. 1 shows a winder 10 of a type particularly adapted for the winding of glass fibers, including a collet assembly 12 driving a winding tube 14 around which is wound the strand 16. The strand is led onto the winding tube by a builder mechanism including the lap wheel 18 which is axially reciprocated to provide the desired type of package. Although the winder

assembly illustrated and described is of a type designed for the winding of glass fibers, it should be understood that the present builder control may be utilized with respect to a variety of winder mechanisms.

Referring to FIG. 2, the lap wheel 18 includes an annular slot 20 which is diagonally cut in the periphery of the lap wheel to engage and provide an oscillating motion to the strand 16. The lap wheel is mounted on the builder shaft 22 which is driven in rotation by a motor (not shown) within the motor housing 24. The lap wheel is axially reciprocated by the hydraulic cylinder 26 which includes the shaft 28 on which is mounted the piston 30.

The builder structure thus far described is similar to that disclosed in my co-pending application Serial Number 117,638, now U.S. Patent 3,114,511.

The stroke of the hydraulic cylinder and the axially reciprocating lap wheel 18 is governed by the four-way spool valve 32 connected with the hydraulic cylinder 26 by fluid conduits 34 and 36. Hydraulic fluid under a constant pressure is supplied to the inlet port 38 of the valve 32 and fluid is exhausted from the valve through the outlet ports 40 and 42.

The spool valve 32 is controlled by solenoids 44 and 46 at the opposite ends thereof which are adapted to operatively coact with the respective end portions 48 and 50 of the valve spool 52. The solenoids 46 and 48 are alternately energized by the rotary switch 54 connected with an appropriate source of electric current 56.

The rotary switch 54 includes the annular switch wheel 58 driven in rotation by the universal motor 60 driving through the reduction unit 62. The switch wheel 58 as shown most clearly in FIGS. 3 and 4 includes an annular slip ring 64 on one face thereof and an arcuate contact shoe 66 extending partly around the opposed face of the wheel, the contact shoe having an interiorly extending cylindrical ring portion 68 in contact with the opposed slip ring 64. The wheel is preferably molded of a hard plastic such as Bakelite, the metallic slip ring and contact shoe elements being permanently molded in position. The contact shoe 66 is set in flush with the face 70 of the switch wheel for reasons which will be presently apparent.

A brush 72 is supported by brush holder 74 in continuous spring-biased contact with the slip ring 64 to direct a current from the current source 56 through line 76 into the slip ring 64 and contact shoe 66. Brushes 78 and 80 mounted in diametrically opposed relation with respect to the switch wheel on the brush supporting means 82 adjacent the switch wheel are adapted to alternately contact the contact shoe 66 during rotation of the switch wheel. The brushes 78 and 80 are respectively connected by lines 84 and 86 to the coils of the solenoids 46 and 44. The solenoid circuits are completed by lines 88 and 90 connecting with the current source 56 through the common line 92.

The speed of the universal motor 60 is controlled by the timer-regulator 94 connected therewith by lines 96. The timer-regulator 94, which is connected with the source of current 56 by lines 98, is adapted to provide an increasing motor speed as the winding of a package progresses, and may be pre-set as desired to provide various package end tapers and packages sizes.

For operation, the timer-regulator is set either manually or automatically prior to the start of a winding operation. As the strand 16 is started on the winding tube, the timer-regulator starts the universal motor at a slow initial starting speed to provide a slow speed rotation of the switch wheel 58. The rotating contact shoe 66 alternately contacts the brushes 78 and 80 thereby alternately exciting the coils of the solenoids 46 and 44. The alternate activation of the opposed solenoids acting on the valve spool

52 provides an instantaneous periodic reversal of the valve and of the hydraulic cylinder 26 to effect an axial reciprocation of the lap wheel 18.

The slow initial speed of the motor 60 provides an initial maximum stroke of the lap wheel 18, and as the winding progresses the timer-regulator increases the speed of the motor at a regular, predetermined rate to increase the frequency of the hydraulic cylinder reversal. Since the cylinder pressure and hence the axial speed of the lap wheel is constant, an increasing frequency of the cylinder reversal results in a shortening of the lap wheel stroke. The timer-regulator, rotary switch and solenoid activated valve provide an accurate and instantaneous builder reversal and a resultant level wound fiber package having evenly tapered end walls.

The time-regulator may be controlled by a foot pedal switch or may be adapted to automatically re-set and start in phase with the collet assembly. A variety of motor regulator arrangements might be utilized, for example an autotransformer equipped with rectifiers and filters to regulate a direct current voltage. Such circuitry is well known for the speed control of small motors.

The molded construction of the switch wheel 58 as shown most clearly in FIG. 4 provides a strong, and inexpensive switch element. The metal slip ring 64 and the contact shoe 66 with its interiorly extending cylindrical ring portion 68 are initially pressed together and placed in a molding cavity for the molding operation. Such an arrangement insures a connection between the slip ring and contact shoe and a flush seating of the contact shoe with respect to the wheel face 70 to prevent excessive wear of the brushes bearing thereagainst.

The angular extent of the contact shoe 66 may be varied as desired but must of course be less than 180° to prevent simultaneous actuation of the solenoid. The greater the angular extent of the contact shoe, the longer each solenoid will be energized and positively hold the valve spool in position prior to reversal.

The control mechanism described may also be employed with hydraulic cylinders in applications other than fiber winding in which rapid-action repetitive movements with a controlled stroke variation are required. For example, various types of laminating equipment require a pressure applying stroke of successively decreasing length as laminations are added to a compressed sheet. By proper arrangement of one or more contact shoes on the switch wheel and a proper timer-regulator setting, such processes could be inexpensively and accurately controlled by the present invention. For complicated control arrangements, a drum may be substituted for the switch wheel to provide a larger area on which to mount the contact shoes.

Manifestly, changes in details of construction can be effected by those skilled in the art without departing from the spirit and the scope of the invention as defined in and limited solely by the appended claims.

I claim:

1. A control mechanism for a fiber winder builder for the winding of taper ended fiber packages comprising a double-acting hydraulic cylinder connected with the builder operable for reciprocation thereof, valve means actuatable for alternately connecting each end of said cylinder with a source of hydraulic fluid under a constant pressure so that fluid will be directed to either end of the cylinder while being exhausted from the other end, solenoid means for actuating said valve, a rotary switch for periodically passing a current from a current source into said solenoid means for actuating said valve so as to alternately direct fluid to the ends of the cylinder, a motor for driving said rotary switch, and means for automatically gradually increasing the speed of said motor throughout the winding operation, thereby increasing the frequency of actuation of said valve and effecting a shortening of the builder stroke to form a level wound taper ended fiber package.

2. A control mechanism for a fiber winder builder for the winding of taper ended fiber packages comprising a double-acting hydraulic cylinder connected with the builder operable for reciprocation thereof, valve means actuatable for alternately connecting each end of said cylinder with a source of hydraulic fluid under a constant pressure so that fluid will be directed to either end of the cylinder while being exhausted from the other end, solenoid means for actuating said valve, a rotary switch for periodically passing a current from a current source into said solenoid means for actuating said valve so as to alternately direct fluid to the ends of the cylinder, a motor driving said rotary switch, and a timer-regulator for automatically increasing the speed of said motor at a predetermined rate throughout the winding operation thereby increasing the frequency of actuation of said valve and effecting a shortening of the builder stroke to form a level wound taper ended fiber package.

3. A control mechanism for a fiber winder builder for the winding of taper ended fiber packages comprising a double-acting hydraulic cylinder connected with the builder operable for reciprocation thereof, a spool valve actuatable for alternately connecting each end of said cylinder with a source of hydraulic fluid under a constant pressure so that fluid will be directed to either end of the cylinder while being exhausted from the other end, a solenoid mounted on each end of said spool valve adapted to actuate the valve, a rotary switch for alternately periodically directing current from a current source to said solenoids to provide a periodic actuation of said valve so as to alternately direct fluid to the ends of the cylinder, a motor for driving said rotary switch, and a timer-regulator for automatically gradually increasing the speed of said motor throughout the winding operation, thereby effecting an increased frequency of actuation of said valve and a shortening of the builder stroke to form a level wound taper ended fiber package.

4. A control mechanism as claimed in claim 3 wherein said rotary switch includes a molded switch wheel, said switch wheel having an annular metallic slip ring molded into one face of said switch wheel concentric therewith, and a metallic contact shoe molded flush with the opposite face thereof, said contact shoe having an interiorly extending ring portion in contact with said slip ring.

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MERVIN STEIN, *Primary Examiner.*