Sept. 22, 1959 R. A. PIM ET AL 2,905,403

HYDRAULIC WINDING TRAVERSE

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FIG-4

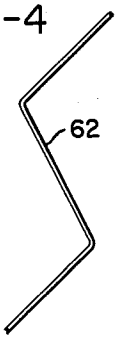
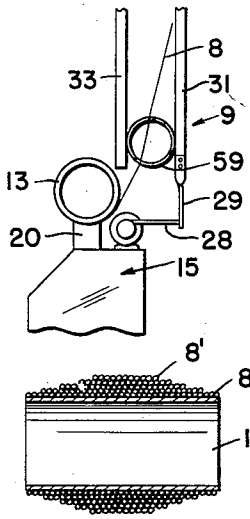


FIG-8



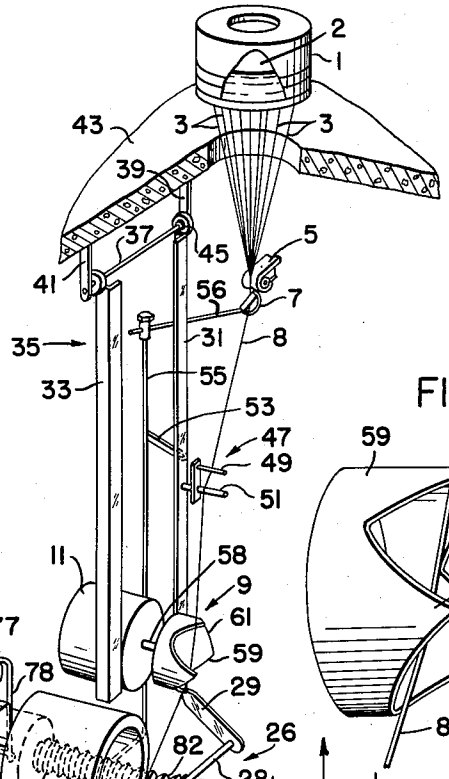


FIG-3

FIG-9

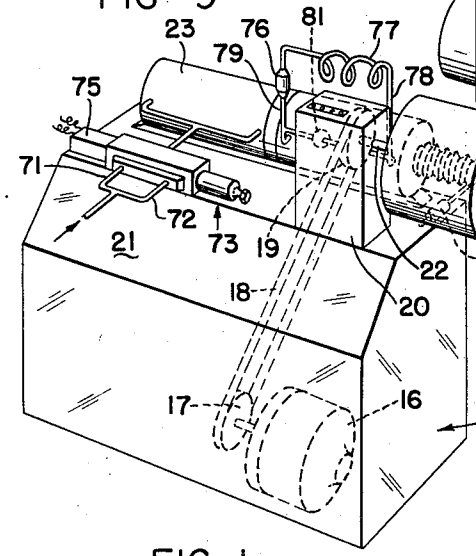


FIG-2

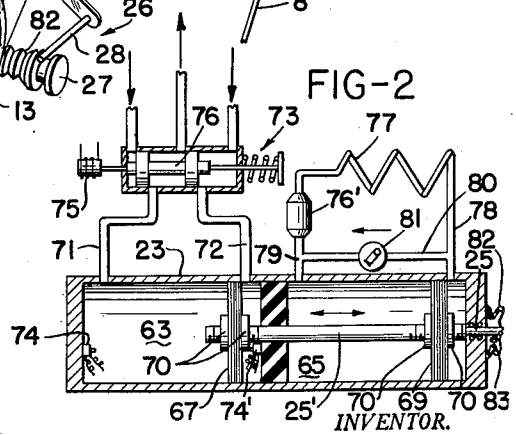


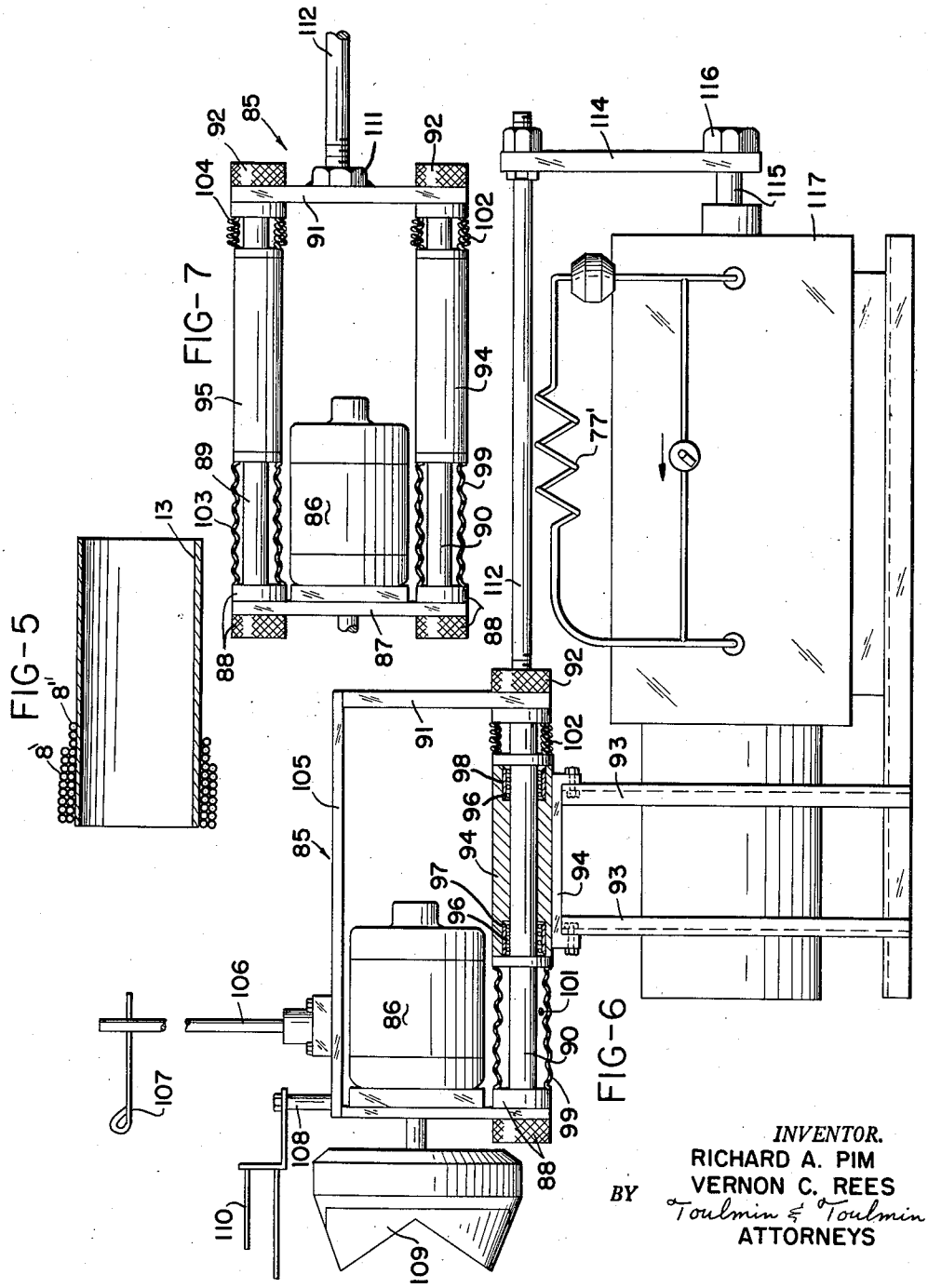
FIG-1

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HYDRAULIC WINDING TRAVERSE

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1 Claim. (Cl. 242—27)

This invention relates to traversing mechanisms and the control of flow in fluid actuated motors, and more particularly to the control of such motors for use in traverse mechanisms in glass fiber yarn winding apparatus. Still more specifically the invention relates to a method of winding glass fiber filaments.

It has been found to be desirable in the winding of freshly drawn glass fibers to employ in the winding thereof a combination of a slow and a fast traverse. The fast traverse provides the yarn to the winding tube over a relatively narrow portion of the length thereof and the slow traverse is effective to continuously move the fast traversing mechanism very slowly across the length of the tube. At the termination of the slow traverse the fast traversing mechanism is quickly returned to the point of initial winding and in this manner 2, 3, 4 or 5 individual yarn layers may be attained on the tube.

In efforts to reduce the yarn breakage factor in the customary winding method the amount of yarn applied to a tube was materially limited and it was found that at about a yarn weight of 1½ pounds the yarn when wound inside to outside across the tube handled satisfactorily without excessive breakage. However it has been found that by employing a combination of fast and slow traverse the amount of yarn per tube may be safely increased to four pounds or more. The increase in handling capacity is attributed to the formation of the separate layers which permit the glass fibers to be removed progressively from the outside layer to finally the inside layer rather than from the outside to the inside to the outside and so forth, through the entire depth of the wind. Each layer contains superposed strands but the superposing is such that the portions which are superposed are close together and extend only over a very short length of the glass filaments.

This is in contrast to the usual procedure where it is customary to so provide the yarn on the tube that every two foot or so the yarn on the tube passes from the innermost position to the outermost. Such procedure gives rise to difficulties, for reasons not completely understood, at the twister operation, where a twist is imparted to the yarn, but which difficulties are evidenced by excessive yarn breakage and loss of material.

When employing the procedure above described, on occasion, some breakage and yarn loss may occur, but seldom is more than one layer affected and thus the whole tube does not become scrap as it does when the yarn on the outer layer passes directly to the interior plies.

It is accordingly a primary objective of this invention to describe a novel method for the winding of glass fibers which method materially increases the capacity of the winding tube.

It is an important object of this invention to describe a novel combination of a slow and fast traverse.

It is a particular object of the invention to describe a novel control useful in conjunction with the regulation of the speed of movement of the pistons of hydraulic motors.

The invention will be more fully understood by reference to the following detailed description and accompanying drawings wherein:

Figure 1 is a perspective view of apparatus useful in the practice of the method of invention;

Figure 2 is a schematic view partially in section of a fluid actuated motor and associated control means including flow restriction coil means;

Figure 3 illustrates the fast traverse mechanism;

Figure 4 illustrates the operation of the fast traverse on the glass strand;

Figure 5 illustrates a tube on which the winding operation is being initiated;

Figure 6 illustrates a further embodiment of the invention;

Figure 7 is a plan view of a portion of the embodiment of Figure 6;

Figure 8 is a schematic elevational view of a portion of the apparatus of Figure 1; and

Figure 9 is a diagrammatic view of the package wound by the apparatus.

Referring to the drawings there is indicated at **1** in Figure 1 a glass melting pot containing molten glass **2** which glass is caused to exude to be drawn into filaments **3**; the filaments as they are drawn are coated with a starch binder suitably applied from a pad where the filaments are formed into a strand **8** as they pass to a tensioning ring **7**. Strand **8** passes downwardly to a fast traverse mechanism indicated generally at **9**, driven by motor **11**, and the strand is wound on tube **13** driven by motor apparatus shown generally at **15** (Figure 8).

Referring briefly to Figure 5 the apparatus of invention is effective to apply the strands **8** to the tube **13** in superposed relation progressively over the length of the tube. This is accomplished by a combination of fast and slow traverse, the fast traverse feeding a continuous strand **8** to a limited portion of the tube length as shown at **8'** and **8''**, and the slow traverse being effective to occasion the progressive movement of the fast traverse mechanism with respect to the tube until the whole tube is covered.

To fill the tube completely in production operations the slow traverse may make as many as 4 or 5 traverses of the tube length and each complete slow traverse results in the application of what is herein termed as a single layer. Accordingly in any given layer the strands will be superposed; but in removal from the tube for spinning the layers will be separately removed and should difficulty arise with any given layer the others are still useful production wise. Further, less difficulty arises with this method of winding, there being much less tendency towards breakage and binder adherence, an advantage which is particularly noted when the tubes are stored for any length of time before unwinding takes place.

Referring again to Figure 1 motive apparatus **15** includes an electric motor **16** provided with a pulley **17** about which belt **18** passes to drive through a pulley **19** in the motor control box **20** and shaft **22** to which the tube **13** is secured. The motor control box **20** is mounted on housing **21** and regulates the starting, stopping and speed of the driving mechanism of the tube.

Also supported on housing **21**, or otherwise suitably mounted, is a cylinder **23** which incorporates the principal components of the slow traverse mechanism described more particularly hereinafter. Rightwardly (Figure 2) a piston rod **25'** extends from the cylinder **23** and upon actuation of the slow traverse mechanism this piston rod moves slowly leftwardly (Figure 1) and at the completion of a traverse the piston rod moves rapidly rightwardly.

Mounted at the end of the piston rod **25** for movement therewith is an arrangement indicated at **26** for causing

movement of the fast traverse mechanism leftwardly (Figure 1) with the slow traverse. Thus secured to the end of piston rod 25 is a grooved element 27 which receives a rod 28 secured to a link 29 which is fixedly fastened to one of two arms 31, 33 of a frame indicated generally at 35. The rod 28 is restrained against longitudinal movement with respect to piston 25.

The arms 31, 33 are secured to fixed collars 45 of shaft 37 which shaft is journaled in rigid members 39, 41, secured to a fixed structural element 43. The arms are restrained from lateral movement on the shaft by collars 45 secured to the shaft by a set screw, but the arms are free to rotate with the shaft.

The arm 31 at the lower end thereof is secured to link 29; also mounted on the arm 31 is a guide 47 having projecting elements 49, 51 through which the strand 8 passes in its course to the tube 13.

A link 53 is pivotally secured to the arm 31 and a vertically extending rigid member 55 is secured to the other end of the link. The rigid member is itself pivotally supported at the lower end thereof on a link 57 which is secured to the housing 21. Rod 56 secured to the upper end of member 55 supports tension ring 7 and the latter moves with the member to maintain tension on strand 8.

Fixedly mounted between the arms 31, 33 is the motor 11 of the fast traversing mechanism and accordingly the motor moves in a slight arc with the arms when the same are motivated by the slow traverse mechanism. The rotatable shaft 58 of motor 11 has affixed to its outer end a fast traverse device which comprises a cylinder 59 the outer end of which as shown (Figure 3) is provided with cone-like projections or fingers 61 formed integral with the cylinder. The strand passing through the spacing of the cone-like projections slides thereon and is caused to be formed into substantially the shape shown at 62 in Figure 4 as it passes to the tube 13.

It is to be noted that the binder which is applied to the glass filaments serves both as a lubricant and a binding agent and may vary in constitution but substantially all binders are of such a nature that a certain amount of the material, due to the high attenuating speeds utilized in filament formation, is caused to deposit on equipment surrounding the drawing or attenuating mechanism. This would require constant cleaning which is expensive or elaborate guards which are usually somewhat ineffective in order to prevent a gumming of the binder and fouling of the equipment. The suspension of the motor 11 as shown in Figure 1 alleviates this problem.

Referring now to Figure 2 the construction of the slow traverse mechanism is shown in detail therein. The cylinder 23 as shown is provided interiorily with chambers 63, 65 and each houses a piston indicated at 67 and 69, respectively; the pistons are secured to the internal extension 25' of piston rod 25 and serve in actuation of the same. The piston rod extension 25' is suitably threaded to receive nuts 70 which retain the pistons in position on the rod.

Chamber 63 is provided with ports 71, 72 through which air under pressure may be selectively passed to drive piston 67 in reciprocation. The air flow to the chamber 63 is controlled by a solenoid actuated valve indicated generally at 73 in a known manner, the chamber 63 being provided in any suitable manner, as internally thereof with a switch 74 actuable on contact with the end of piston rod 25 therewith to change the direction of current flow in the solenoid 75 and control the position of the piston rod 76 and pistons in the solenoid valve. As shown in Figure 2 air under pressure is starting to flow into the right hand end of chamber 63 to start the slow traverse operation.

The chamber 65 and coil 77 secured thereto through conduits 78, 79 are filled with oil and accordingly piston 69 moves through oil when piston 67 moves under the influence of the air pressure. The oil (Figure 2) is forced by the leftward movement of the piston through a filter

76' and coil 77 to the right hand end of the chamber; conduit 80 is a by-pass and contains a check valve 81 which prohibits oil movement through conduit 80 in leftward movement (Figure 2) of the piston 69 but permits flow therethrough in the rightward movement of piston 69.

The oil passes only very slowly through coil 77 and accordingly leftward movement of piston 69, and also piston 67 is restricted thereby. Thus the piston rod 25 may be made to move very slowly in the leftward direction to provide the slow traverse. This arrangement is extremely flexible as the turns of coil 77 and the diameter of the conduit constituting the coil as well as the oil may be such as to provide an extremely slow traverse—in practice a cylinder having a piston traverse of three inches per minute may be suitably restricted to a traverse of one-third of an inch per minute by employing the arrangement described in Figure 2.

Upon completion of the slow traverse the switch 74 is actuated to reverse the direction of air flow to chamber 63 and piston 67 (Figure 2) then moves rightwardly; the confined oil of chamber 65 then flows relatively rapidly from the right to the left hand end, the by-pass conduit 80 being effective now to permit oil movement therethrough. This fast return may be accomplished in a matter of seconds by simply providing a suitable by-pass 80.

To prevent gumming of binder on the exposed piston rod 25 a bellows 82 surrounding the same and supported from cylinder 23 and element 27 is provided; an opening 83 permits free air-flow as the bellows expand and contracts.

In the operation of the arrangement shown in Figures 1–5, inclusive, the molten glass 2 as it exudes is coated preferably with a starch-oil binder at pad 5 and individual filaments are drawn together at pad 5; the formed strand of filaments then passes to tension ring 7 which pulls the strand toward the apex of the fast traverse while the rotating fingers thereof urge the strand outwardly.

In practice the inherent movement occasioned by the fast traverse may be about 2¼ inches along the length of tube 13 which may itself be about 6 inches long and 8 inches in diameter; with a slow traverse speed of approximately ⅓ of an inch per minute it will take 10 to 11 minutes for completion of the slow traverse to cover the tube with one layer of glass strand.

At the completion of the first layer the slow traverse mechanism is reversed and quickly returns, that is in a matter of seconds, to the starting point and accordingly the second layer is built over the first layer in exactly the same manner without causing any break in the movement of the yarn.

In each layer then the strands fed to the tube are caused by the fast traverse to cover a length, for example, of 2¼ inches, the fast traverse causing a reciprocating feed motion, accounting for the superpositioning in the layer; however, all superpositioned strands of a layer are close together along the strand length due to the fact that the throw of the fast traverse covers only a portion of the tube length at each reciprocation of the fast traverse.

As a specific example, set out by way of illustration and not of limitation, the tube 13 may rotate at about 4950 r.p.m. and the fast traverse member at an r.p.m. of 900, the diameter of the tube being about 8 inches, and in this case the first complete layer will weigh about 1½ pounds and may have, for example, a length of 35,000 yards.

The mechanism and method of invention thus set forth provide a materially improved tube of yarn from which it has been found in practice the strands may be removed for spinning without the occurrence of material breakage.

As shown in Figure 6 in elevational view and in Figure 7 in plan view there is indicated generally at 85 a frame to which the fast traverse motor 86 is secured by arm or crosshead 87. The crosshead 87 is fixedly secured by

collars as at **88** to longitudinally movable opposed shafts **89, 90**; the shafts are also provided with a rearward crosshead **91** retained on the shaft by collars as at **92**.

Also as shown in Figure 6 a vertically extending support member **93** is fixedly secured by bolts to a housing **94** for support of the housing; similarly as shown in Figure 7 a housing **95** through which the shaft **89** passes is secured on support **93**. Each of the housings **94, 95** contain ball bushings **96** and through which the shafts **89, 90**, respectively, sliding pass. In each housing a bushing holder indicated at **97, 98** retains the ball bushings in position, and this structural arrangement provides a firm support for the motor **86** and the equipment associated with the frame **85**.

Secured to the housing **94** and extending leftwardly in Figure 6 is a bellows **99** the leftward end of which is affixed to the collar **88**, the bellows being contractable and expandible with movement of the shaft **90** and being provided with an opening indicated at **101** for free passage of air. Rightwardly in Figure 6 the housing **94** has secured thereto a second bellows **102** which extends rightwardly and is retained by the collar **92**. The bellows serve to protect the shaft from exposure to binder material and as indicated in Figure 7 the shaft **89** is protected by bellows **103** and **104** in a similar manner.

The frame **85** has extending upwardly from arm **105** a rod **106** which adjustably supports the tensioning ring **107**; arm **105** also has secured thereto rod **108** from which there extends over the fast traverse device **109** strand guide **110**.

Fixedly secured to the rearward crosshead **91** by nut **111** is a shaft **112** threaded at its end to receive the nut **111**. Secured to the shaft **112** and extending downwardly therefrom is a cross arm (Figure 6) **114** which is fixedly retained on piston rod **115** by nut **116**. This piston rod extends from a cylinder **117** which is similar to that described in connection with Figure 1 and is operable to drive the piston slowly rightwardly (Figure 6) and more quickly leftwardly, the coil **77'** being provided to retain the slow traverse of the piston **115'** in a manner precisely as set forth in connection with Figure 1.

In the operation of the device of Figures 6 and 7 the fast traverse motor and the associated mechanism are moved slowly rightwardly (Figure 6) by the connection of the cross arm **114**, the shaft **112** and the cross arm **91**. Support for the fast traverse assembly is attained through the shafts **89, 90**, which as already noted are movable through the housings **94, 95**. The operation of the structure of Figures 6 and 7 is otherwise similar to that described in connection with Figures 1–5, inclusive.

It will be understood that this invention is susceptible to modification in order to adopt it to different usages and conditions and accordingly it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claim.

We claim:

In combination in a winding and traversing mechanism for glass filaments, a tube on which the filaments are to be wound, fast traverse means to supply the filaments to the tube over a portion of the length thereof, slow traverse means operable to move the fast traverse across the face of the tube, said slow traverse means comprising a fluid operated motor having a piston rod, means securing the piston rod to the fast traverse means, and means to slide the fast traverse means in response to movement of the piston rod, the said fluid operated motor having fluid flow resistance means for limiting motor fluid flow and the motor and fast traverse means speed in one direction.

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