Feb. 20, 1962 L. J. HIGGINS, JR 3,022,020

FIBER DRAWING APPARATUS

Filed Nov. 30, 1955 4 Sheets-Sheet 1

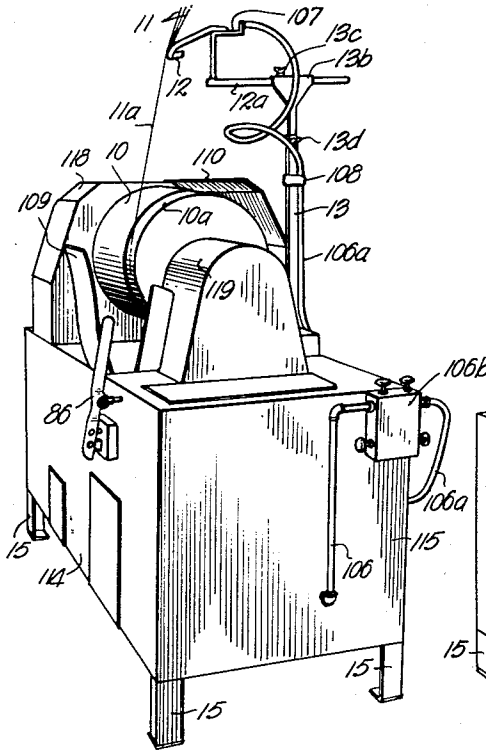

Fig. 1.

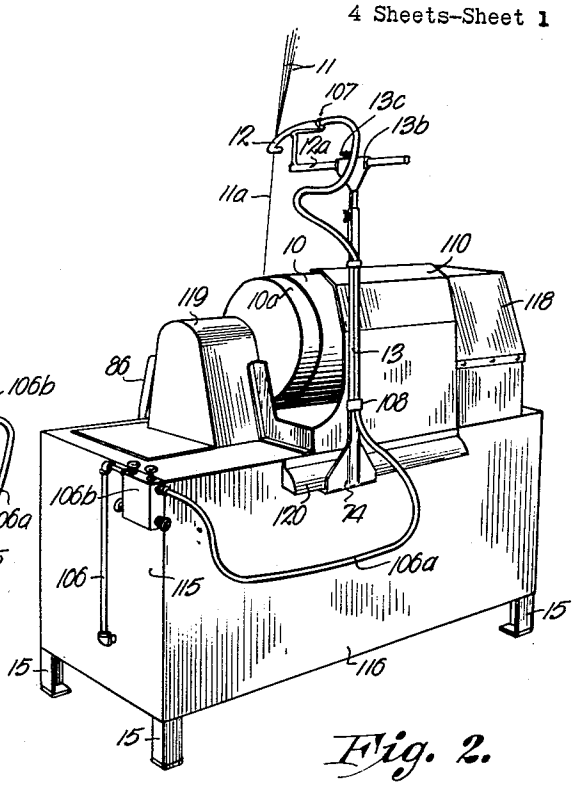

Fig. 2.

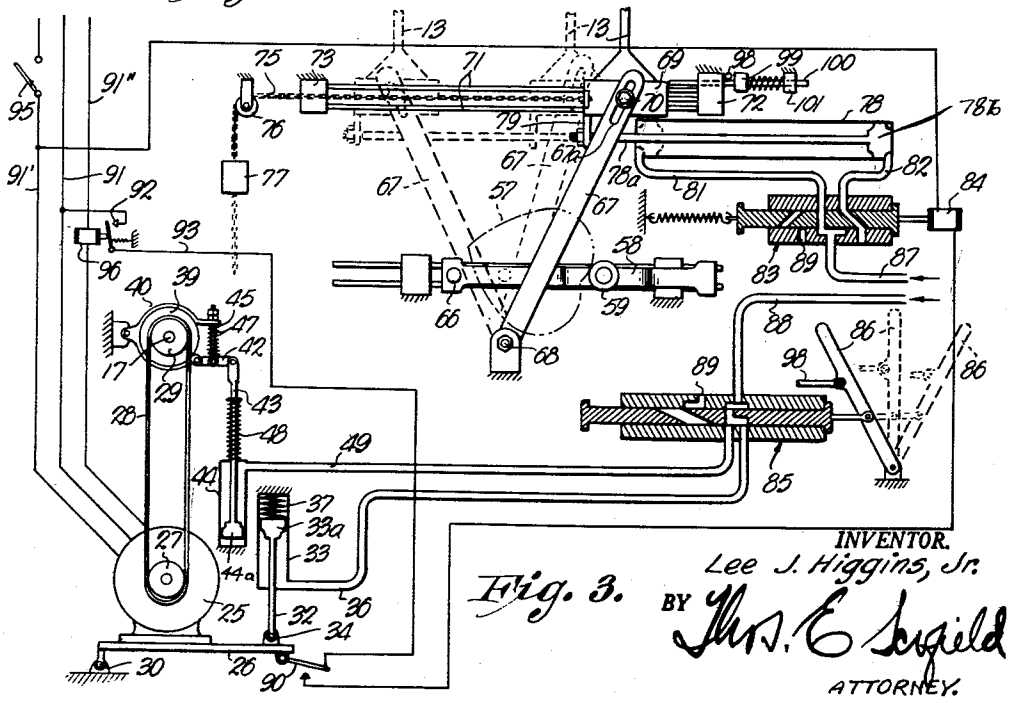

Fig. 3.

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FIBER DRAWING APPARATUS

Filed Nov. 30, 1955 4 Sheets-Sheet 2

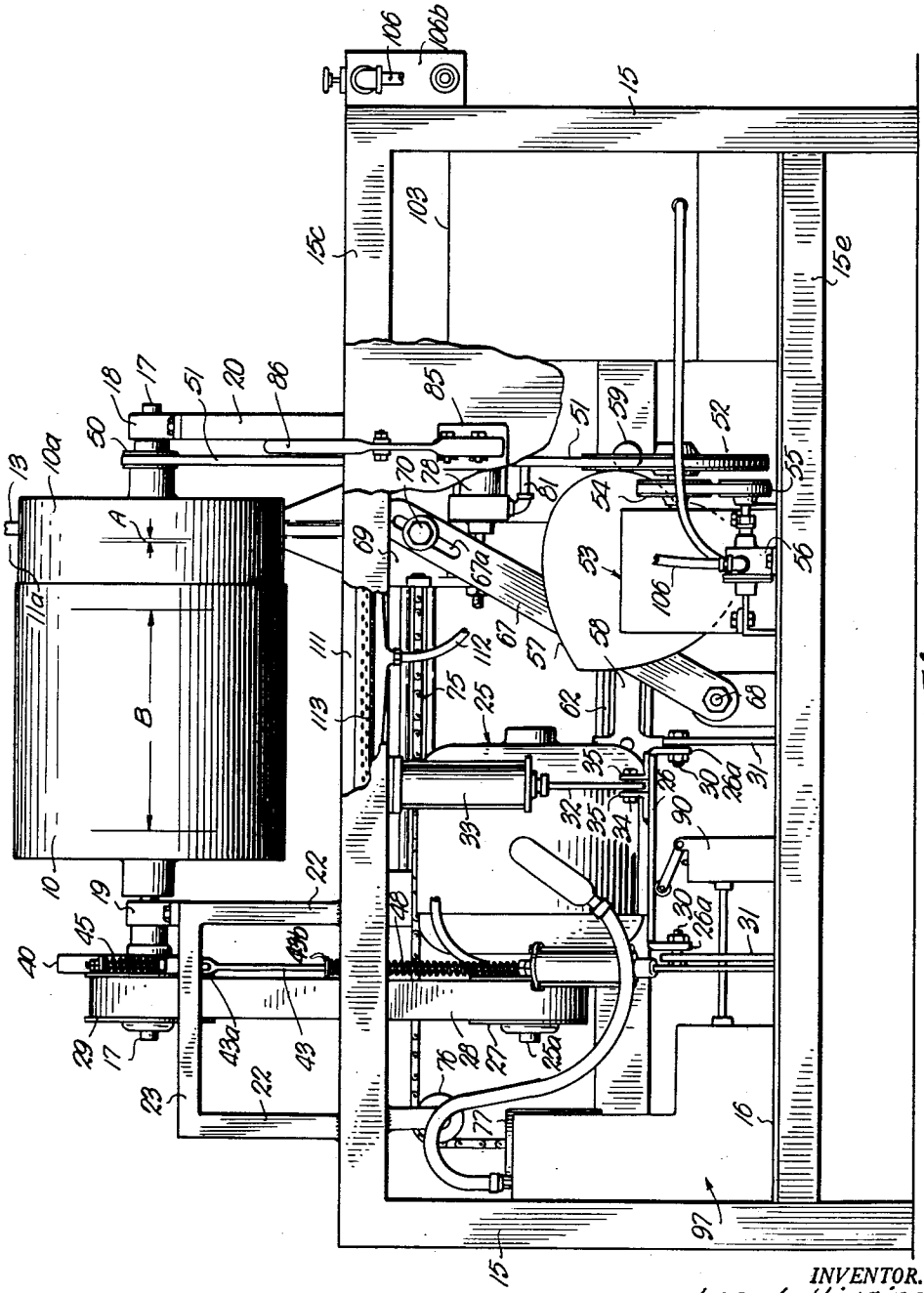

Fig. 4.

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FIBER DRAWING APPARATUS

Filed Nov. 30, 1955 4 Sheets-Sheet 3

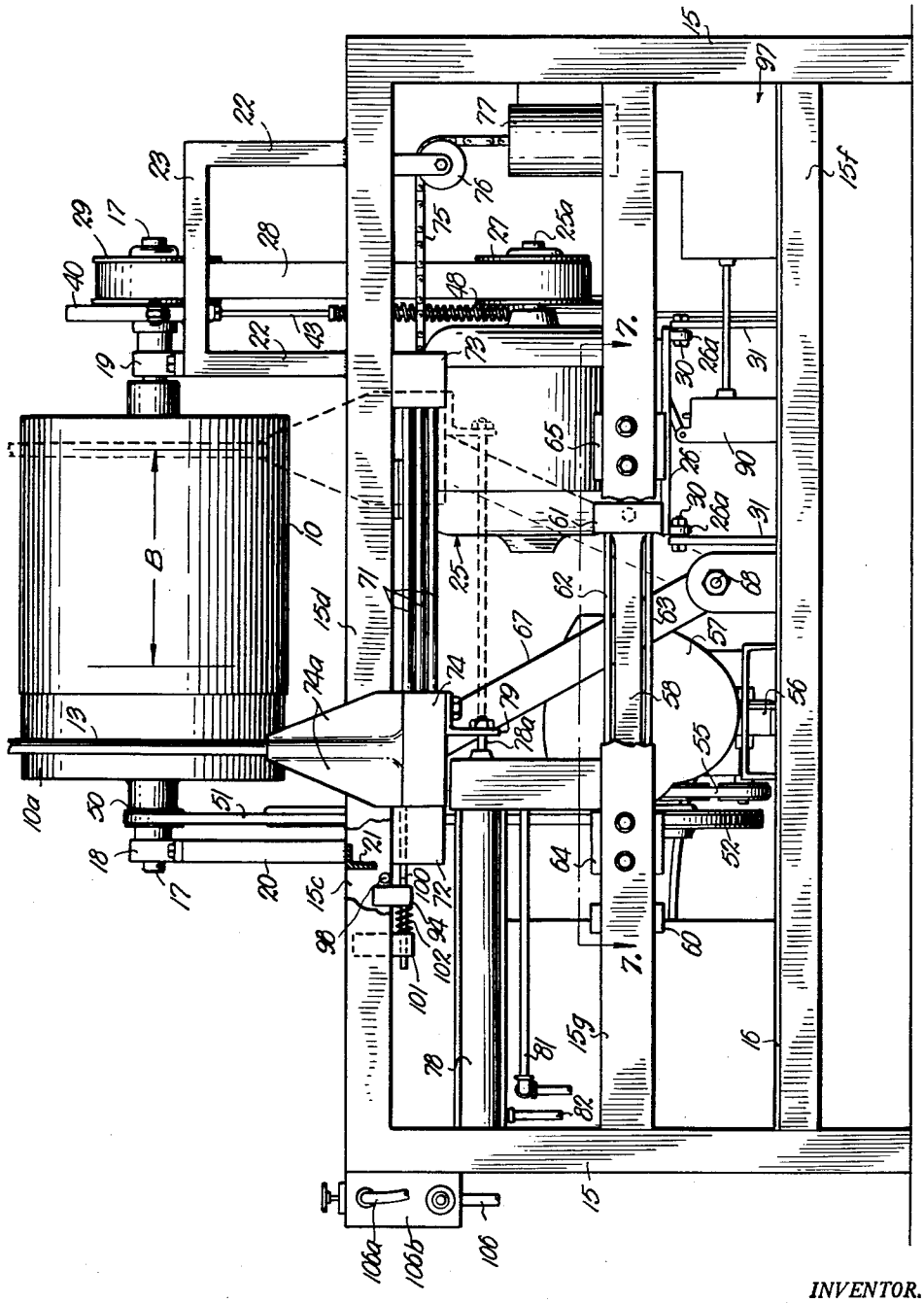

Fig. 5.

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FIBER DRAWING APPARATUS

Filed Nov. 30, 1955 4 Sheets-Sheet 4

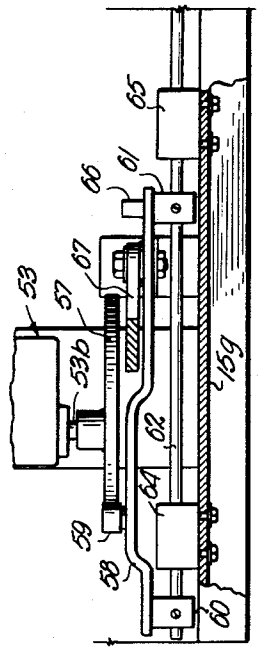

Fig. 7.

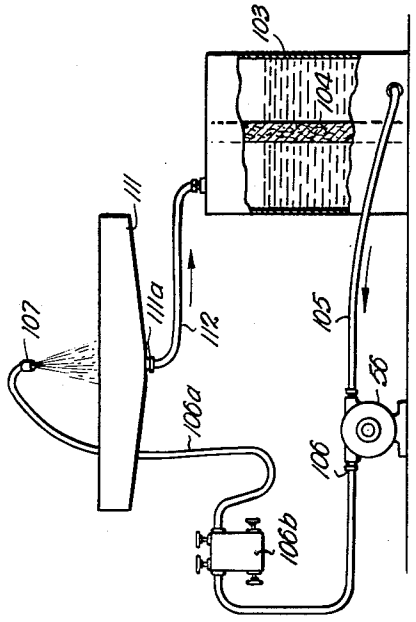

Fig. 8.

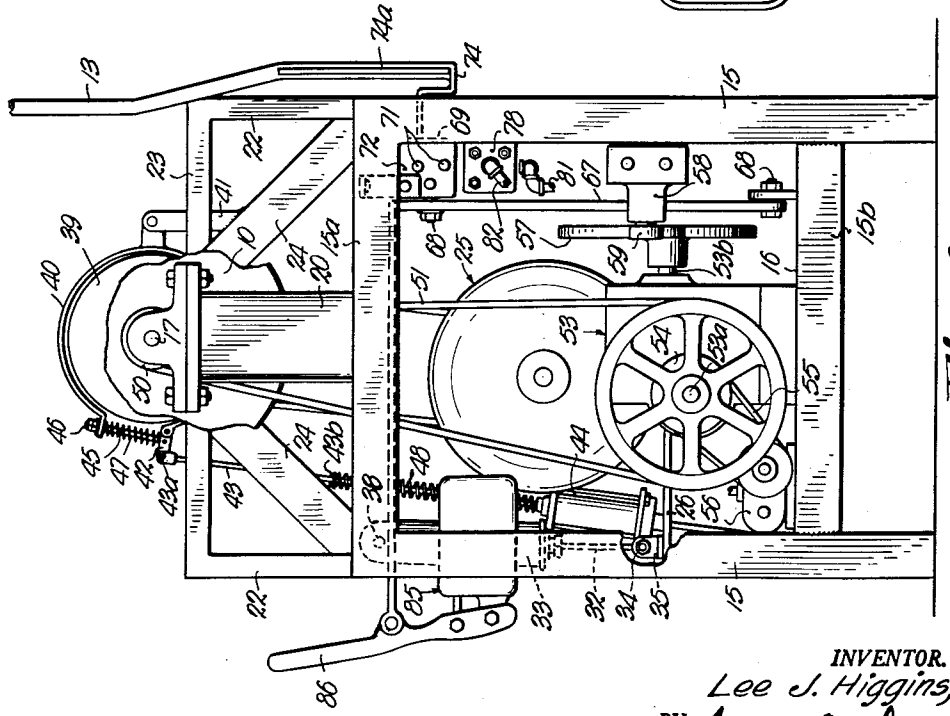

Fig. 6.

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United States Patent Office 3,022,020
Patented Feb. 20, 1962

3,022,020

FIBER DRAWING APPARATUS

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Filed Nov. 30, 1955, Ser. No. 550,078
6 Claims. (Cl. 242—18)

The present invention relates in general to the manufacture of glass fiber and it refers more particularly to an improved apparatus for drawing fiber from a source of molten glass.

This application covers an improvement based upon the co-pending application of Joseph F. Stephens and George H. Sowers, Serial No. 353,964, filed May 11, 1953, now Patent No. 2,846,157.

It is a broad object of this invention to provide an improved apparatus for producing glass fiber on a continuous basis, and, as it is produced, collecting the fiber in different lots according to size, the collecting operation being shifted selectively from one lot to another (without interruption in production of the fiber) in accordance with the instantaneous size of the fiber. In carrying out the invention, there is employed a rotating drum to which the fiber is attached and which serves both to draw the fiber from a conventional fiber-generating bushing or furnace and also to wind up the fiber thus produced. An important feature of the invention resides in the provision of improved means for causing the fiber to be fed onto the drum in different axially restricted and axially separated regions thereof, depending upon the fiber size at any given instance.

According to the invention, all fiber drawn by the drum while operating at a speed which results in the obtaining of fiber of a desired diameter is fed oto a selected zone of the drum by guiding the strand or strands to that zone while the design speed is maintained. However, during periods of acceleration to or deceleration from the design speed when due to the slow drawing speed the fiber generated is coarser than that desired, provision is made for automatically shifting the guide means to another position whereby the fiber will be guided to another zone of the drum which is axially separated and remote from the zone in which is collected the fiber of the desired diameter. The respective sizes of fiber thus are kept separate from one another without any interruption in the continuity of the drawing of the fiber, and when the winding thereof on the drum has been completed the two sizes can be removed from the drum as separate hanks, neither of which is contaminated by fiber of the other size. A feature of the invention resides in effecting the shift in the feeding of the fiber from one of said zones to the other at relatively high speed. This is important in that it achieves a clear and decisive zone of separation between the fine and coarse windings.

A further object of the invention is to provide a fiber drawing apparatus in which the number of moving parts are reduced to a minum so that there are few bearings and other areas of frictional contact likely to be infiltrated and clogged by fragments of fiber or dust particles. It is, in this connection, a feature of the invention that the parts have been sufficiently reduced in number and have been so arranged as to make it possible to enclose the operating mechanism within a closed cabinet which aids in preventing the intrusion of dust particles.

Still another object is to provide a fiber drawing apparatus in which liquid sizing is deposited on the fiber, as it is drawn, by means of a sizing circulation system which is automatically controlled by the drawing apparatus and in which the sizing system is included as a part of the apparatus. A valuable feature of the invention in this respect is the provision of a sizing circulation system in

which excess sizing applied to the fiber is collected and, after impurities and abrasive particles are removed therefrom, returned to the spray nozzles for reuse.

A further object is to provide a fiber drawing apparatus in which safety means are provided for preventing the application of braking force to the winding drum until such time as the fiber guide means is positioned to deliver fiber into the coarse fiber collection zone. This prevents the accidental mixing of fine and coarse fibers, thus preserving the uniformity of diameter in the main collecting zone.

Other and further objects of the invention together with the additional features of novelty whereby the objects are achieved will appear in the course of the following description.

In the accompanying drawings, which form a part of the specification and are to be read in conjunction therewith, and in which like reference numerals are employed to indicate like parts in the various views;

FIG. 1 is a front perspective view of a fiber drawing apparatus embodying the inventtion;

FIG. 2 is a rear perspective view of the unit illustrated in FIG. 1;

FIG. 3 is a schematic diagram of the electrical and hydraulic circuits and the associated mechanical parts utilized in the operation of the machine;

FIG. 4 is a front elevation of the unit, the wall of the cabinet being broken away to show the interior, and other parts being broken away for purposes of illustration;

FIG. 5 is a rear elevation of the unit, the wall of the cabinet and other parts being removed or broken away for purposes of illustration;

FIG. 6 is an end elevation of the unit taken from the right hand end of FIG. 4, the cabinet walls having been removed and other parts being removed or broken away for purposes of illustration;

FIG. 7 is an enlarged sectional view taken along the lines 7—7 of FIG. 5 in the direction of the arrows; and

FIG. 8 is a schematic view of the sizing circulation system for the machine.

In co-pending application, Ser. No. 353,964, now Patent No. 2,846,157, to which reference has been made above, there is disclosed a method of drawing glass fiber for which instant invention is especially adapted to aid in performing. Briefly, the method disclosed therein comprises the gathering on a rotary drum of a plurality of filaments formed by multi-orifices in a bushing fed molten glass from a suitable melting source. To obtain fibers of a given diameter, the drum is rotated at a predetermined constant speed, the particular speed of rotation governing the fiber diameter. In the particular apparatus illustrated in said application, the drum is shifted axially back and forth at a slow rate to wind the fibers in superimposed helical layers. Whenever the rate of rotation of the drum falls off from the rate desired, or when starting the drum from a stopped condition and bringing it up to speed, provision is made for shifting the drum to a position wherein the coarser fibers will wind on another section of the drum, thereby preserving the uniformity of the main winding.

One of the features distinguishing the present invention from the apparatus disclosed in co-pending application, Serial 353,964, is that in the present invention the drum remains in a fixed axial position at all times, the filaments being moved back and forth at the proper rate to obtain the helical winding by a reciprocating traversing arm.

Referring to the drawings, reference numeral **10** indicates the cylindrical rotary drum on which are to be wound filaments **11**. The filaments are drawn from a conventional bushing (not shown) and are gathered into a single strand **11***a* by means of the gathering shoe **12**. This gathering shoe is the conventional flannel pad on a

grooved metal part, or alternatively the stationary or rotatable graphite wheel known to the art. The shoe 12 is carried in a manner presently to be described on the upper end of the traversing arm 13. Arm 13 is adapted to be shifted axially of the drum by mechanism hereinafter to be set forth.

It will be noted that as in co-pending application, Serial 353,964, now Patent No. 2,846,157, the drum 10 is divided into two separate zones A and B (see FIG. 4). In using the unit, after attaching the strand 11*a* to zone A of the drum (which is preferably of slightly reduced diameter as indicated at 10*a*), the drum is brought up to proper speed without any movement of arm 13 and the gathering shoe 12 carried thereby. Accordingly, the fibers drawn during this period of acceleration, which naturally are coarser than desired, are wound onto the drum in the zone A. When the drum reaches the speed necessary for producing filaments of the desired fineness, the traversing arm 13 is automatically shifted, by means later to be described, to the left as seen in FIGS. 3 and 4 (to the right in FIG. 5) so that the strand 11*a* travels into zone B of the drum. Thereafter, so long as the drum continues to travel at full speed, the arm 13 is reciprocated to produce level winding of the strand throughout zone B only. If, for any reason, the speed of drum 10 decreases, the arm is immediately shifted again so that the coarse fiber then generated will be wound on the drum only in zone A. If the speed drop represents a transient condition, the arm subsequently is again shifted so that the winding will be resumed in zone B as soon as the drum speed is restored to the proper value for producing filaments of the desired fineness. As a result of this mode of operation, it will be clear that all of the fine fibers are wound on the drum in zone B while all of the coarse fibers are collected in zone A.

Ignoring for the present the cabinet, and referring initially to FIGS. 4, 5 and 6, the supporting frame work of the machine has four upright legs 15. These are connected together and braced by a pair of crosspieces 15*a* and 15*b* at each end of the frame and by four horizontal members 15*c*, 15*d*, 15*e* and 15*f* extending longitudinally of the frame. Conveniently, all of the aforementioned frame components are metal members welded together at their junctions to form a strong rigid structure. The lower horizontal frame members 15*b*, 15*e* and 15*f* provide support for a lower deck 16 on which are supported various parts of the unit later to be described.

The drum 10 is mounted on the top of the frame, being carried by a shaft 17 journaled at opposite ends of the drum in bearings 18 and 19 respectively. Bearing 18 is mounted on an upright pedestal 20 supported at its lower end on a cross member 21 extending laterally between and connected to horizontal frame members 15*c* and 15*d*. Bearing 19 is carried by a superstructure comprising four upright legs 22 welded to the top horizontal frame members 15c and 15d, four interconnecting horizontal crosspieces 23, and a pair of diagonal bracing members 24 (best seen in FIG. 6).

The rotary drive for drum 10 is provided by an electric motor 25 which is supported within the frame on a platform 26. A drive pulley 27 is secured to motor shaft 25*a* and an endless belt 28 drivingly connects motor pulley 27 with the pulley 29 secured to the drum shaft 17. The platform 26 on which the motor is mounted is capable of up and down movement, being supported at its rearward edge on a hinge axis formed by a pair of bolts 30 received in downwardly extending ears 26*a* formed on the platform. Bolts 30 are supported on the frame by upstanding posts 31 rigidly affixed at their lower ends to deck 16. The forward edge of the platform is supported by a rod 32 extending downwardly from a spring-loaded pneumatic cylinder 33. The lower end of rod 32 is pivotally connected with the platform by means of a cross pin 34 extending through the rod and through apertures formed in a clevis-like bracket formed by a pair of L-shaped members 35 welded or otherwise secured to the platform.

As is best seen in FIG. 3, pneumatic cylinder 33 has therein a conventional piston 33*a* to which rod 32 is affixed. Air is supplied from below the piston through line 36, a coil spring 37 on top of the piston continually urging the piston downward. Spring 37 is supplemented, of course, by the weight of the motor acting on the platform 26. The stroke of piston 33*a* is such that when the platform is in its lowermost position belt 28 is drawn taut between pulleys 27 and 29 so that the motor 25 will drive the drum 10; and when the platform is in its uppermost position (the position illustrated in the drawings), the belt is too loose to be effective in driving the drum.

Air is supplied to cylinder 33 under sufficient pressure to counteract the combined downward forces exerted by the weight of motor 25 and the spring 37 so as to maintain the platform, through rod 32, in its uppermost position. The upper end of pneumatic cylinder 33 is pivoted to the frame as at 38 (see FIG. 6) to permit the tilting of the cylinder necessary to compensate for the pivotal movement of platform 26 between its limit positions.

On the drum shaft 17 adjacent its main drive pulley 29 is a brake drum 39 loosely embraced by a brake band 40. Band 40 is fixed on one side of the drum to a bracket 41 extending from and secured to one of the diagonal brace members 24. One end of the brake band is pivotally connected to a cross link 42, the link being connected at its other end with a clevis 43*a* on a shaft 43 extending upwardly from a pneumatic cylinder 44. Rising from an intermediate point in cross link 42 and pivotally secured at its lower end to the link is a rod 45 extending at its upper end through an aperture formed in the other end of the brake band 40. Nuts 46 are threaded on the rod above the end of the brake band and a helical spring 47 encircling the rod tends to maintain the ends of the band separated.

A second helical spring 48 encircles shaft 43 and bears against a stop 43*b* to constantly urge it in an upward direction. As shown in FIG. 3, acting against the spring is air supplied under pressure to the cylinder through line 49. When air is supplied to cylinder 44, piston 44*a* is driven to its lower point of travel and shaft 43 is drawn down with it. This causes cross link 42 to exert a force through rod 45 drawing the ends of brake band 40 and clamping it tightly about the brake drum to apply a braking force. This is the condition illustrated in the drawings, except in FIG. 6. When the pressure in cylinder 44 is released, springs 47 and 48 cooperate to pivot cross link 42 counterclockwise and cause the brake band 40 to expand and separate itself from the brake drum, as illustrated in FIG. 6.

Turning now to the opposite end of the fiber collecting drum 10, affixed to shaft 17 adjacent bearing 19 is a second pulley 50. A belt 51 connects this pulley with a pulley 52 mounted on the input shaft 53*a* of a conventional speed reducer unit 53. A second pulley 54 is secured to shaft 53*a* and drives through belt 55 a gear pump 56, the purpose of which will be later described.

The speed reducer 53 is of the right angle drive type, the output shaft 53*b* being located at right angles with the input shaft 53*a* and extending toward the rear of the machine. Mounted on shaft 53*b* and adapted to rotate therewith is a heart-shaped cam 57. Positioned in a plane parallel with the cam 57 and adapted to be reciprocated longitudinally by the cam is a bar 58 (see FIG. 7) having a roller 59 which engages the margin of the cam and serves as a cam follower. The bar 58 is supported on blocks 60 and 61 at its opposite ends (see FIG. 7). The blocks are mounted on a pair of vertically spaced parallel slide rods 62 and 63 (see FIG. 5). Rods 62 and 63 are slidably supported in suitably bored blocks 64 and 65 secured in any convenient fashion to a horizontal stringer 15*g* which in turn is affixed at

its ends to the upright frame legs **15** at the rear of the unit.

It will be noted that provided on that end of plate **58** opposite the end carrying cam roller **59** is a dog **66** (see FIG. 7). Dog **66** lies in the same plane as, and is adapted to engage under conditions later to be described, a rocker arm **67** pivoted to the frame at **68**. The upper end of arm **67** is connected to a horizontally traversable block **69** through the medium of a stub bearing assembly **70** extending from the block into an elongated slot **67***a* in the arm. Block **69** is slidably carried by three horizontal and parallel rods **71**, each of which is received at its opposite ends in bearing blocks **72** and **73**. These blocks are rigidly secured in any suitable fashion to the frame member **15***d* and it will be evident that the block **69** is movable between them.

Carried by block **69** is the traversing arm **13** which is attached to the arm through the medium of a goose-necked plate **74** secured to that side of block opposite from rocker arm **67** (see FIG. 6). The lower end of arm **13** is welded to the plate, gussets **74***a* being provided to strengthen the connection. The arm is preferably of hollow rectangular construction, the upper end telescopically receiving a similar section **13***a* terminating in a lateral sleeve **13***b*. The gathering shoe **12**, to which reference has previously been made, is carried by a spindle **12***a* slidably received in sleeve **13***b*. Lateral set screws **13***c* and **13***d* are provided respectively on arm **13** and sleeve **13***b* so that the height and lateral spacing of shoe **12** with respect to the drum can be adjusted as desired.

Returning now to the traversing block **69**, it will be noted from FIGS. 3, 4 and 5 that there is attached to the block a chain **75**. The chain extends horizontally away from the block and around a sprocket or wheel **76** supported by the frame. Connected to the free end of the chain and exerting a tensional pull thereon is a weight member **77**. Through the tension exerted on the chain by weight **77** a continuous force is provided always urging block **69** toward the far right broken line position illustrated in FIG. 5. However, this force is normally resisted when the machine is not in operation, or during acceleration or braking as will be later explained, by a horizontally disposed pneumatic cylinder **78** having piston rod **78***a* which is slidably connected with block **69** through the medium of a depending flange **79** secured to the underside of the block and apertured to slidably receive rod **78***a*. Pneumatic cylinder **78** is of the double acting type, having air lines **81** and **82**, respectively, at the opposite ends thereof. As viewed in the various figures of the drawing, the retracted position of the rod **78***a* is illustrated in the solid lines.

The air supply lines for the pneumatic cylinder **78**, as well as cylinders **33** and **44**, have been included in FIGS. 4, 5 and 6 only to the extent necessary to indicate their presence. This is also true of the details of the valves which control the air supply. These are shown schematically, however, in FIG. 3, from which it will be evident that spring-biased valve **83** is arranged to be operated by solenoid **84** (solenoid **84** normally being deenergized) and valve **85** is arranged to be operated manually through the three-position lever **86**. The actual location on the unit of this lever and valve is shown in FIGS. 1, 4 and 6, the lever being located on the front where it is readily accessible by an operator. Air under pressure is connected to the respective valves via supply lines **87** and **88**. The valve ports **89** are open to the atmosphere. Thus, air from line **87** normally passes through valve **83** into the line **81** of cylinder **78** maintaining the piston at the right hand end of the cylinder, as shown in FIG. 3 and also in FIG. 4. At the same time air from line **88** passes through valve **85** into the cylinders **33** and **44**.

Mounted beneath or adjacent motor platform **26** and adapted to be operated thereby is a normally open limit switch **90**. Switch **90** is part of an electrical circuit which extends from the central conductor **91** of the three-phase current supply to the motor **25** through contact **92**, conductor **93**, switch **90**, the winding of valve solenoid **84** and back to another conductor **91'** of the three-phase supply. A main control switch **95** is provided in conductor **91'**. Contact **92** is opened or closed by means of a relay **96** which is interposed in the third conductor **91''** of the three-phase power supply to the motor.

Relay **96** is designed so as to close contact **93** when the motor reaches its design or normal operating speed. During acceleration, the current flow through **91''** is sufficiently high to cause relay **96** to hold contact **92** open. However, when design speed is reached the load falls off and the contact is closed. The purpose of the various relays and switches will be discussed when describing the operation of the invention at a later point in the specification.

In the preferred embodiment of the invention valve **83**, its solenoid **84** and relay **96** are conveniently collected in a small cabinet **97** secured to and supported on the lower frame deck **16** as shown in FIGS. 4 and 5.

Returning now to a brief further consideration of hand lever **86** it will be noted that pivotally secured to the lever is an extension rod **98** which spans the frame (see FIG. 6) and terminates adjacent and to one side of the support block **72** for the rods carrying traversing block **69**. When hand lever **86** is in its full "in" position (as illustrated in FIG. 3), the end of rod **98** lies between support block **72** and a movable stop lug **99**. Lug **99** is carried on a spindle **100** which is slidably received in block **72**, one end of the spindle being positioned in the path of traversing block **69** (see FIG. 3). The other end of the spindle is slidably supported in a bracket **101**, and a helical spring **102** encircles the spindle between the bracket and the stop lug **99**. While spring **102** continually urges lug **99** toward block **72** to close the gap therebetween, the traversing block **69**, by virtue of its engagement with the spindle, prevents any movement so long as the block remains in the position illustrated in FIGS. 3, 4 and 5. Once the traveling block **69** is set in motion, the spindle is released and stop lug **99** moves into the path of extension rod **98**. As will be explained at a later point herein, rod **98** is withdrawn from between the block **72** and stop lug **99** by the operation necessary to set the traversing block **69** in motion. Thereafter, until such time as the traveling block **69** is returned to its stationary position, the stop lug **99** lies in the path of rod **98** and prevents the return of lever **86** to the full "in" position. The reason for this will become plain during the description of the operation of the unit.

At the opposite end of the frame from the valve and switch cabinet **97** is an upright tank **103** (see FIGS. 4 and 8) which serves as a storage reservoir for a suitable sizing liquid for the drawn fibers. The tank is provided internally with a filter partition **104**. Leading from the tank on one side of the partition to the suction side of pump **56** (earlier described) is a hose line **105**. The discharge of the pump is connected by means of a pipe **106** and connecting flexible hose **106***a* to a nozzle **107** mounted adjacent the gathering shoe **12** and arranged to deposit sizing on the fibers as they pass the gathering shoe. Hose **106***a* is secured by clamping bands **108** to traverse arm **13** and is of sufficient length to permit movement of the arm through the limits of its travel. It will be noted that interposed in line **106** is a fine filter **106***b*, preferably of the core type. A suitable type filter is one manufactured by the Home Filter Company under the name "Por-O-Met," the best core being what the company designates as type C.

Positioned on opposite sides of the drum **10** are shields **109** and **110**, respectively. These shields catch the excess sizing liquid thrown from the drum by centrifugal force and direct it into the dished collecting pan **111** disposed

directly beneath the drum and supported by the frame (see FIG. 4). The pan **111** has an outlet **111***a*. Coupled with the outlet is a drain conduit **112** which discharges at its other end into tank **103** on the opposite side of filter **104** from the connection with pump line **105**. A foraminous sieve-like sheet **113** is disposed within and secured at its margin to the side walls of pan **111** to guard the outlet against being clogged by broken fibers or slugs of glass that may inadvertently fall into the pan.

One of the features of the instant invention which makes it a valuable improvement over the apparatus disclosed in co-pending application, Serial 353,964, is that the various operating parts can be so arranged within the side planes of the frame work as to make it possible to enclose them within a protective cabinet. As shown in FIGS. 1 and 2, the sides of the frame are covered with sheet metal or any other suitable facing material to form wall panels **114**, **115** and **116**. The bottom of the unit is closed by the deck **16** earlier mentioned. On top of the unit a first hood **118** encloses the main drive belt **28**, the brake mechanism and the supporting structure located at one end of the drum. A second hood **119** of smaller size at the other end of the drum encloses the power take-off belt **51** which leads to speed reducer **53**. The remaining top area of the machine is covered with sheet material, as shown, the pan **111** filling the space below the drum as previously described.

The plate **74**, to which is secured the upright traverse arm **13**, extends outwardly through side panel **116** in an elongate slot of substantially equal length with drum **10**. This slot is covered by an arcuate hood **120**.

Considering the operation of the unit and referring first to FIG. 3, let it be assumed that switch **95** is open and that motor **25** is thus not running. Valve lever **86** is in the "in" position as illustrated in FIG. 3 and as a consequence platform **26** is in its "up" position due to the air pressure transmitted to cylinder **33**. Because of the latter fact, motor **25** is elevated and is thus ineffective at this time to drive drum **10** because of the looseness of belt **28**. Due to lever **86** being in the "in" position, brake **40** is being operated. Also, due to switch **95** and limit switch **90** being open, solenoid **84** is deenergized and accordingly valve **83** and piston **78***b* are positioned as shown in FIG. 3. Piston rod **78***a* is almost fully withdrawn into cylinder **78** and, against the influence of the weight **77**, the traversing block **69**, is attached arm **13** and rocker arm **67** are held in the position illustrated in FIGS. 3, 4, 5 and 7. This represents the status of the machine when no fiber is being drawn and the drum **10** is at rest.

To begin the glass fiber drawing operation, the operator first closes switch **95** to energize the motor and set it running. By pulling hand lever **86** to its intermediate position, he releases brake band **40** from engagement with the brake drum. Then he draws the stranded glass filaments downwardly and wraps the end of the strand around the reduced section **10***a* of the drum while turning the latter manually until the strand is secured to the drum. When the strand is suitably secured, he merely grasps the hand lever **86** and draws it to the full "out" position which is the full clockwise position illustrated in the broken lines in FIG. 3.

Upon the movement of valve **85** to the full "out" position the air is released from cylinder **33** to the atmosphere. As a result motor **25** moves downwardly tightening belt **28** and beginning to turn the drum **10** to wind the glass fiber strand thereon. In moving downwardly platform **26** also closes the limit switch **90** but this serves no useful purpose at the moment since the increased load upon motor **25** causes relay **96** to hold open contact **92**. Thus, valve **83** remains in its original position and the rocking lever **67** and traverse arm **13** remain stationary while the drum is accelerating with the result that the glass strand is wound on section **10***a* of the drum.

When the drum reaches its design speed the drop off in current in conductor **91''** decreases the electromagnetic force in relay **96** enough to permit the closing of contact **92** and cause the energization of valve solenoid **84**. The resultant operation of valve **83** under control of solenoid **84** disconnects the air supply line **87** from line **81** to the left-hand end of cylinder **78** and connects it to line **82** to the right hand end causing the piston **78***b* to travel to the left in the cylinder. As will be evident, this removes the restraining influence on the traveling block **69**, and under the influence of weight **77** the block is moved to the left as viewed in FIGS. 3 and 4 until the rocker arm **67** engages dog **66** on plate **58**.

From the time that drum **10** begins its rotation, the heart-shaped cam **57** also is set in motion, being driven from drum **10** by belt **51** through the speed reducer **53**. Cam **57** thus rotates about its axis **53***b* at a rate directly proportional to the rate of rotation on the drum. We have previously noted that the initial operation of valve **83** shifts piston **78***b* to the left and thus frees block **69** and rocker arm **67** to shift to the left under the influence of weight **77**. Movement of the block will continue until the rocker arm **67** engages dog **66** on plate **58** and the plate is carried far enough to cause roller **59** to engage and ride on the periphery of the cam. From that time forward the plate **58** travels back and forth at uniform speed, the cam forcing it to the right against the action of the weight and permitting it to return again once each revoluion, its supporting rods **62** and **63** sliding through the blocks **64** and **65**. Rocker arm **67** follows the movement of plate **58** and thus causes traversing block **69** and its attached arm **13** to reciprocate through a stroke parallel to the axis of the drum defined by the limits of zone B on the drum. As the traversing arm **13** moves back and forth it shifts the fiber strand **11***a* axially along the drum and causes it to wind in uniform layers in zone B thereof.

From the description which has preceded, it will be understood that the glass fiber wound on the reduced portion **10***a* of the drum during the time that it was accelerating is coarser than desired, while that now being wound on the drum in zone B as the drum turns at full speed is fiber of the desired fineness.

When it is desired to stop the drawing operation, the operator need only push hand lever **86** forward to the intermediate position illustrated in the broken lines in FIG. 3. Valve **85** is thus shifted to a position wherein the air from supply line **88** passes through the valve into cylinder **48**. This causes piston **33***a* to rise and draw with it the platform **26**, thereby loosening the belt **28** and breaking the drive connection between the motor and the drum. At the same time limit switch **90** opens, deenergizing valve solenoid **84** and causing valve **83** to assume its original condition, as shown in FIG. 3. Air supply line **87** is thus disconnected from line **82** and connected with line **81** causing the piston **78***b* to be driven to the other end of the cylinder and drawing with it the traversing block **69** and arm **13**. This returns the arm **13** to the position wherein the fiber is wound on the reduced portion **10***a* or zone A of the drum. Thus, during deceleration collection of coarse fiber in zone B is effectively prevented.

Once the traversing block **69** and arm **13** have been returned to the position just described (the position illustrated in solid lines in FIGS. 3 and 5), the operator can now apply the brake **40** in order to bring the drum to a rapid halt. The brake is applied by pushing hand lever **86** forward from its intermediate position to full forward (solid lines FIG. 3), which shifts valve **85** to cause air to enter cylinder **44**. Piston **44***a* is thus forced downwardly and, as hereinbefore explained, causes brake band **40** to clamp tightly around the brake drum.

It should be noted that the brake cannot be applied until platform **26** has been raised sufficiently far to open switch **90** and cause traversing block **69** to be restored to its stationary or nonoperating position. So long as

block 69 remains in motion under the influence of cam 57, it moves between the broken line positions illustrated in FIGS. 3 and 5. Thus, the stop lug 99 remains in the path of extension 98 on the hand lever and prevents forward movement of the lever beyond the intermediate position. However, upon deenergization of solenoid 84 piston 78*b* moves to the other end of cylinder 58 and displaces the stop lug out of the path of extension 98. This frees the hand lever for forward movement and the brake can then be applied in the manner heretofore described. The value of this feature will be evident, it being primarily that it prevents pitting the brake against the motor since the brake is operable only after the drive connection between the motor and drum has been broken.

It will be understood that at all times during rotation of the drum the liquid sizing circulation system is in operation, the sizing being deposited on the fiber strand 11*a* by the nozzle 107 which in turn is fed from pump 56. Of course, when the drum is halted the flow of sizing liquid ceases since the pump is driven directly from the drum through belts 50 and 55. Accordingly, the flow of sizing from nozzle 107 is controlled automatically, the flow being initiated or halted according to whether or not the drum is in rotation. The foraminous sieve-like element 113, the upright filter 104 and the fine filter 106*b* guard against the accumulation in the sizing liquid of particules which might otherwise clog the pump and lines.

From the foregoing it will be evident that all of the ends and objects hereinbefore set forth have been accomplished.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

Since many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. In fiber manufacturing apparatus of the type employing a rotary drum to draw the fiber from a fiber generating device and wind up the fiber as it is drawn, a stationary base, said drum being supported on said base, a traversing arm supported on said base for movement in a plane parallel to the axis of the drum, said arm having a portion engaging said fiber ahead of said drum, power means associated with and adapted to engage said arm for reciprocating same between two end positions defining a traversing phase in which said fiber is laid in oppositely directed helical layers over a portion of the length of the drum, said traversing arm having a normal rest position such that said arm is spaced away from said one end of said traversing phase and disengaged from said power means, means continually biasing said arm away from said rest position toward operating engagement with said power means, an electric motor, transmission means operable to drivingly connect said motor with said drum whereby to accelerate the drum from rest to a fiber drawing speed, and means responsive to and controlled by the load on the motor and effective when the speed of the drum reaches the fiber drawing speed to cause said arm to move away from said rest position and into engagement with said power means.

2. Apparatus as in claim 1 including means operable to restore said arm to said rest position and at the same time disconnect said transmission means.

3. Apparatus as in claim 1 including braking means for said drum, and disabling mechanism associated with said braking means and operable to prevent braking of the drum until such time as said arm has been restored to its rest position.

4. In fiber manufacturing apparatus of the character employing a rotary drum to draw the fiber from a fiber generating device and wind up the fiber as it is drawn, a stationary base, said drum being rotatably supported on said base, an electric motor also carried by the base, transmission means operable to drivingly connect said motor with said drum to accelerate said drum from rest to a selected fiber drawing speed, a traversing arm also supported on said base and movable in a plane substantially parallel to the axis of the drum, said arm having a portion engaging said fiber ahead of the drum, said arm reciprocable between two end positions defining a traversing phase and having a normal rest position in which the arm is located outside said traversing phase, means yieldably biasing said arm toward said traversing phase, holding mechanism normally maintaining said arm in said rest position, load sensing means electrically responsive to the load imposed on said motor by the drum and operable to cause said holding mechanism to release said arm for movement away from said rest position into said traversing phase in response to the decrease in load as the drum reaches fiber drawing speed.

5. Apparatus as in claim 4 including means operable to restore said arm to said rest position and at the same time disconnect said transmission means whereby to shift said arm out of said traversing phase during reduction in the drum speed from the fiber drawing speed.

6. Apparatus as in claim 4 including braking means for said drum, and disabling mechanism associated with said braking means and operable to prevent braking of the drum until such time as said arm has been restored to its rest position.

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