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Carlisle

[11] **3,901,455**

[45] **Aug. 26, 1975**

[54] **WINDING FIBRES**

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[21] Appl. No.: **448,566**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 278,743, Aug. 8, 1972, abandoned.

[30] **Foreign Application Priority Data**

Aug. 13, 1971 United Kingdom..... 38121/71

[52] **U.S. Cl.**..... **242/18 G;** 242/18 R; 242/43

[51] **Int. Cl.**[2]..... **B65H 54/02;** B65H 54/28

[58] **Field of Search**..... 242/18 G, 18 R, 43; 65/11 R, 11 W

[56] **References Cited**

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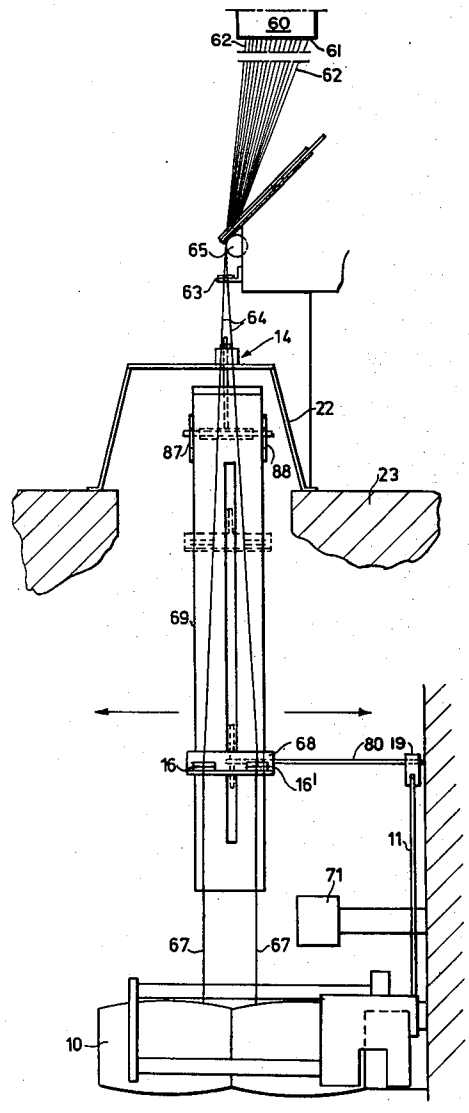
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Primary Examiner—Stanley N. Gilreath

[57] **ABSTRACT**

An improved apparatus, by means of which a cake of wound strands may be produced and from which the strands may be unwound easily and correctly, has a bushing from which filaments may be drawn and primary guide means to collect the filaments into strands. Secondary guide means receives the strands from the primary guide means and the strands are then passed over an oscillatable traverse member and are wound onto a former, the secondard guide means and the traverse member being oscillated synchronously to one another.

2 Claims, 7 Drawing Figures



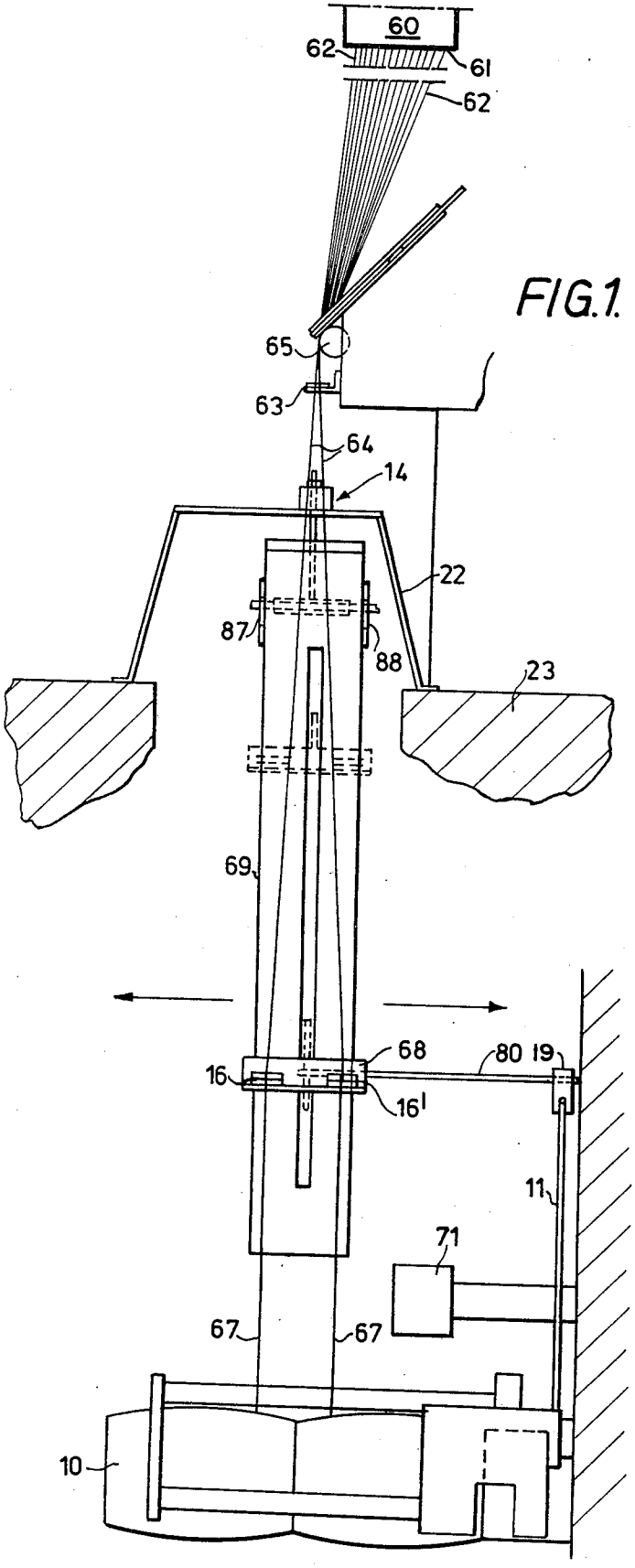


FIG.1.

FIG. 2.

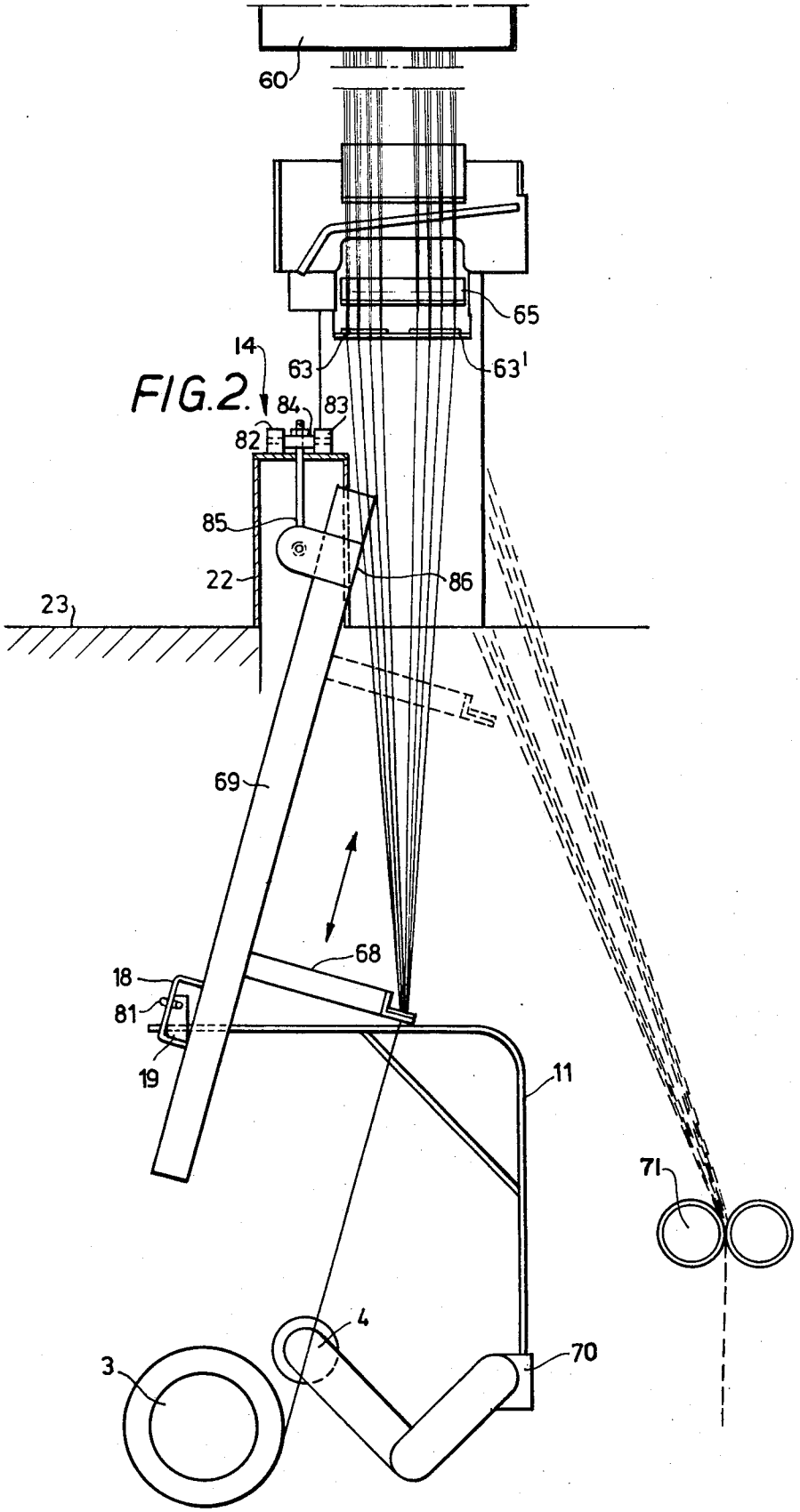
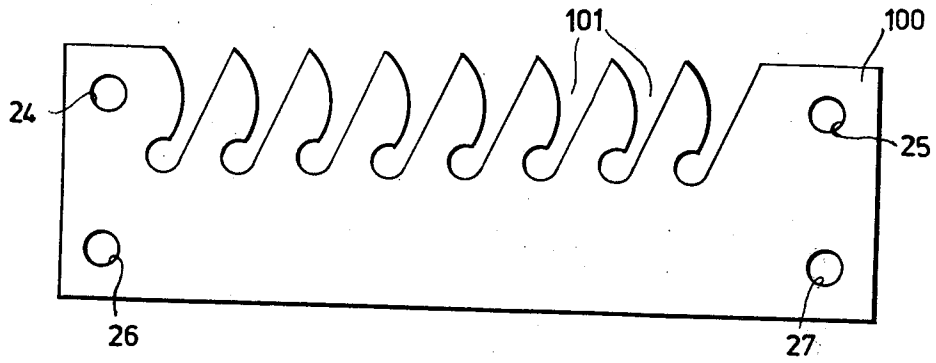


FIG. 3.



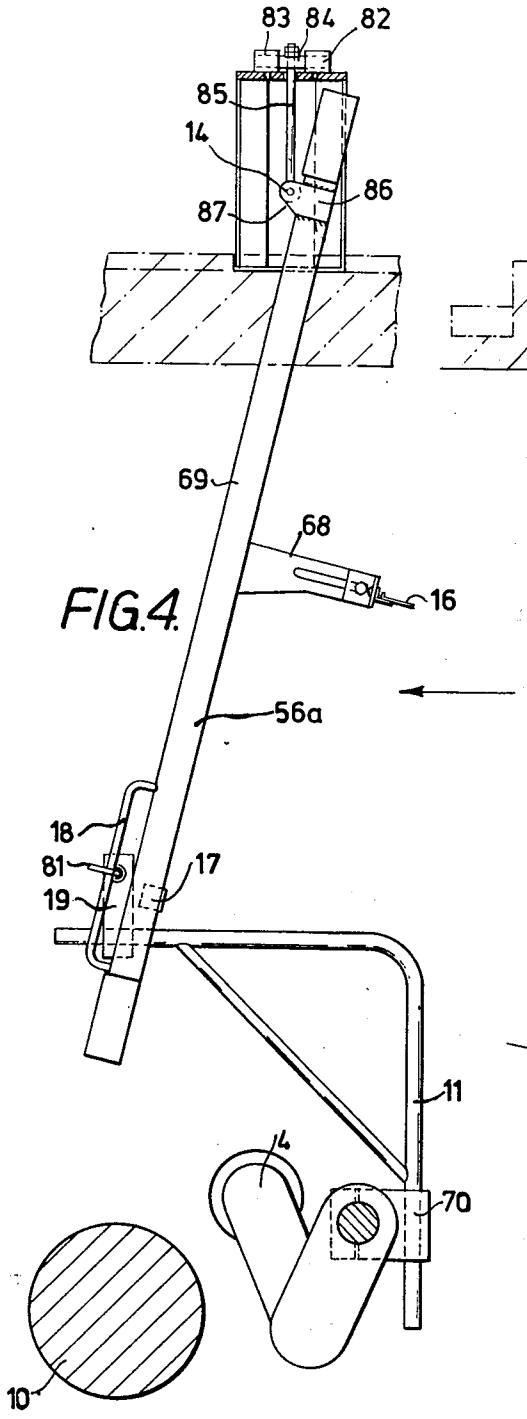

83
84
82
85
14
86
87
69
68
16
56a
18
81
19
17
11
4
70
10

FIG.4.

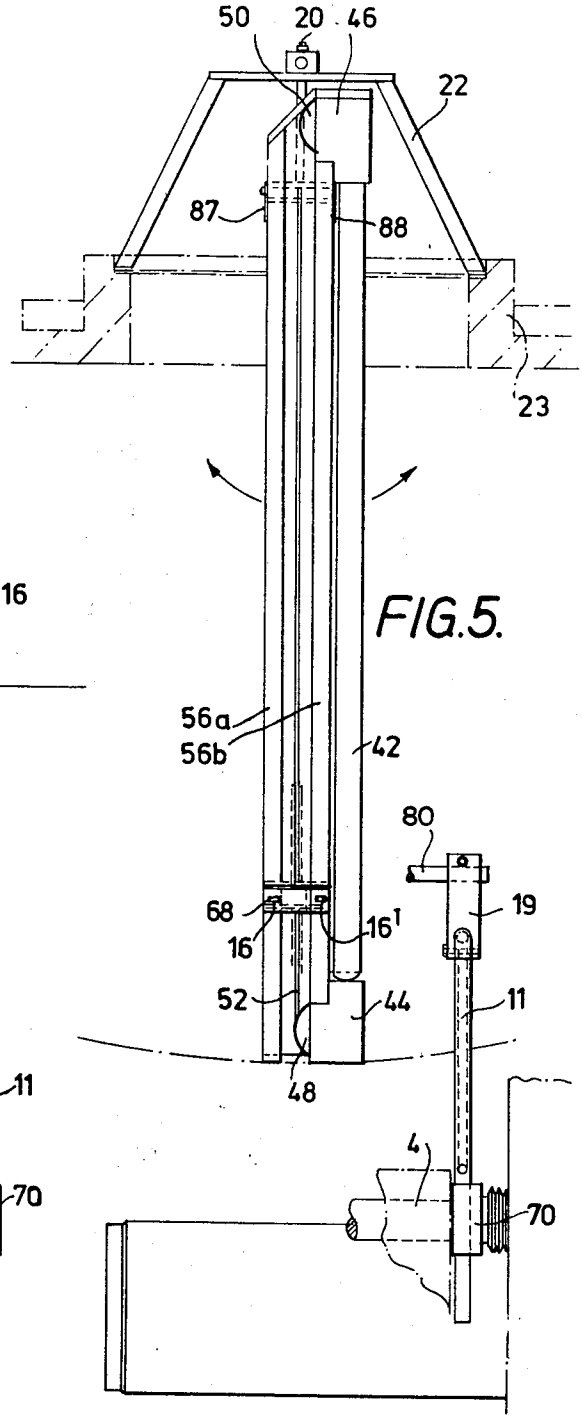

50
20
46
22
87
88
23
56a
56b
42
80
19
68
16
16'
52
44
11
48
4
70

FIG.5.

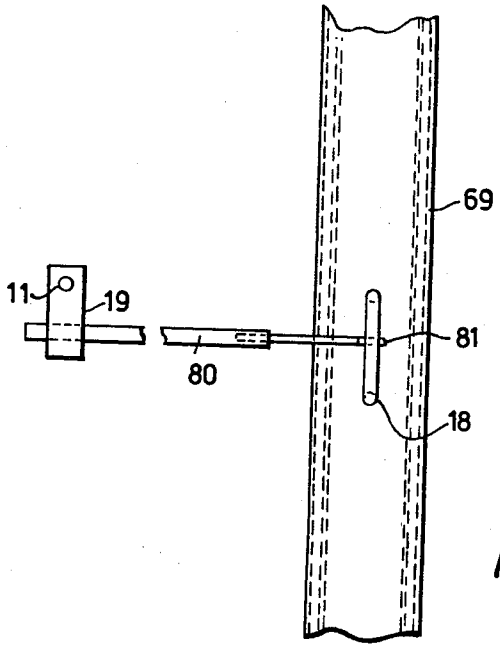


FIG. 6.

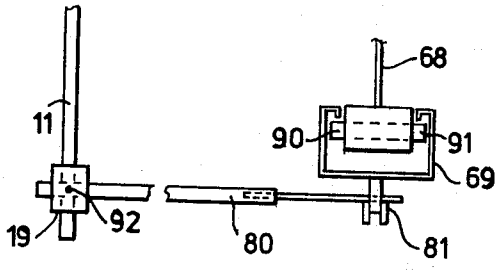


FIG. 7.

WINDING FIBRES

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part application of application Ser. No. **278,743** filed Aug. **8, 1972** now abandoned and is assigned to the assignee of the first application.

FIELD OF THE INVENTION

This invention relates to the provision of an apparatus for winding strands on to a former in an improved manner. The strands may consist of glass fibres of filaments or fibres or filaments of other materials such as synthetic resin materials, natural fibre materials and the like.

BACKGROUND TO THE INVENTION

This invention is related to improvements in systems of the kind disclosed e.g. in U.S. Pat. No. **3,321,290.** This specification U.S. Pat. No. **3,321,290** describes one form of operation for the production of glass fibres from a glass melt by means of a series of platinum bushings arranged along forehearths fed with the glass melt from a melting tank. As can be seen by reference to FIG. **15, 16** and **17** of this specification, the drawing of glass fibres is conveniently carried out with floor provided at two levels for the operators, the bushing being arranged in the upper floor area, and the winding unit in the lower floor area. It can be seen from FIGS. **16** and **17** that the single filaments drawn from the bushing are grouped together into bundles of filaments or strands **72** and **73** at a position near the bushing by means of a gathering device **364** or in FIG. **17** by means not shown. It is also known that by utilising a gathering device having a series of slots it is possible to combine or split the filaments up into more than two strands. The number of strands to be handled will depend upon the number of filaments produced, and the way in which they are split or combined.

The number of strands passing from the primary gathering device is therefore determined by the initial splitting of the filaments anc can vary, for example from as low as two to as high as **20** or even higher. With a **2,000** tip bushing as a source, **20** strands would usually have to be wound on to two formers in groups of **10** and even then it is difficult to avoid an excessive loss of split on unwinding. By loss of degree of split, we mean that on unwinding, instead of the original split of filaments being drawn, e.g. **10** strands, at points through the cake strands adhere together, and instead of **10** strands, one may, e.g. find six strands, four of which are as originally split, and the other two each being formed from three of the original strands. The amount that this occurs is determined by measuring the degree of split. The degree of split may be determined by either of the following methods:

a. a cake is unwound and a random sample of **100** meters is taken from it and the actual number of strands at various points is counted. From this degree of split is:

$$\frac{\text{Actual number of strands}}{\text{Theoretical number of strands}} \times 100$$

b. a small sample is chopped into 2 inch lengths and then each strand is weighed so that an operator knowing the weight of each original strand can construct a histogram of the number of strands at each weight obtained compared with a standard sample.

We have now found that, by use of the present invention, we can ensure that on unwinding a glass fibre cake the degree of split retained measured by one or other of the above tests is of the order of at least 90 percent, and can be as high as 100 percent. The problem of maintaining a high degree of split is particularly difficult when winding large size cakes for, e.g. greater than 10Kgms from large bushings, e.g. 1632 to 2000 tips. Previously in order to avoid excessive loss of split it has been necessary as indicated above to wind e.g. 20 strands onto two formers in groups of 10 and to limit the cake weight, the present invention enables one to wind all the strands onto the one former is desired, without excessive loss of split, or to wind two cakes as before at an increased weight and with no substantial loss of split.

The present invention while not limited to operations of the kind described in U.S. Pat. No. 3,321,290 is of particular value in improving the efficiency of such operations by ensuring a high degree of split retention, particularly during the winding of large cakes. This means that the number of times that the bushing operation must be stopped to remove a finished cake is reduced. The invention also results in a reduction in the time involved in re-strating the winding operation.

The invention is based on a filament drawing system in which strand collecting guides or shoes are provided at two positions in the path between the bushing base and the actual winding drum or collect. Such systems have previously been proposed and are in use. However in previous systems involving operations on two floors, the guides or shoes at both positions have been fixed, one usually being at a point just below the bushing (primary shoe), and the other at a point intermediate the first set and the winding drum (secondary shoe) usually below the first floor. This meant that when the first set had been threaded the operator needed to pass through the floor the bundle of strands for threading at the next position by the second operator. We have found that by making it possible for the operator to adjust by simple means the position of the secondary shoe along the path between the primary shoe and the winding drum or collet, we can improve the efficiency of the operator. In addition by making the secondary shoe oscillate synchronously with the traverse or spiral on the winding unit, and fixing the spatial position relative to the winding unit, we can attain the degree of split retention set out above. Also we can easily alter the spatial position in response to the need to alter the conditions for various products. In addition to providing means to raise and lower the secondary shoe, we also arrange for the shoe to oscillate synchronously with the traverse member or sprial. Such traverse or sprial moves the advancing strand lengthwise of the collector to provide a wound package having strand turns disposed as helices to prevent filament entanglement. Such a spiral is described in U.S. Pat. No. 2,391,870.

Such a spiral is arranged to oscillate to and fro as it rotates, and we have found it advantageous to arrange the equipment of the present invention as indicated above so that the secondary shoe oscillates synchronously from side to side with the movement of the spiral.

SUMMARY OF THE PRESENT INVENTION

An object of the invention is improved apparatus for the winding of glass fibre strands into cakes. Another object of the invention is an improved apparatus for the winding of glass fibre strands into cakes in which the degree of split retention is greater than 90 percent. Still another object of the invention is apparatus for winding glass fibre strands including guide means or shoes associated with winding means, at least one shoe being arranged to be moveable from a raised position to a lowered position, and oscillatable synchronously with traverse means provided to co-operate with the winding means. These and other objects are obtained by employing apparatus including a source of a plurality of glass filaments in the form of a container for holding molten glass, a wall of the container having openings through which flow streams of molten glass:

means for attenuating the molten streams of glass into advancing continuous glass filaments:

primary guide means for gathering the advancing continuous filaments into a plurality of strands:

winding means for winding said strands, said winding means comprising a driven drum onto which said strands are wound, and oscillatable traverse means adjacent said drum for traversing said strands during winding:

secondary guide means engaging said strands at a point between said traverse means and said primary guide means:

positioning means for carrying said secondary guide means so as to enable said secondary guide means to be selectively positioned at a point intermediate between said traverse means, and said primary guide means, said positioning means comprising an elongated member mounted so as to pivot about its upper end, connecting means connecting said elongated member to said oscillatable traverse means so as to cause it to oscillate synchronously with said traverse means, and to determine the angle said elongated member is placed to the vertical, and means to mount said secondary guide means on said elongated member to allow it to be positioned at any pre-determined point along said member. Other objects and advantages of the invention will become apparent as the invention is described in more detail with reference made to the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic view in front elevation showing the apparatus for winding glass fibre according to the invention in a process for forming and winding continuous strands of filaments formed from glass.

FIG. 2 is a diagrammatic side elevation of FIG. 1.

FIG. 3 is a plan view of the fibre contacting shoe used with the guide means in the present invention.

FIGS. 4 and 5 are front and side elevations showing in more detail the winding arrangement of the present invention.

FIG. 6 is a close-up frontal view of a portion of FIG. 2 and

FIG. 7 is a plan view of the arrangement of FIG. 6 partially sectioned.

In the drawings FIG. 1 and FIG. 2 show a process for forming continuous glass filaments from heat softened glass where the glass filaments are combined into two or more strands and subsequently collected as a wound package. In FIG. 1, a container or feeder 60 holds a supply of molten glass. The container 60 is connected to a forehearth which supplies molten glass from a glass melting tank. The container is electrically heated to maintain the molten glass at a proper fibre forming temperature and viscosity. The container 60 has a bottom 61 including a plurality of orifices or passageways for delivering streams of glass which are attenuated into individual glass filaments 62. The filaments 62 are combined into a series of strands or bundles 64 by a gathering shoe or primary guide means 63 and 63'.

The filaments may be sprayed with water above the primary guide means or gathering means 63 and 63' and it is also desirable they should be provided with a size coating. An applicator roll 65 supported within a housing and rotating in the size may be used. As the filaments 62 pass over the roll 65 some of the fluid on the roll transfers to the filaments. The strands 64 are further guided on their passage to the winding collet 10, by means of the secondary guide means 16 and 16' suspended from a pivot 14. The strands are further combined at this stage into a smaller number of strands.

In the embodiment shown in FIGS. 1 and 2 there is shown the simultaneous winding of two cakes on a single winding drum, the strands 64 having been combined into single strands 67 at the secondary guide means 16 and 16'. A double spiral traverse 4 ensures that each strand 67 is wound in helices on the winding drum 3. The direction of traverse movement of secondary guide means 16 and 16' is shown by the arrows in FIGS. 1 and 5. The winding drum 3 is fitted with a pair of cardboard sleeves before winding is commenced to enable the cakes to be removed on completion of winding.

As shown in FIGS. 1 and 2, the path of the glass strands is dictated by the presence of the primary guide means 63 and 63' and the secondary guide means 16 and 16'. The primary guide means 63 and 63' and secondary guide means 16 and 16' may be in the form of shoes 100 as shown in FIG. 3. The shoes 100 are removably retained on the guide means by pins that pass through the holes 24, 25, 26 and 27. The primary guide means 63 and 63' are fixed in position and the gathered strands are passed through slots 101 formed in shoes 100. Our invention is based on the need to be able to adjust the position of the secondary guide means relative to the winding drum in order to ensure a high degree of split retention (as defined above). Suitable means to adjust the relative spatial position of the secondary guide means 16 and 16' as shown in FIGS. 1 and 2, and in more detail in FIGS. 4 and 5. FIGS. 1 and 2 demonstrate how the relative position of the secondary guides to the winding drum or collet may be adjusted. The secondary guides 16 and 16' are mounted upon a carriage 68. This carriage 68 is in turn positionable along an elongated member 69, as indicated by the arrows in FIG. 2. In FIG. 2 the carriage is shown in two positions on the member 69, the dotted lines showing a raised position.

The elongated member 69 as can be seem by reference to FIGS. 1 and 2, and FIGS. 4 and 5, is adjustable to an angle from the vertical. This adjustment can be described by reference in particular to FIGS. 4 and 5, in which an arm 11 is shown connecting the end of the traverse 70 to a block 19. A rod 80 is fixed in the block 19 at right angles to the rod 11. The elongated member 69 is provided with a handle 18. The end of the rod 80 is provided with a U-shaped end 81, and the arms of the

U are arranged to fit around the handle **18** as shown in FIGS. **6** and **7.** Movement of the block **19** along the arm **11** enables the elongated member **69** to be adjusted to the vertical about its mounting at a pivot **14,** as indicated by the arrow in FIG. **4.** This mounting is formed by providing a supporting frame work **22** fixed above an opening in the floor **23** upon which rest bearing blocks **82** and **83.** The bearing blocks provide a bearing for the rod **84** which is provided with a hole through which a support member **85** passes and is held in place at its upper end by having a screw thread at that end, and a locking nut placed on that thread. At the opposite end, the elongated member **69** is attached by means of a collar **86** fixed to the member. The collar extending from the member to provide bearing flanges **87** and **88.** The pivot **14** is thus formed by the rod passing through these bearing flanges, and a bearing block or hole in the end of the support member **85.**

The member **69** is therefore connected to the end of the traverse member **70** so that when the traverse is caused to oscillate from side to side because of the connection between end **70** and handle **18,** the elongated member **69** also moves from side to side about the pivoting point formed by the bearing blocks **82, 83** and the rod **84.**

The connection between the handle **18** and the U-shaped end **81** of the rod passing into the block **19** allows movement i.e. it allows for the movement in an arc, as the member **69** moves from side to side synchronously with the spiral or traverse.

Thus by utilising the mounting arrangement described above, we can both adjust the relative spatial position of the guide means **16** and **16'** to the winding drum **10,** and also arrange for the guide means to move from side to side synchronously with the traverse member or spiral.

Thus by moving the carriage **68** along the member **69,** and the member **69** along the rod **11,** the relative position of the guide means **16** and **16'** to the winding winding drum **10** can be adjusted as desired. The distance we measure is that between the end of the guide means **16** and **16'** and the centre of the winding drum **10.**

In FIGS. **4** and **5** can be seen one embodiment of the means employed to position the carriage **68** at a point along the length of the elongated member **69.** A double acting air cylinder **42** is equipped at opposite ends with suitable air ports (not shown) in order to operate a movable piston (not shown) installed within. At opposite ends of air cylinder **42** are housings **44** and **46,** within which are pulleys **48** and **50,** only portions of which are shown. A cable **52** is movable on pulleys **48** and **50,** and has its opposite ends connected to the piston within air cylinder **42,** so that movement of the piston in either direction results in movement of cable **52.** The function of cable **52** is to position guide shoes **16** and **16'.** The cable runs within the elongated member **69,** which is shaped to provide a runway, as can be seen by reference to the partial plan view in FIG. **7.** The cable has mounted on it the carriage **68** which in turn is provided with runners **90** and **91.**

The cable **52** has the carriage **68** attached to it. Thus when the air cylinder piston is adjusted, the cable moves and in turn the carriage **68** moves on its runners within the runway in the member **69.**

Thus before the actual operation of winding is commenced, the equipment must be adjusted to ensure that during winding the guide means **16** and **16'** on the carriage **68** are in correct spatial position. This is done by adjusting the position of the block **19** on the rod **11,** and then passing a pin **92** through both the block and rod to hold it in that position. The range of movement of the carriage **68** is restricted by providing stops within the runway in the member **69.** The lower most stop **17** is shown in FIG. **4.**

Considering the operation of the winding equipment of the invention as illustrated in FIGS. **1** to **7,** a first operator in order to commence winding cakes of glass fibres, takes the filaments **62** leaving the bushing **60** and gathers all the filaments together. He then passes these filaments down to pull rolls **71.** The pull rolls will have the effect of starting the drawing and attenuating of the filaments. Once the first operator is satisfied that the drawing has commenced satisfactorily he uses the primary guide means **63** and **63'** to make the first split of the filaments into strands. His next task it to ensure that the carriage **68** is in the raised position and once it is he carries out a further gathering of the strands reducing the number of individual strands to, in the present case, two. This is conveniently done by removing the shoe as shown in FIG. **3** from the pins on which it is mounted on the carriage **68,** gathering the strands into the slots, and then replacing the shoe on the carriage **68.** Once this second split has been carried out, the second operator transfers the strands from the pull wheel onto the winding drum **3,** and as the drum is run up to winding speed, the carriage **68** moves to a predetermined position on the elongated member **69,** by operating the air cylinder **42** so as to move the cable **52** and in turn the carriage **68** carrying the secondary guide means **16** and **16'.**

The position selected for the guide means near to the traverse or spiral is chosen so as to regulate the spacing of the shoe of the secondary guide means from the centre of the former **3,** and our experiments have shown that we can ensure at least 90 percent degree of split if this spacing is in the range of 517 mm to 813 mm. The lower end of this range from 517 mm to say 670 mm is preferably used for cakes which are going to be used in the manufacture of chopped strand mat since, for that purpose, it does not really matter how the glass strands are unwound from the cake so long as a high degree of split is obtained. At the other end of the distance range scale, for example, from 713 mm to 813 mm spacing it has found that improved winding characteristics are obtained for strands which are going to be used for rovings.

What is claimed is:

1. An apparatus for winding glass fibre strands into cakes comprising:

a source of a plurality of glass filaments in the form of a container for holding molten glass, a wall of the container having openings through which flow streams of molten glass: means for attenuating the molten streams of glass into advancing continuous filaments: primary guide means placed below said container for gathering the advancing continuous filaments into a plurality of strands,

winding means on which glass fibre strands are formed into cakes, including at least a driven drum onto which said strands are wound, and oscillatable traverse means adjacent said drum for traversing said strands during winding,

secondary guide means positioned at a point intermediate said traverse means and said primary guide means for further combining and guiding said glass fibre strands on their passage between the primary guide means and the winding drum,

positioning means for selectively positioning said secondary guide means at a point intermediate between the traverse means and the primary guide means, comprising an elongated member mounted so as to pivot about its upper end, connecting means connecting said elongated member to said oscillatable traverse means so as to cause it to move from side to side synchronously with the oscillations from side to side of said traverse means, and to determine the angle said elongated member is placed to the vertical, and means to adjustably mount said secondary guide means on said elongated member to allow it to be positioned at any pre-determined point along said member.

2. Apparatus for winding glass fibre strands into cakes comprising:

a container for molten glass which container has a plurality of openings therein through which flow streams of molten glass, means for attenuating the streams of molten glass to filaments, primary guide means for gathering the filaments into a number of strands, a driven former onto which the strands are wound to form a cake, an oscillatable traverse means disposed adjacent the former and in the path of the strands being wound, secondary guide means for guiding said strands intermediate the primary guide means and the traverse means, said secondary guide means being mounted for movement longitudinally along an elongate member to take up a predetermined position, said elongate member extending in the general direction between the primary guide means and the traverse means at a pre-adjusted angle to the vertical and, connecting means between the elongate member and the traverse means so that the elongate member oscillates synchronously with the traverse means about a pivot at the end of the elongate member adjacent the primary guide means.

* * * * *