

Sept. 19, 1961

A. L. SOKAL
EXPANSIBLE MANDREL

3,000,585

Filed Nov. 29, 1957

2 Sheets-Sheet 1

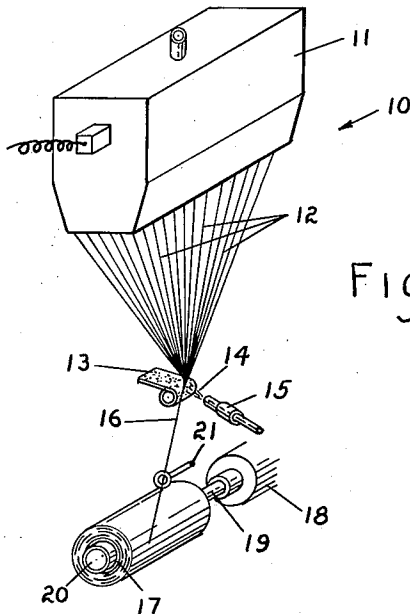


Fig. 1

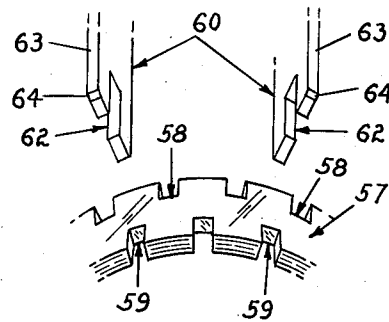


Fig. 5

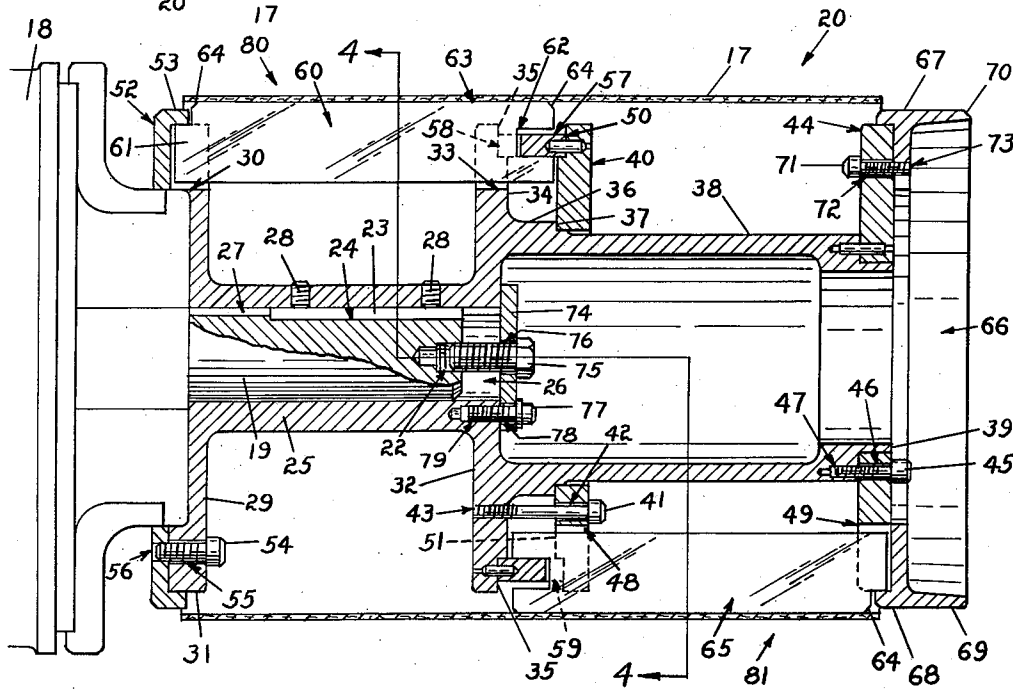


Fig. 3

INVENTOR.
Andrew L. Sokal
BY
Nobbe & Swope
ATTORNEYS

Sept. 19, 1961

A. L. SOKAL
EXPANSIBLE MANDREL

3,000,585

Filed Nov. 29, 1957

2 Sheets-Sheet 2

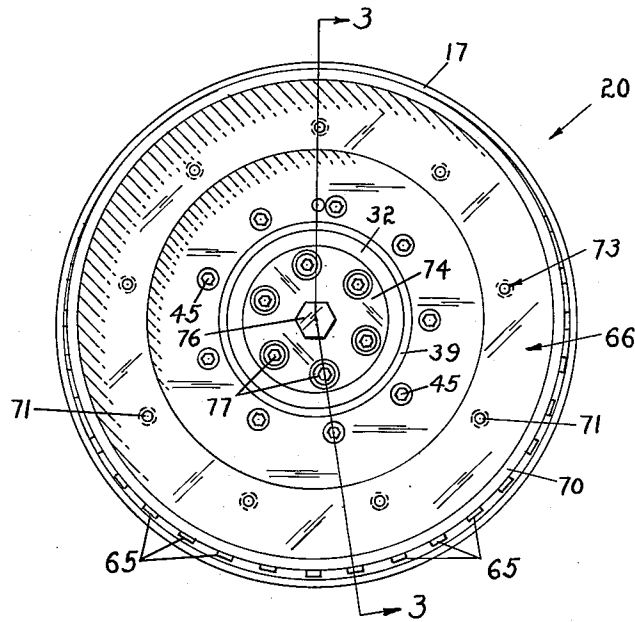


Fig. 2

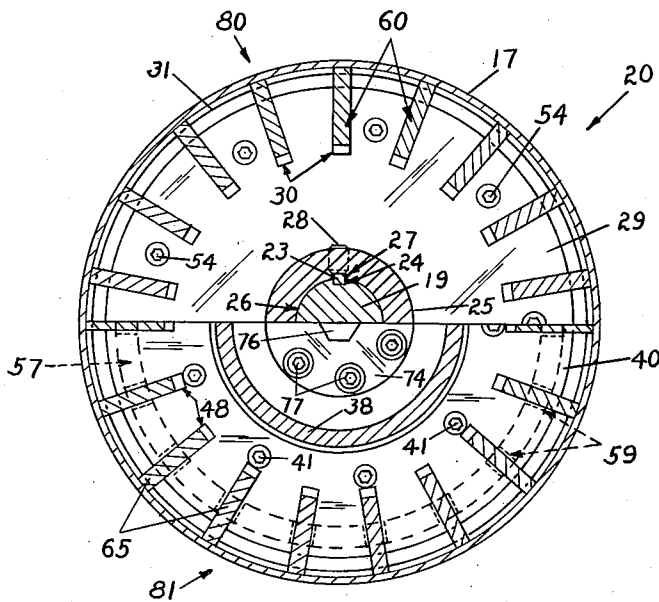


Fig. 4

INVENTOR.
Andrew L. Sokal
BY
Hobbs & Swope
ATTORNEYS

1

3,000,585

EXPANSIBLE MANDREL

Andrew L. Sokal, Waterville, Ohio, assignor, by mesne assignments, to Johns-Manville Fiber Glass Inc., Cleveland, Ohio, a corporation of Delaware
Filed Nov. 29, 1957, Ser. No. 699,688
5 Claims. (Cl. 242—72)

This invention relates broadly to an expansible mandrel for rotating a cylindrical core in unison therewith. More specifically, it relates to a mandrel which is smaller in diameter than the inside of the core when the mandrel is at rest and which increases in diameter to firmly grip the core when the mandrel is rotated about its axis.

The particular mandrel forming the subject matter of the present invention is primarily used in the winding of textile fibers into a cake or package of substantially cylindrical form. In recent years, the textile industry has intensified its efforts to improve its operating efficiency and included among the improvements was the adoption of a core that is larger in diameter and length than those formerly used. The larger core permits the winding of greater yardage into a cake and consequently reduces the "down" time required for changing cores in an amount directly proportional to the increased yardage in the larger size cakes as compared to the smaller size cakes.

With the increase in yardage per cake, the mass of the cake increased proportionately and the design principles which were adequate for the smaller size mandrels could not merely be enlarged. The principles disclosed in the present invention were combined to satisfy the needs as hereinafter disclosed.

It is therefore an object of this invention to provide an expansible mandrel which at rest is smaller in diameter than the inside diameter of the core.

It is another object of this invention to provide a mandrel which upon rotation is expanded by centrifugal force to firmly grip the inside diameter of the core at regularly spaced intervals.

It is still another object of this invention to provide a mandrel which upon rotation is expanded by centrifugal force to center the core upon the mandrel.

It is still another object of the invention to provide a mandrel which in expanded condition exerts an equally distributed diverging force upon the interior of the core to true the diameter thereof.

Other objects and advantages of the invention will become more apparent during the course of the following description when taken in connection with the accompanying drawings.

In the drawings wherein like numerals are employed to designate like parts throughout the same:

FIG. 1 is a perspective of one form of filament drawing apparatus;

FIG. 2 is a view of the mandrel taken from the free or loading end;

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 2;

FIG. 4 is a cross-sectional view taken on the line 4—4 of FIG. 3; and

FIG. 5 is a fragmentary exploded perspective of two of the core gripper bars and the central retaining ring therefor.

Referring to FIG. 1 of the drawing, the numeral 10 designates filament drawing apparatus in general. The form shown is that generally used in the production of glass filaments which are collected to form a single strand. However, the scope of the instant invention is in no way to be construed as being limited solely to this application.

The drawing apparatus 10 includes a bushing 11 wherein glass is reduced to a fluid state by heat applied

2

to the bushing in any manner. As the fluid glass reaches a predetermined consistency, fine streams exude from a multitude of small openings extending through the bottom of the bushing, are attenuated into fine filaments 12, are collected at a pad 13, or its equivalent, and a lubricant or a size 14 is applied at this point by a pressurized nozzle 15. The collected strand 16 is then wound upon a laminated paper core 17. A motor 18 has an output shaft 19 which rotates a mandrel 20 and the core 17 at a constant lineal speed in excess of the lineal rate of draw thereby attenuating the strand 16 prior to winding on a core. The numeral 21 diagrammatically illustrates a device for traversing the strand longitudinally of the core 17 to produce a symmetrically contoured package.

As shown in FIG. 3, an internally threaded hole 22 enters the end of the motor shaft 19 and a flat key 23 is seated in a keyway 24 machined in the shaft. Both the threaded hole 22 and the key 23 serve to retain and rotate the mandrel 20 in unison with the shaft 19.

The mandrel 20 has a central hub 25 extending less than half the length thereof which hub is provided with a bore 26 and a keyway 27 cut longitudinally of the bore adapted to respectively receive the motor shaft 19 and the key 23 with the latter retained by set screws 28. A circular flange 29 is formed on the end of the hub 25 adjacent the motor 18 in concentric relation to the hub 25 and a plurality of slots or apertures 30 extend inwardly from the periphery 31 at regularly spaced angular intervals. As shown in FIG. 4 the slots are at 20 degree intervals, however, any other angle providing equal spacing may be used. A similar flange 32 of equal diameter to the flange 29 is provided at the other end of the hub 25 and is provided with a plurality of slots or apertures 33 equal in number to the slots 30 and in alignment therewith. The face 34 of the flange 32 remote from the motor 18 is machined adjacent the periphery to provide a seat 35 concentric with the hub 25 for a purpose which will become apparent.

An enlarged diameter tubular extension 36 of the hub 25 projects a short distance from the face 34 of the flange 32, reduces in diameter to form a circular shoulder 37 and continues at a second reduced diameter 38 to a still smaller circular pilot 39.

An annular flange 40 is seated against the shoulder 37 and retained by screws 41 extending through a plurality of clearance holes 42 in the flange 40 and engaging threaded holes extending through the flange 32. A second annular flange 44 is received by the pilot 39 and is secured to the hub extension 38 by a plurality of screws 45 passing through clearance holes 46 in the flange 44 and entering threaded holes 47 in the hub extension 38. The flange 40 and the flange 44 are identical in diameter to the flanges 29 and 32 and each respectively have a plurality of notches 48 and 49, equal in number, dimensions and in similarly paired alignment to the slots 30 and 33, but with the centerlines of each pair of notches 48 and 49 preferably bisecting the angle defined by the centerlines passing through adjacent pairs of slots 30 and 33. A seat 50 is formed on the face 51 of the flange 40 and is positioned in alignment with and in opposition to the seat 35 on the flange 32.

An annularly shaped end plate 52 has a rim 53 extending inwardly to encompass the outside diameter of the flange 29 and is secured to the flange by a plurality of screws 54 passing through clearance holes 55 extending through the flange 29 and engaging threaded holes 56 extending through the end plate 52.

An annular ring 57 is clamped between the seats 35 and 50, respectively formed on flanges 32 and 40. The ring 57 is recessed on alternate sides, as shown in FIGS. 3, 4 and 5. The recesses adjacent the flange 32 are designated by the numeral 58 and are aligned with the

slots 30 in the flange 29 and the slots 33 in the flange 32. The recesses adjacent the flange 40 are designated by the numeral 59 and are aligned with the notches 48 in the flange 40 and the notches 49 in the flange 44.

A plurality of bars 60 for gripping the core 17 are made of sheet steel or other suitable material cut into a substantially rectangular shape with the thickness slightly less than the width of the slots 30 and 33 and a length slightly shorter than the face-to-face distance between the end plate 52 and the flange 40. The one end of each of the gripper bars 60 is provided with a projection 61 confined within the slot 30 and the rim 53 for outward movement when acted upon by centrifugal force and for inward movement when acted upon by the force of gravity. The other end of each bar 60 extends through the slot 33 and into the notch 58 and is provided with a recess 62 entering from the end of the bar and extending through the thickness of the material. The recess 62 is slightly greater in width than the thickness of the annular ring 57 and permits outward and inward movement of this end of the bar of the same magnitude as the other end so that the gripping face 63 of each bar is at all times parallel to the axis of the mandrel 20. The ends of the gripping face 63 are provided with bevels 64 to facilitate removal and replacement of the core 17.

An additional set of gripper bars 65, identical in physical shape and form to the bars 60, are turned end for end and confined between the flange 32 and an annular end cap 66. The end cap 66 has a rim 67 which is T shaped in cross-section with one leg 68 of the T encompassing the periphery of the flange 44 to limit the outward travel of the bar 65 within its slot 49. The other leg 69 of the T projects into space and is provided with a bevel 70 at its extremity to guide replacement of the core 17. The inner end of each bar 65 is retained by a notch 48 in the flange 40 and by a recess 59 in the annular ring 57 in a manner identical to that described previously in connection with the bar 60.

Screws 71 retain the end cap 66 in encompassing relation with the flange 44 by passing through clearance holes 72 in the flange 44 and engaging threads formed in holes 73 extending through the web portion of the cap 66.

Additional means for retaining the mandrel 20 on the motor shaft 19 is provided by a circular plate inserted into the cavity within the tubular hub extension 36 and secured by a screw 75 which passes through a central clearance hole 76 in the plate and engages the threads in hole 22 of the motor shaft and by additional screws 77 passing through clearance holes 78 extending through the plate at regularly spaced intervals adjacent the periphery thereof which screws 77 engage threads formed in holes 79 entering the end of the hub 25 in concentric relation to the axis thereof.

The gripper bars 60 collectively comprise a first gripper bank 80 and the gripper bars 65 collectively comprise a second gripper bank 81. When the mandrel 20 is at rest the gripper bars 60 and 65 are individually attracted by gravity so that those at the top of the mandrel 20 are retracted and those at the bottom of the mandrel are extended. With the bars 60 and 65 in the "at rest" position, a core may be freely slid onto the mandrel and will hang loosely therefrom. However, as the mandrel 20 is rotated, the individual gripper bars 60 and 65 are moved into a partially extended position, which since the force is applied equally upon all the bars to urge them away from the axis of the mandrel centers the core 17 about the axis and the circumference of the core, if other than circular, is transformed to a true diameter. Simultaneously therewith, the bars 60 and 65 grip the interior of the core 17 firmly to rotate it in unison, without slippage, with the mandrel 20. When rotation of the mandrel is halted, the gripper bars 60 and 65 return to their initial position and the force acting upon the inside of the core is released.

The two banks 80 and 81 comprised of gripper bars 60 and 65 and the angular displacement of the bars of one bank in relation to the other provide a number of salient advantages over a single bank of bars extending the full length of the core 17, including centering of the core about the axis of rotation, truing the diameter of the core, positive gripping action of the bars with the core upon rotation of the mandrel, and elimination of an outward bowing of the full length bars at the mid-section.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred embodiment of the same, but that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. In apparatus for winding continuous filamentary material on a semi-rigid core comprising an expansible mandrel that is symmetrical about an axis, a motor connected to rotate said mandrel about said axis, the improvement comprising a hub in concentric relation to said axis, first and second flanges at the terminal ends of said hub having equal peripheral diameters concentric with said axis, each of said flanges defining a plurality of identical slots extending radially and inwardly from the periphery of each flange and with each slot in said first flange in alignment with a slot in said second flange, an extension for said hub concentric with said axis, a third flange on said hub extension in spaced proximity to said second flange, a fourth flange at the terminus of said hub extension spaced apart from said third flange a distance equal to the length of said hub, said third and fourth flanges having equal peripheral diameters concentric with said axis and equal to the diameters of said first and second flanges, each of said third and fourth flanges defining a plurality of slots equal in number to the slots in said first and second flanges extending radially and inwardly from the peripheries of said third and fourth flanges with each slot in said third flange in alignment with a slot in said fourth flange and with said aligned slots in said third and fourth flanges displaced from the said aligned slots in said first and second flanges an amount equal to one-half the angle included between adjacent aligned slots in said first and second flanges, a bar having a core gripping surface extending parallel to said axis mounted in each pair of aligned slots, each of said bars being radially movable in respect to said axis, and mechanical means engaging the ends of said bars to limit the magnitude of said movement.

2. An expansible mandrel that is symmetrical about an axis and is adapted to wind continuous filamentary material on a yieldable core, the improvement comprising, in combination: a first hub portion concentric with said axis; a first pair of flanges extending from said first hub portion, each of said flanges defining a plurality of regularly and correspondingly spaced apertures, said apertures of one flange of said first pair equalling in number and being in alignment respectively with said apertures of the other flange of said first pair to provide first pairs of aligned apertures; a second hub portion in longitudinal alignment with said first hub portion; a second pair of flanges extending from said second hub portion, each of said flanges defining a plurality of regularly and correspondingly spaced apertures, said apertures of one flange of said second pair equalling in number and being in alignment respectively with said apertures of the other flange of said second pair to provide second pairs of aligned apertures, said second pair of aligned apertures being respectively angularly displaced relative to said first pairs of aligned apertures one-half the angular distance between the apertures of said first pairs of aligned apertures; a flat bar for each pair of apertures, each of said bars having its end portions positioned in said apertures to permit radial movement of said bar in respect to said axis; and means engaging the ends of said bars to limit the magnitude of said radial movement.

5

3. In a centrifugally expansible mandrel that is substantially symmetrical about an axis, and adapted to wind continuous filamentary material on a yieldable core, the improvement which comprises, in combination: a plurality of hub portions arranged concentrically about said axis; a flange positioned adjacent the end of each hub portion, the flanges associated with each hub portion constituting a pair; each flange having a plurality of similar slots spaced at equal angular intervals adjacent the outer periphery thereof; a bar having a gripping surface extending parallel to said axis for each pair of slots and being supported for radial movement in respect to said axis in said slots, said bars being arranged in banks, one bank for each pair of flanges, and said banks being arranged to support said core throughout its length; and means associated with said flanges to limit the radial movement of said bars.

4. An apparatus for winding a continuous filamentary material on a cylindrical core comprising a centrifugally expansible mandrel symmetrical about an axis and having two hub portions, and means for rotating said mandrel to apply said centrifugal force, the improvement comprising, in combination: a bank of bars for each of said hub portions, each of said bars being radially movable in respect to said axis; a core gripping surface on each bar; flange means for supporting therein each of said bars within a bank at equal angular intervals, the bars of one bank being angularly displaced from the bars of the other bank by an amount equal to one-half of said

6

angular intervals; and means associated with said flange means for limiting the radial movement of said bars.

5. In an expansible mandrel adapted to wind continuous filamentary material on a yieldable core, the improvement comprising, in combination: a hub concentric with the axis of said mandrel; a plurality of flanges exceeding two transverse to the longitudinal axis of said mandrel and concentric with said axis, said flanges being arranged in pairs of each flange defining a plurality of apertures, the apertures of one flange of a pair being in alignment with the apertures of the other flange of the pair to form pairs of apertures; a bar member for each pair of apertures, said bar member being radially movable in respect to said axis within said pair of apertures, the ends of said bars being of a configuration to adapt said ends for insertion within radial movement restricting means, said bars being arranged in banks to support said core throughout its length; and means for receiving said bar members and restricting their radial movement.

References Cited in the file of this patent

UNITED STATES PATENTS

734,747	Rabbeth	July 28, 1903
2,274,681	Fletcher	Mar. 3, 1942
2,755,027	Jones et al.	July 17, 1956

FOREIGN PATENTS

891,964	France	Dec. 17, 1943
---------	--------	---------------