Aug. 25, 1959 E. BOBKOWICZ 2,900,782

UNIVERSAL SPINNING UNIT

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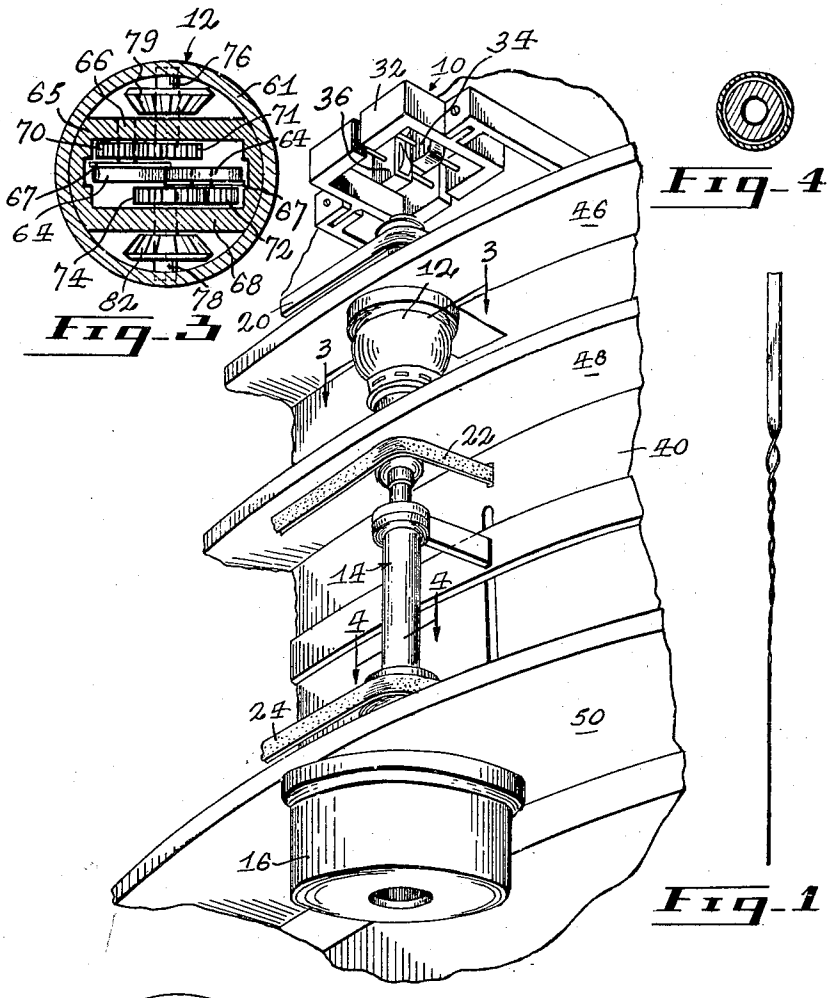


Fig-4

Fig-1

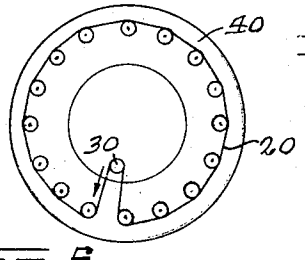


Fig-5

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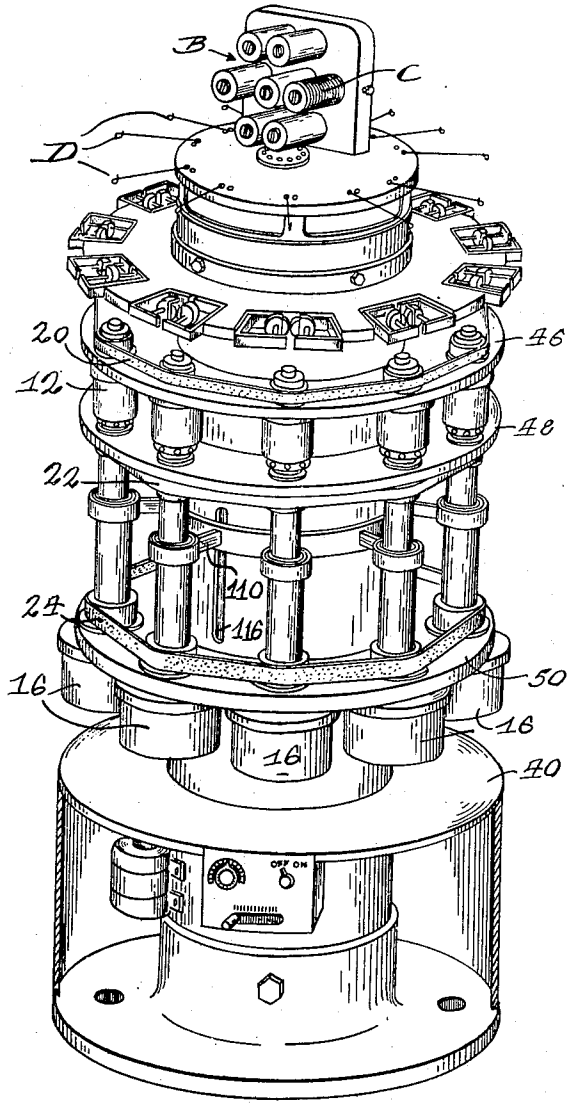


Fig. 6

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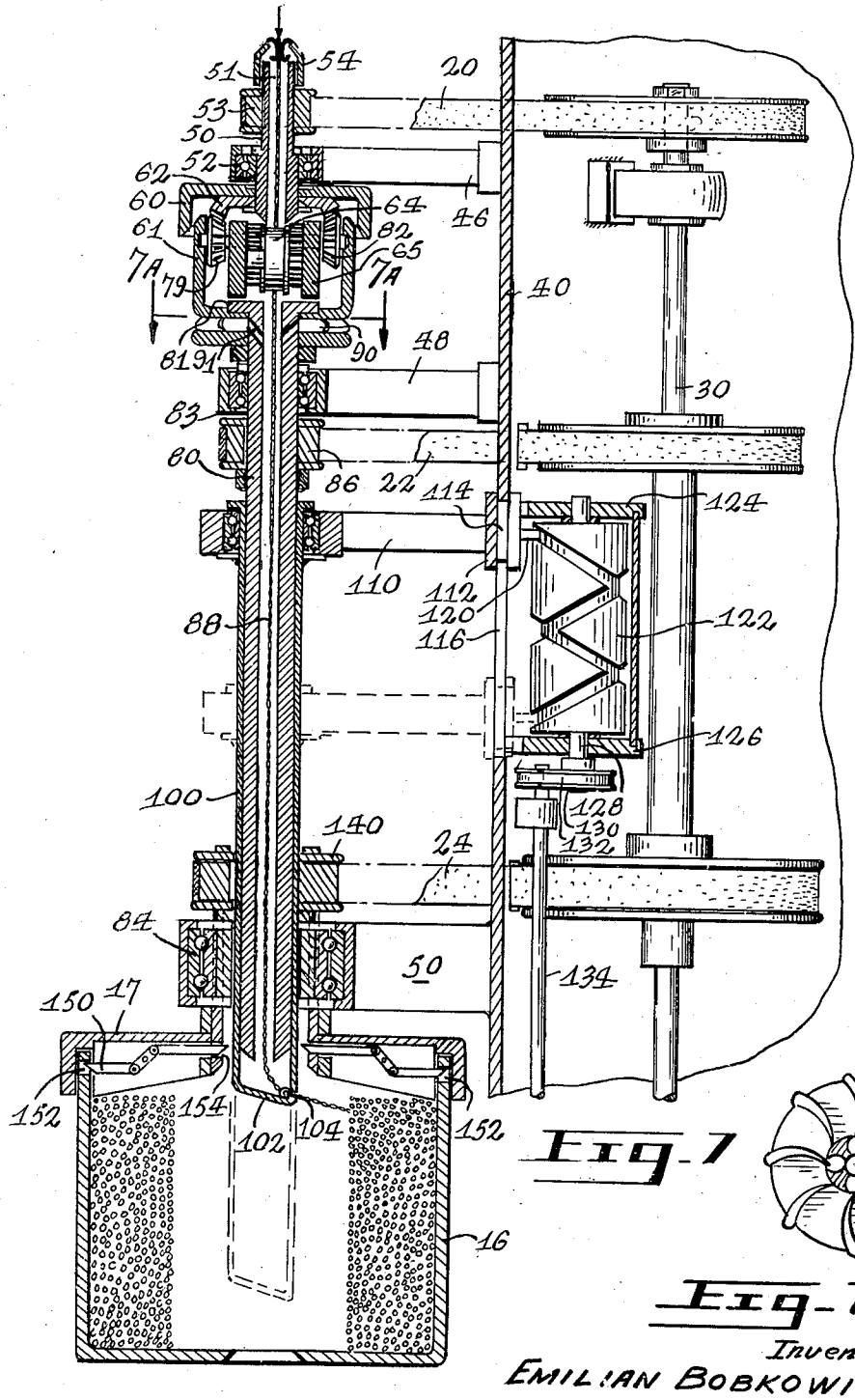


Fig. 1

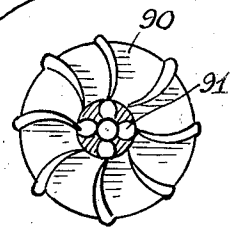


Fig. 1A

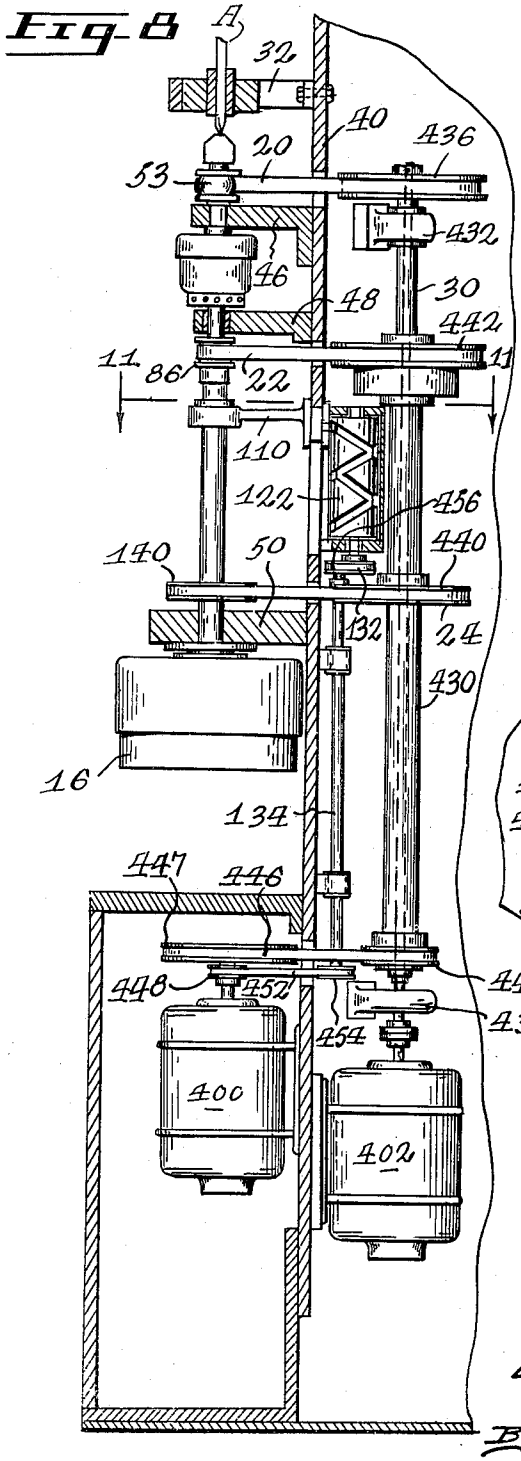
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Fig. 8



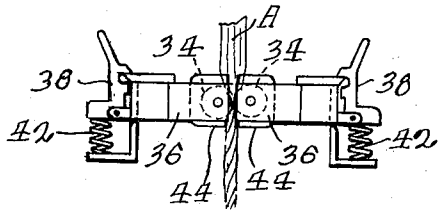


Fig. 10

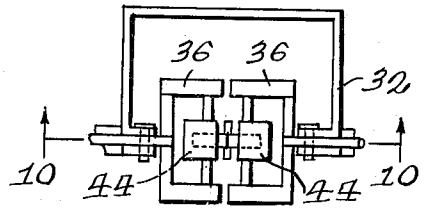


Fig. 9

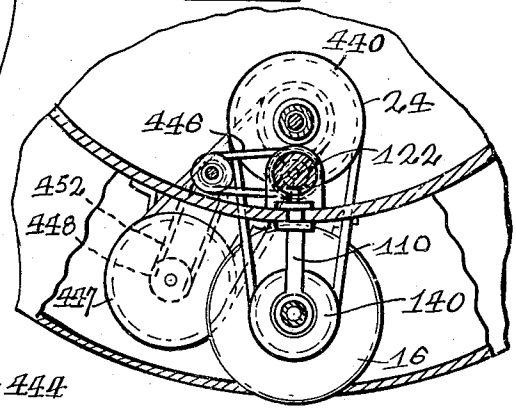


Fig. 11

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UNIVERSAL SPINNING UNIT

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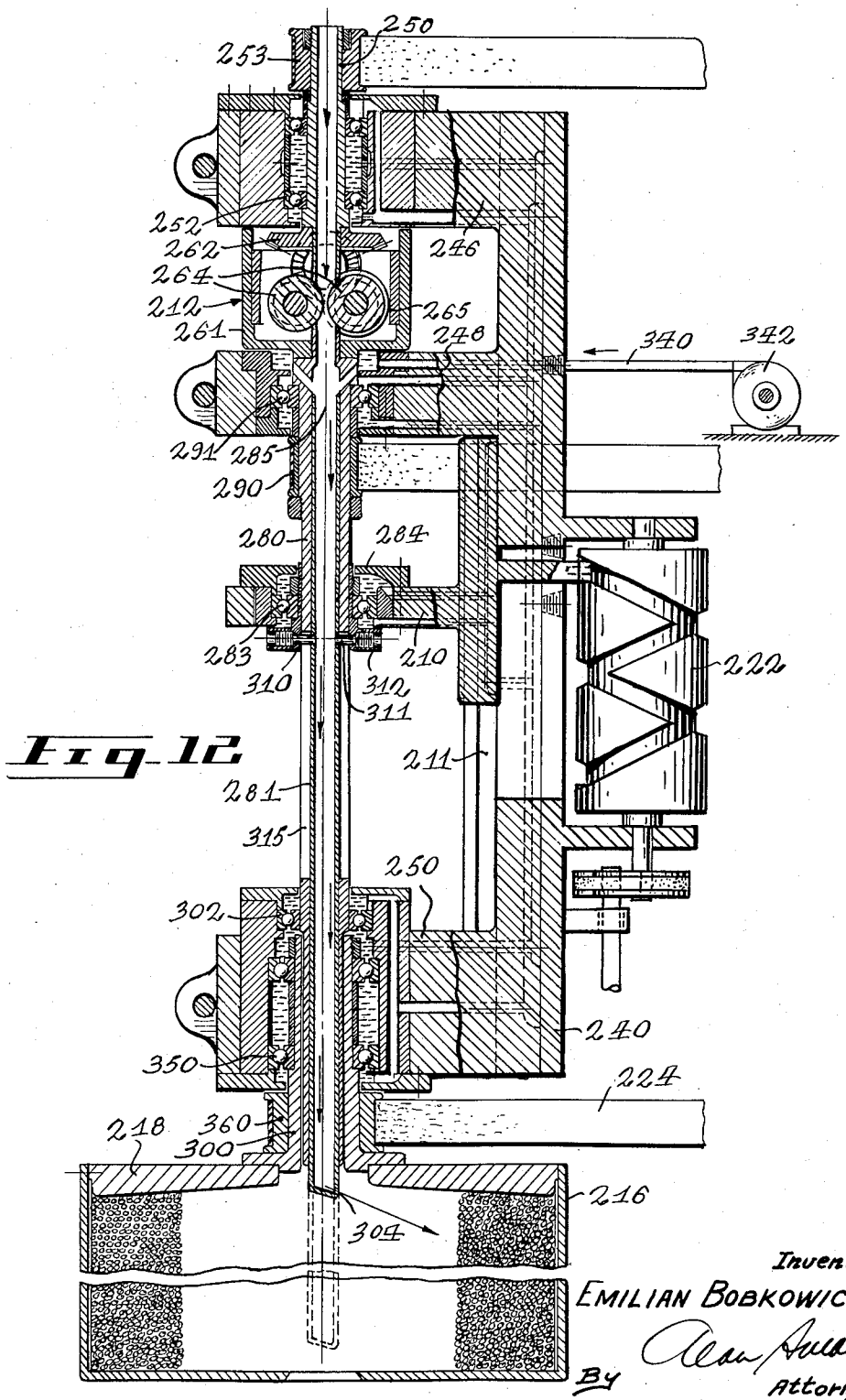


Fig. 12

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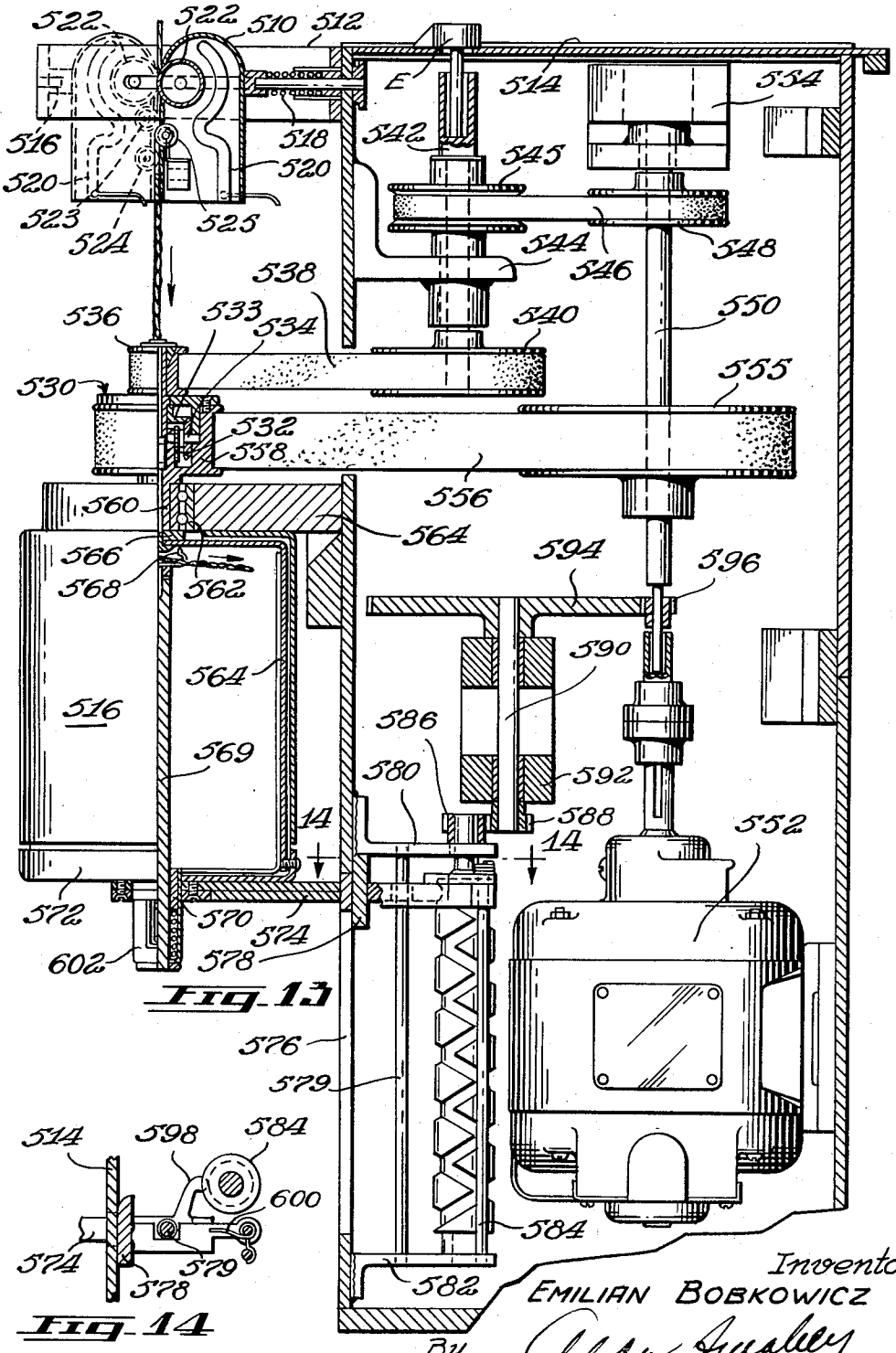


Fig. 13

Fig. 14

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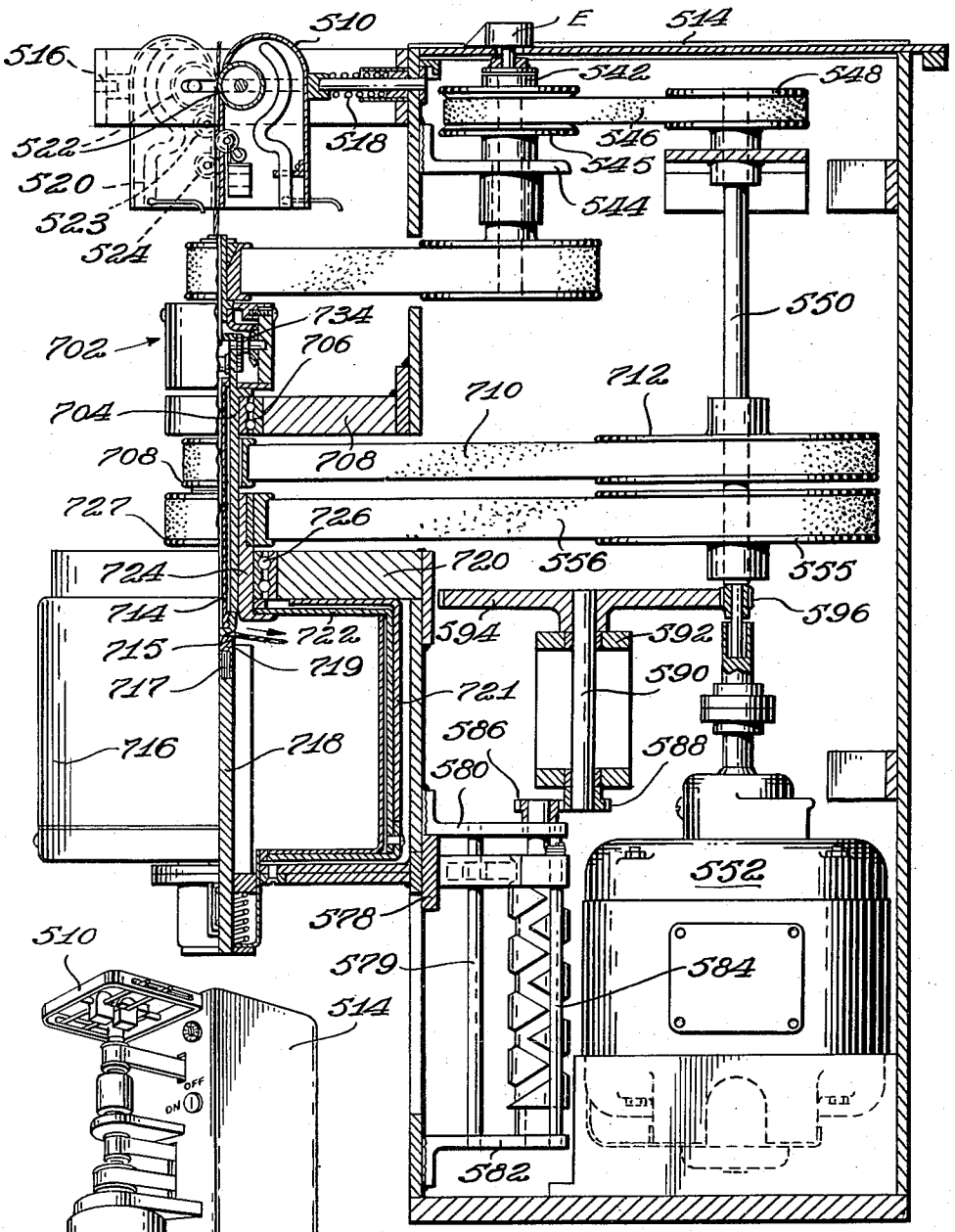


FIG. 16

FIG. 15

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2,900,782

UNIVERSAL SPINNING UNIT

Emilian Bobkowicz, Montreal, Quebec, Canada

Application June 10, 1957, Serial No. 664,749

16 Claims. (Cl. 57—31)

The present invention relates to improvements in the spinning of yarn, twine or cord and more particularly to an improved method and apparatus especially adapted to insert a heat-welded locked twist into semi-plastic textile fiber strips, for example the type of yarn disclosed in the applicant's co-pending United States application, Serial No. 284,284, filed April 1952, now abandoned. The apparatus and method of the invention can also be utilized for spinning and twisting of conventional yarns, twines, without using the heat-welding device.

To impart a heat-welded twist into semi-plastic fiber strips strongly bonded together allows much higher spindle speeds than spinning of conventional yarn from rovings of loose fibers. The heat-welding twisting operation of such fiber strips necessitates the application of the twist in a straight line directly to the twisting axis to obtain an even yarn and twist, which is not the case in any of the conventional yarn twisting means, for example flyer cap, flyer, ring spindle or pot, due to the gyration of balloons of yarn around the twisting point.

The application of outside pressure to the semi-plastic yarn towards its axis, while the imparted plastic agents are still soft, is essential to obtain a properly heat-welded tight twist to form a strong bond of a smooth, even, continuous homogeneous filament with a permanently locked in fiber twist. Increased speed of spinning necessitates a device to collect a large package of yarn otherwise the advantages of high speed will be outbalanced by too many doffing operations.

All of the conventional spinning and twisting methods and means are mechanically limited in package, size, speed and none of them are capable of meeting all the needs as described above.

The method and the apparatus of the present invention are particularly designed to meet the requirements for imparting at high speed a heat-welded twist to semi-plastic fiber strips to produce a homogeneous filament-like yarn with a permanently locked in fiber twist.

The method and mechanical means of this invention have the following main features:

(1) It imparts the twist under heat and pressure by using a heat-welding device to soften the imparted plastic agent on the fiber strips at the twisting point to impart a permanently locked in twist into a semi-plastic fiber strip to form a homogeneous filament.

(2) Conventional false twist devices are used to impart a pre-twist into roving to keep the fibers together until they reach the twisting unit. This is accomplished by revolving the yarn at a point between two spaced apart fixed points which results in two reverse twists from the point of revolution of the false twist unit to the fixed points with actually no twist or zero twist on the yarn as it passes through the delivery rollers to the final twisting unit.

The false twist method of the invention is carried out by a false twist spindle assembly in accordance with the invention including revolving yarn pick-up and delivery rollers to directly impart a positive twist instead of a

false twist. This is accomplished by elimination of the second fixed point of the (non-rotating about a center point) pick-up and delivery rollers according to conventional false twist principles, and also by throwing, through a novel spindle construction, the loose end of the yarn at the twisting speed into a revolving collecting pot. As the yarn has already had a positive twist imparted between a first set of yarn delivery rollers and a second revolving set of yarn pick-up and delivery rollers and as it is delivered through centrifugal force in the form of small balloons to the interior of the pot, the heat-welded yarn with a permanently locked in position twist is collected on the walls of the pot to form a large size yarn cake-package without any danger of untwisting.

(3) In accordance with the modified false twist method of the invention, the present spinning and twisting apparatus for imparting a positive twist to the yarn is either directly connected with the collecting pot with both revolving at the same speed or, alternatively, the false twist arrangement is revolving at much higher speed than the collecting pot. The application of the twist at very high speeds requires that the large package of the ready yarn be carried at the same high speed as this is the case in all conventional means where twisting is done by the collecting device thus at the same speed. The separation of the twisting unit from the collecting pot, each revolving at different speeds in accordance with the present invention, is possible because the yarn is thrown into the pot in small balloons at the twisting speed. Further, the imparted twist has been locked by the heat-welding and is therefore untwistable because it forms a continuous homogeneous coagulated semi-plastic fiber filament before it reaches the pot.

(4) The present twisting unit is suitable for imparting twist in any type of fibers, or yarns without any changes, which is not possible with conventional twisting units.

As previously mentioned, the apparatus of the invention includes means whereby the twist initially imparted to the yarn is maintained because it is permanently locked in by heat welding during its delivery to the collecting pot and means are also provided whereby the package is progressively traversely built-up within the pot. The yarn is delivered to the interior of the pot in such a manner that through centrifugal force, and, in a preferred embodiment, by the addition of an air stream directed towards the outer periphery of the package, the twisted yarn is laid-in in a traverse compact built-up relationship.

Having thus generally described the nature of the invention, particular reference will be made to the accompanying drawings, wherin there is shown by way of illustration a preferred embodiment thereof, and in which:

Figure 1 is a diagrammatic view of a fiber strip as it would appear before twisting and after twisting and compacting by the apparatus of the invention;

Figure 2 is a diagrammatic view in perspective elevation of one form of a complete twisting and collecting unit constructed in accordance with the invention;

Figure 3 is a cross-sectional view of the construction shown in Figure 1 along the line 3—3;

Figure 4 is a cross-sectional view of the apparatus shown in Figure 2 along the line 4—4 to show the interior of the telescoping inner and outer tubes of the filter and yarn-delivery portion of the unit;

Figure 5 is a diagrammatic view illustrating one form of drive which might be utilized to simultaneously drive a plurality of circumferentially spaced twisting and built-in units constructed in accordance with the invention;

Figure 6 is a diagrammatic view in perspective elevation of a complete twisting and collecting machine in accordance with the invention, embodying a plurality of

twisting and collecting units as shown in Figure 2 and means whereby a continuous wider fiber strand is split to form narrow strips suitable for twisting into yarn;

Figure 7 is a cross-sectional view of the unit shown in Figure 2 to illustrate in more detail the internal structure of the twisting and delivery mechanism and also one form of a reciprocal package built-in drive which can be utilized in the apparatus of the invention;

Figure 7A is a sectional view of the construction of Figure 7 along the line 7A—7A to show the air inducting ring;

Figure 8 is an enlarged portional view partially in cross-section of the apparatus shown in Figure 6 to illustrate in more detail the relative position of the building mechanism and the main drives for the twisting and collecting units of the apparatus;

Figure 9 is a plan view of the initial yarn guiding and heating portion of the apparatus;

Figure 10 is a sectional view of Figure 9 along the line 10—10 illustrating one form of heating unit;

Figure 11 is a plan view partially in section of the lower portion of the construction shown in Figure 8 along the line 11—11 to illustrate the relative positions of the driving motors and the built-in motion mechanism;

Figure 12 is an enlarged detail view mainly in section of an alternate preferred form of a twisting and collecting unit in accordance with the invention;

Figure 13 is a side elevation partially in cross-section illustrating a further preferred alternative form of a twisting and spinning unit in accordance with the invention;

Figure 14 is a sectional view of the construction shown in Figure 13 to illustrate the disengageable follower and arm of the building portion of the unit;

Figure 15 is a view in perspective assembly of the exterior of a single unit as shown in Figure 13 to illustrate the relative positions of the various elements and the slot for the builder arm;

Figure 16 is a side elevation partially in cross-section of a still further alternative form of twisting and spinning unit in accordance with the invention and of a similar type to that illustrated in Figure 13.

With particular reference to Figures 1 through 10, one form of a spinning and twisting unit constructed in accordance with the invention is shown externally and in cross-section.

Each of these units comprises a top yarn or strip heating assembly **10**, a twisting and yarn delivery assembly **12**, a traverse motion yarn delivery or builder assembly **14**, and an inverted pot-type yarn collector **16**. Separate drive means in the form of belts **20**, **22**, **24** extend from a main drive shaft **30** to the twisting and delivery assembly **12**, the builder assembly **14**, and the collecting pot **16** respectively, so that these portions of the unit may be driven at varied speeds to suit the required twist and delivery speed of the yarn proportionately to the speed of rotation of the yarn collecting pot **16**. Alternatively, these assemblies may be driven by separate motors if desired.

In order that the construction and function of these various assemblies be more clearly understood they will now be described in more detail.

Yarn heating assembly

The yarn heating assembly **10** includes a supporting frame **32** which is mounted on the exterior of the main housing or frame **40** of the construction illustrated. A pair of heated rollers **34** are mounted in opposed relationship on brackets **36**. The brackets **36** are pivotally mounted on opposite sides of the supporting frame **32** and are retained in operative position by the engagement of pivotally mounted catches **38** resiliently biased into holding position by springs **42**. Each roller **34** is partially surrounded by a suitable heating element **44** which is controlled to the suitable temperature by a thermostat of any conventional type. As is shown in Figures 9 and 10, the material "A," when in strip form, passes between and is heated by the contact of the rollers **34** and at the same time is held while the twist is applied by the yarn delivery and twisting assembly **12** to which the strip now passes.

Yarn delivery and twisting assembly 12

It should be mentioned that the spinning and twisting assemblies of the invention are preferably mounted in multiple, as is common in textile spinning practices. With reference to Figure 6 of the drawings, the assemblies are supported in axial alignment about the main housing or frame **40** between spaced annular supports **46**, **48** and **50**. The interior of the frame **40** contains the motion building and drive elements.

In the assembly shown in Figure 6 means in the form of a slitting device "B" is provided on top of the machine and into which a continuous wider fiber strip is fed and, by passing through slitting rollers "C" provided with a plurality of spaced relatively thin steel circular knives, is slit into a plurality of relatively narrow strips, equal to the amount of spindles mounted on the frame. From the slitting rollers "C" the strips are guided by the guiding units "D" to the respective spinning and twisting units. The spacing between the knives of the slitting rollers "C" can be adjusted by spacing disks to cut the strips to any desired width.

The yarn delivery and twisting assembly is supported between the annular supports **46**, **48** and includes a hollow shaft **50** which is journalled on bearings **52** on the support **46**. A yarn guide or cap **54** is mounted on the upper end of the shaft **50** so as to maintain the yarn centrally of the boring **51** and to obtain a polishing action. A pulley **53** is mounted on the shaft **50** and the driving belt **20** is connected to this pulley. The twisting and feeding or spindle portion of the unit is in two main portions, namely, a cap or top portion **60** which together with a crown gear **62** is secured to and is rotated by the shaft **50**, and a lower portion **61** which serves as a support and housing for the twisting and pick up of delivery rolls **64**. As shown in Figures 3 and 4, the rolls **64** are mounted in opposed relationship within a support block **65** on shafts **66**, **68**, journalled in the block **65**. Gears **70**, **72**, are mounted on the respective shafts **66**, **68**, and are in meshed engagement with a further pair of gears **71**, **74**, mounted on shafts **76**, **78**, extending through the block **65** to journal in the side walls of the lower portion **61**. Bevel gears **79**, **82**, are mounted on the portions of the shafts **76**, **78**, extending between the block **65** and the interior of the spindle portion **61**. With this arrangement, rotation of the shaft **50** also rotates the crown gear **62** which is in meshed engagement with the bevel gears **79**, **82**. This imparts the necessary drive through the gears **71**, **74**, **70**, **72**, to rotate the yarn delivery rolls **64** in opposite directions. The rolls **64** are each provided with a flange or bead **67** on one side which extends beyond and overlaps the unflanged side of the opposing roll and the opposed faces of the rolls are spaced apart a predetermined distance defining therebetween with the flanges **67** a yarn receiving nip or throat adapted to compress and feed the yarn through the twisting spindle.

The desired twisting rotation of the spindle lever portion **61** is accomplished by a hollow tubular yarn guide **80** having a flanged top portion **81** fitting within and secured to the portion **61**. The tubular guide member **80** extends from the spindle portion **61** and acts as a lower supporting axial shaft for that member. The guide **80** is journalled between a bearing **83** mounted in the annular support **48** and a further bearing **84** mounted on the annular support **50**. A pulley **86** is keyed to the guide member **80** and the drive belt **22** extends from the main drive to the pulley **86**. The yarn guide member **80** is provided with a yarn guiding bore **88** through which the yarn passes to the collecting pot and means, in the form of an annular blower **90** mounted directly beneath the spindle portion **61**, are provided to pick up and deliver air through

openings 91 into the bore 88 of the guide member 80. This entrained forced air passing through the interior of the guide member 80 acts to blow the twisting yarn into the collecting pot 16 as will be described in more detail later.

The top portion 60, through the crown gear 62 engages the bevel gears 79, 82, of the lower portion 61. The speed of the top portion 60 can be varied as desired, for example, by a variable pitch pulley or any other conventional speed regulator, whereas the lower portion 61 is preferably driven at a fixed constant speed. The top portion 60 will always run somewhat slower than the lower portion 61, the result being that the yarn delivery rollers are rotated at a variable speed which can be adjusted by increase or decrease of the difference in speed between the upper portion 60 and the lower portion 61. Accordingly, the speed of the upper portion 60 regulates the speed of delivery of yarn per minute while the lower portion 61 is imparting the twist, therefore, adjustment of the spinning and twisting spindle of the invention is simple enabling the imparting to the yarn of the desired amount of twist per length delivered.

Builder assembly 14

The yarn building assembly of the unit acts to deliver the twisted yarn into the pot 16 from the guide member 40 while the pot 16 is driven at a lower speed than is normal since it acts only to collect the ready twisted yarn delivered thereto and does not act to impart the twist to the yarn as is done in conventional pot spinning. This is accomplished by a hollow sleeve 100 having a closed end 102 provided with a yarn discharging orifice 104 through which the twisted yarn is fed by the blast of air or thrown out by centrifugal force through the central bore 88 of the guide member 80. The sleeve 100 slidably fits over the guide member 80 into which it is keyed for revolution therewith and the upper end is connected to a reciprocating builder arm 110 mounted on and extending radially outwards from an annular supporting member 112. In the construction shown in Figure 6, the member 112 is mounted for sliding movement about and relative to the main frame 40 and is common to all the builder arms shown. The necessary reciprocating drive to the member 12 is accomplished by a sliding bar 114 fitting through a vertical slot 116 in the frame 40. A key 120 extending from the rear face of the sliding bar 114 engages in the thread of a double helically threaded cylinder 122. The cylinder 122 is journalled between standards 124, 126, on a shaft 128 and a pulley 130 mounted on the shaft 128 is connected by a belt 132 to a main drive shaft 134.

The lower end of the sleeve 100 slidably fits through a pulley 140 secured to the upper cover portion 17 of the collecting pot 16 and the bearing 84 journalling the pot cover portion 17 to the annular support 50. A drive is provided to the collecting pot 16 through the belt 24 connecting the pulley 140 to the main driving shaft.

The collecting pot cover portion 17 is provided with a concentric extension 19 which is journalled in the bearing 84 and extends beyond the bearing to provide the sleeve shaft for the pulley 140. The collecting pot 16 is retained in position on the cover portion 17 by pivotally mounted double latches 150 the outer ends of which engage with slots 152, and 154, in the cover extension 19 and the side walls of the pot 16 respectively.

With this arrangement, as previously mentioned, it is possible to drive the collecting pot 16 separately so that it can be rotated at a relatively lower speed, since it does not impart the twist to the yarn, sufficient only to lay the yarn about the inner walls of the collecting pot in compact layers by centrifugal force aided by the blowing action of the spindle and tube of the twisting and delivery assembly.

A preferred and alternate form of the spinning unit of the invention is shown in Figure 12. This unit is basically the same as that previously described with the difference that the sliding guide sleeve 281 is keyed in revolving guide member 280. Further, means in the form of pressurized air conduits are provided leading to the interior of the inner guide or sleeve 281 for the desired forced air blast feeding the ready twisted yarn to the collecting pot 216.

The twisting and yarn delivery section of the unit of Figure 12 includes a hollow shaft 250 which is journalled in bearings 252 on a support 246. The shaft 250 acts as an axle for a pulley 253 and a crown gear 262. The spindle housing 261 is provided with a gear supporting block 265 and gears 70, 72, 71, 74 and 79, 82 act to drive the opposed yarn delivery rollers 264 as previously described.

The lower portion of the spindle housing 261 is connected to a hollow tubular sleeve 280, the upper portion of which is journalled for rotary movement between a bearing 291 on a support 248 and bearings 283 mounted on an extension 284 of a builder arm 210 mounted for sliding reciprocal movement on a slide guide 211 provided on the main frame 240. In this arrangement the drive is imparted to the sleeve 280 by a drive pulley 290 mounted on the sleeve 280 beneath the bearing 291. An inner yarn guide tube 281 slidably and telescopically fits within the sleeve 280 and extends from adjacent the yarn twisting and delivery assembly to a position within the collecting pot 216. The lower end of the yarn guide 281 slidably fits through the lower portion of the sleeve 280 which is journalled in bearing 302 supported on a support 250 extending from the main frame 240. The inner yarn guide tube 281 is connected to the sleeve 280 by pins 310 which are mounted in threaded bosses 312 and engage in corresponding openings 311 provided in the wall of the sleeve 280. The side walls of the outer sleeve 280 are slotted at each side, as indicated at 315 to accommodate the pins 310. With this arrangement, the inner yarn guide tube 281 is rotated with the outer sleeve 280 and is also reciprocated relative to the sleeve 280 by the movement of the builder arm 210. The builder arm 210 is of course driven in the necessary building motion through a double helically threaded cylinder 222 as previously described.

The lower end of the yarn guide tube 281 is closed and is provided with a yarn discharge orifice 304 through which the yarn is delivered to the collecting pot 216. In this construction an air pressure conduit 340 is provided which extends from a suitable blower or compressor 342, located within the machine frame 240, through the support 248 to deliver forced air to the upper end of the hollow interior 285 of the yarn guide tube 281. Accordingly, as the yarn is twisted and delivered to the interior of the yarn guide 281 it passes through the hollow interior 285 and is discharged from the discharge orifice 304 into the collecting pot 216.

As in the first described construction, means in the form of a pulley 360 is mounted on an extension 300 of the pot cover assembly 218 and a belt 224 connects the pulley 360 to the main drive of the apparatus. A lubricated bearing assembly 350 journals the extension 300 of the pot cover assembly to the support 250. The collecting pot 216 is releasably connected to the lower portion of the pot cover assembly 218 so that as previously described the collecting pot 216 can be driven at a relatively lower speed. Since in this preferred arrangement the yarn guide tube is also rotated in addition to the forced air delivering the yarn to the interior of the pot the rotation of the collecting pot may be driven at considerably slower speeds than the twisting portion of the apparatus.

It will be appreciated that the drives and arrangement of a multi-spindle assembly of units in accordance with the invention, as shown in Figure 6, are illustrative only and that these could be varied as is well known in the art. With reference to Figure 5, a single belt 20 is dia-

grammatically shown as being coupled to and driving all the top pulleys of the assembly.

With particular reference to Figures 8 and 11 a typical unit is illustrated wherein driving motors **400, 402,** are utilized to drive the various portions of the unit assembly. As previously mentioned, the drive to the drive belts **20, 22, 24,** is from a main drive shaft. In the construction shown the main drive shaft **30** extends through a hollow drive shaft **430** and is journalled at either end in brackets **432, 434** extending from the interior of the casing **40**. The motor **402** is connected directly to the shaft **30** and a pulley **436** mounted on the upper end of the shaft supports and drives the belt **20**. The hollow drive shaft **430** is mounted for free rotation relative to the main shaft **30** and pulleys **440, 442,** support and drive the belts **22, 24,** respectively. A further pulley **444** is mounted on the lower end of the shaft **430** and the shaft is driven through a belt **446** extending from a drive pulley **446** mounted on the shaft of the motor **400**. A second drive pulley **448** is also mounted on the shaft of the motor **400** and through a belt **452** is adapted to drive a pulley **454** mounted on the lower end of the builder drive shaft **134**. A pulley **456** is mounted on the upper end of the builder drive shaft **134** and is engaged by the belt **132** from the pulley **130**. With this arrangement, and by the selection of drive pulleys of the desired dimensions it is possible to drive the various portions of the unit at varying predetermined proportionate speeds to give the desired results.

In the further alternative constructions shown in Figures 13 through 16 a single unit is shown as a self-contained assembly. It will be appreciated of course that this is to simplify the description and similar units can be assembled and driven in multiple fashion as shown in connection with the constructions of Figures 1 through 13.

Referring specifically to the construction shown in Figure 13, this unit again includes a heating unit, a twisting portion and a collecting pot with one main difference in that the building motion is now accomplished by a reciprocating builder tube or spindle which can be engaged or disengaged from the building drive mechanism to permit removal of the yarn package. In this construction the actual twisting elements are connected with the collecting pot **516** while in the construction shown in Figure 16 they are separate from the pot which is driven at a lower speed, as will be described later.

Alternative yarn heating assembly

The yarn heating assembly **510** is mounted on a supporting bracket or frame **512** extending from the casing **514** by engagement between a fixed pin **516** and a resiliently biased pin **518**. Withdrawal of the pin **518** allows the heating unit to be removed for service or if it is desired to use the unit on other types of yarns requiring the use of heat. The heating assembly **510** is provided with two resistance elements **520**, a pair of opposed yarn guiding and condensing rollers **522** of similar construction to the rollers **34** previously described, and three additional compression rollers **523, 524** and **525**, the roller **525** being disposed between and spring urged towards the other two for the purpose of providing an additional heat bonding effect and polishing to the exterior of the yarn. The rollers **522, 523, 524** and **525** are all heated by the resistance elements **520** so that as the strip from which the yarn is twisted passes through the rollers the imparted permo plastic material is softened and the strip held while the twist is applied by the yarn twisting and delivery assembly **530**.

The yarn twisting assembly **530** is of similar construction to that previously described in that a hollow shaft **532** guides the yarn into and between an opposed pair of rollers driven through a differential gearing mechanism **534**. A pulley **536** mounted on the shaft **532** drives the main gear of the gearing mechanism and a belt **538** extends to the pulley **536** from a driving pulley **540**. The driving pulley **540** is mounted on a shaft **542** journalled between a supporting bracket **544** and the top of the casing. A variable pitch pulley **545** is also mounted on the shaft **542** and a belt **546** extends between the pulley **544** and a variable pitch pulley **548** mounted on a main driving shaft **550**. Through the rotation of a central knob E the speed on pulley **536** can be varied due to the change of pitch on a conventional spring type variable pitch pulleys **545, 548**.

The shaft **550** extends from a connection with a driing motor **552** to adjacent the top of the casing where it is journalled in a bearing **554**. A further drive pulley **555** is mounted on the shaft **550** and a belt **556** extends between this pulley and a pulley **558** constituted by an integral part of a spindle and pot driving assembly. The pulley **558** is an extension of a tubular shaft **560** which is journalled for rotation in bearing **562** mounted in a supporting plate **564** extending from the front of the casing **514**. The hollow interior of the pulley **558** serves as the housing for the gearing transmission **534** and the hollow shaft **532** together with the main drive gear **533** of the transmission assembly **534** is mounted for free rotation relative thereto. The lower end of the shaft **560** is connected to the inner shell **564** of the collecting pot **516** so that this shell is rotated through the drive of the belt **556**. The yarn leads through the center of the shaft **560** and through a lower cap **566** into the path of a yarn guide finger **568** mounted for free rotation on the upper end of the builder motion shaft **569** which extends axially through the opening **570** of the cover **572** of the collecting pot **516**. The shaft **569** is mounted on a builder arm **574** which extends through and is guided by a slot **576** provided in the wall of the casing **514**. A slide plate **578** is mounted on the inner end of the builder arm **574** and a shaft **579** mounted between brackets **580, 582,** passes through the arm **574** to also act as a guide and a pivotal axis for the uncoupling of the arm with the double helically threaded builder shaft **584**. The buider shaft **584** is also journalled between the brackets **580, 582,** with a gear **586** mounted on the upper end of the shaft in meshed engagement with a gear **588**. The gear **588** is mounted on one end of a stub shaft **590** journallel in a journal block **592** with a large driving gear **594** mounted on the other end of the shaft **590** in meshed engagement with a gear **596** mounted on the main driving shaft **550**.

The builder arm **574** is reciprocally moved in its building motion by the engagement of a follower **598** pivotally mounted on the arm by the shaft **579**. A spring **600** normally urges the follower **598** into contact with the leads of the builder shaft **584**. The collecting pot **516** has an arrangement at the bottom in the form of a tube **602** into which a slightly expandable paper or plastic tube can be inserted or released by spring action when the pot has collected a full pot of yarn to avoid collapsing of the yarn layers when the unit is stopped to doff the ready yarn package. The builder arm **574** can be pushed to the side along the transverse extension of the slot **576** by pivoting it about the shaft **579** which also acts to disengage the follower **598** from contact with the leads of the builder shaft **584**. In this arrangement the twist is imparted to the yarn, as before, by the axial rotational movement of the main rollers of the gear assembly **534** and since the pot is connected to the pulley **558** it is driven at the same speed.

The construction shown in Figure 16 is quite similar to that of Figure 13 with the difference that the collecting pot **716** is separate from the twisting assembly and therefore can be driven at different, and preferably, lower speeds. The yarn heating assembly, casing, driving motor, shafts and builder motion drive are identical and therefore designated in a similar manner as in the construction of Figure 13.

The yarn delivery and twisting assembly **702** differs from that shown in Figure 13 in that the differential gearing assembly **734** including the yarn delivery and twisting rollers is mounted on a hollow shaft **704** journalled for rotation in a bearing **706** mounted on an extension **708** of the casing **514** and this shaft together with the lower portion of the gearing assembly **734** is driven by a pulley **708**. A belt **710** extends between the pulley **708** and a further driving pulley **712** mounted on the main drive shaft **550**. An inner yarn guide tube **714** is mounted for axial sliding movement within the hollow shaft **704** so that it is rotated therewith but is free for axial reciprocation by the builder shaft **718**. The collecting pot **716** includes an outer shell **721** mounted on a casing extension **720** and an inner shell **722** connected to and adapted for rotation with a hollow shaft **724** journalled for rotation in a bearing **726** mounted in the casing extension **720**. A pulley **727** is mounted on the upper end of the shaft **724** and the belt **556** from the pulley **555** is connected to the pulley **727**.

The builder motion assembly, as previously mentioned, is identical to that described for the construction of Figure 13. The builder shaft **718** is slightly different from the builder shaft **569** in that, as the inner yarn guide tube **714** is rotated, the upper end of the shaft **718** is provided with a freely rotatable cap **719** mounted on bearings **717**. The lower end of the yarn guide tube **714** is provided with a bearing cap **715** which rests on the cap **719** so as to reduce the friction between the rotating tube **714** and the non-rotating reciprocating shaft **718**. The cap **715** is provided with a yarn discharge opening so that the yarn is discharged against the inner walls of the collecting pot as the guide tube **714** is reciprocated therein by the building motion. It is also contemplated, although not specifically illustrated, that air under pressure can be delivered to the interior of the tube **714** in the manner of the first constructions described to aid in the laying in of the twisted yarn.

I claim:

1. A spinning and twisting apparatus of the false twist type adapted to impart a positive twist to a fiber roving, fiber strip or yarn, comprising, a supporting frame, a first fixed set of opposed material engaging rolls, a false twist spindle mounted for rotation on said frame about a vertical axis aligned with said material engaging rolls and including an internal hollow material feeding and delivering tube, said spindle including a driven top section embodying a variable bevel gear arrangement engaging the lower portion of said spindle, the lower portion of said spindle supporting a set of opposed material delivering rolls for axial and trans-axial rotation, a geared transmission between said upper spindle gear arrangement and said material delivering rolls, separate driving means for said upper and lower spindle portions whereby said rolls are adapted to be rotated in one direction feeding said material and also rotated about the axis of said feeding direction to impart a positive twist to said material, a material collecting pot mounted for rotation on said frame in aligned position relative to and about an axis representing the line of travel of the material fed thereto, a traverse motion package building mechanism mounted on said frame and cooperating with said hollow material delivery tube, and separate and variable driving means connected to said material collecting pot.

2. A spinning and twisting apparatus, as claimed in claim 1, including heating means mounted on said frame and surrounding said first fixed set of yarn guiding rolls.

3. A spinning and twisting apparatus, as claimed in claim 1, including means to supply a stream of air under pressure through the interior of said hollow yarn feeding tube.

4. A spinning and twisting apparatus, as claimed in claim 1, wherein said hollow material feeding tube is engaged and rotated with the spindle unit containing said second set of yarn pulling rolls.

5. A spinning and twisting apparatus, as claimed in claim 1, wherein said hollow material feeding tube is mounted for reciprocal movement relative to said yarn collecting pot and said building mechanism building arm is connected to said feeding tube.

6. A spinning and twisting apparatus, as claimed in claim 1, wherein said building arm includes a spindle extension disposed in alignment with said yarn travel vertical axis and said spindle extension extends axially through said yarn collecting pot.

7. A spinning and twisting apparatus, as claimed in claim 1, wherein said hollow material feeding tube is in two telescopically interconnected parts and the inner one of said parts is mounted for reciprocal and rotary movement relative to the outer part, said inner part being connected to said material delivery rolls for rotation therewith and said building mechanism building arm for reciprocal movement thereby.

8. A yarn spinning and twisting apparatus, as claimed in claim 1, wherein said hollow material feeding tube is in two telescopically interconnected parts and the outer one of said parts is mounted for reciprocal movement relative to the inner part, said outer part being connected to said building mechanism building arm for reciprocal movement thereby, said inner part being mounted for rotary movement relative to said outer part and being connected to said set of material feeding rolls for rotation therewith.

9. A spinning and twisting apparatus adapted to impart a positive twist to a semi-plastic fiber strip, comprising a supporting frame, a first opposed set of yarn guiding and compressing rolls fixedly mounted on said frame for free rotation, heating means mounted on said frame and surrounding said first set of rolls, a second set of opposed yarn compressing and feeding rolls mounted on said frame beneath and in alignment with said first set of rolls, said second set of rolls being mounted for driving strip-feeding rotation in the axial direction of said unit with the axes of said rolls mounted for trans-axial material twisting rotation about the axis of said unit, roll driving means including a differential mechanism connected with said second opposed set of material pulling and feeding rolls, a material collecting pot mounted for driven rotation on said frame beneath and in alignment with said first and second sets of rolls, pot driving means connected to said collecting pot, a hollow material delivery tube leading from said second pair of strip-feeding rolls to said collecting pot, and a builder mechanism mounted for reciprocal movement on said frame and cooperating with said hollow material delivery tube to lay said fiber strip as delivered in twisted condition from said tube in even layers within said collecting pot.

10. A spinning and twisting apparatus, as claimed in claim 9, including means supplying a stream of air under pressure to the interior of said hollow yarn-feeding tube.

11. A spinning and twisting apparatus, as claimed in claim 9, wherein said hollow material feeding tube is engaged and rotated with said second set of yarn-feeding rolls.

12. A spinning and twisting apparatus, as claimed in claim 9, wherein said hollow material feeding tube is mounted for reciprocal movement relative to said collecting pot and said building arm is connected to said feeding tube.

13. A spinning and twisting apparatus, as claimed in claim 9, wherein said building mechanism includes a building arm provided with a spindle extension disposed in alignment with said unit vertical axis and said spindle extension extends axially through said collecting pot.

14. A spinning and twisting apparatus, as claimed in claim 9, wherein said hollow material feeding tube is in two telescopically interconnected parts and the inner part is mounted for reciprocal and rotary movement relative to the outer part, said inner part being connected to said second set of strip-feeding rolls for rotation there-

with and said building mechanism for reciprocal movement thereby.

15. A spinning and twisting apparatus, as claimed in claim 9, wherein said hollow strip-feeding tube is in two telescopically interconnected parts and the outer part is mounted for reciprocal movement relative to the inner part and is connected to said building mechanism for reciprocal movement thereby, the said inner part being mounted for rotary movement relative to said outer part and being connected to said second set of strip-feeding rolls for rotation therewith.

16. A spinning and twisting apparatus as claimed in claim 9 wherein said collecting pot is mounted in an inverted position on said frame and includes means extending within the interior of said pot for supporting the yarn package collected therein.

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