# United States Patent

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[72] Inventors George Hirst
Dewsburh;
Brian Whiteley, Halifax, both of England



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[73] Assignee Fairbairn Lawson Limited
Yorkshire, England
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[33] Great Britain
[31] 20996/68


[54] **TEXTILE THREAD-WINDING APPARATUS**
**31 Claims, 12 Drawing Figs.**


[52] U.S. Cl. ........ 242/18 A
[51] Int. Cl. ........ B65h 54/02
[50] Field of Search ........ 242/18, 18 A, 25 A



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,772,054 | 11/1956 | Herele et al. | 242/18 A |
| 3,279,709 | 10/1966 | Carlson et al. | 242/18 A |
| 3,355,117 | 11/1967 | Gerhardt et al. | 242/18 A |

FOREIGN PATENTS

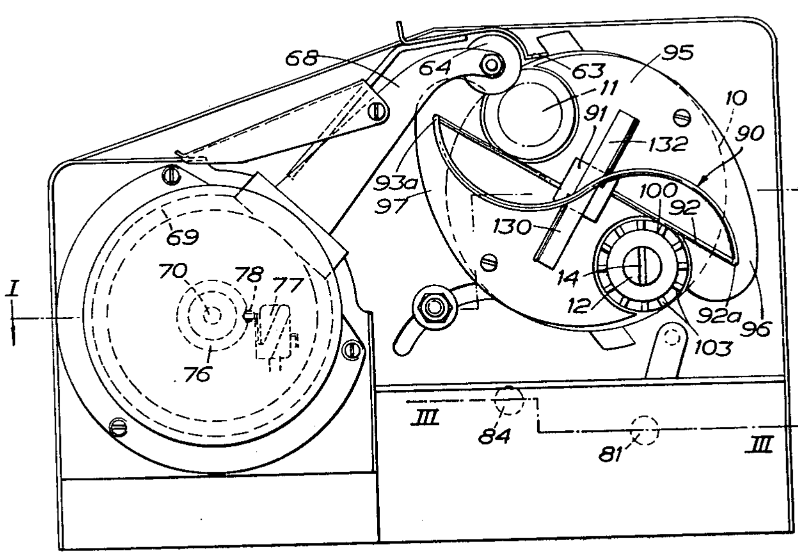
| | | | |
|---|---|---|---|
| 1,199,792 | 6/1959 | France | 242/18 A |
| 822,329 | 10/1959 | Great Britain | 242/18 A |
| 1,071,073 | 6/1967 | Great Britain | 242/18 A |
| 1,104,156 | 2/1968 | Great Britain | 242/18 A |



*Primary Examiner*—Stanley N. Gilreath
*Attorney*—Norris & Bateman



**ABSTRACT:** A textile thread-winding apparatus has a turret with two spindles each adapted to receive a thread carrier. The turret can turn to bring either of the spindles into the winding on station, and in so doing, it pushes a deflector into the path of the thread. The deflector guides the thread onto a catcher on the spindle at the winding on station, so that the latter begins to pick up the thread. The full package continues to rotate even at the reserve station until the trailing thread to the catcher is severed.

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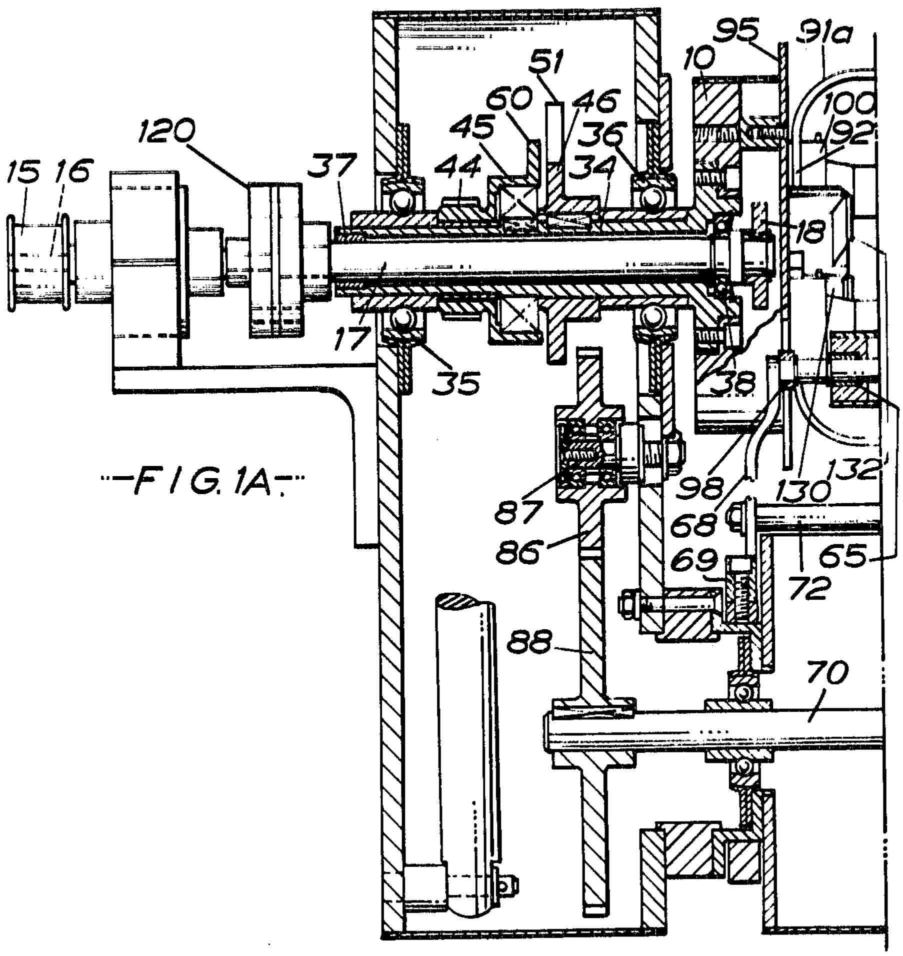
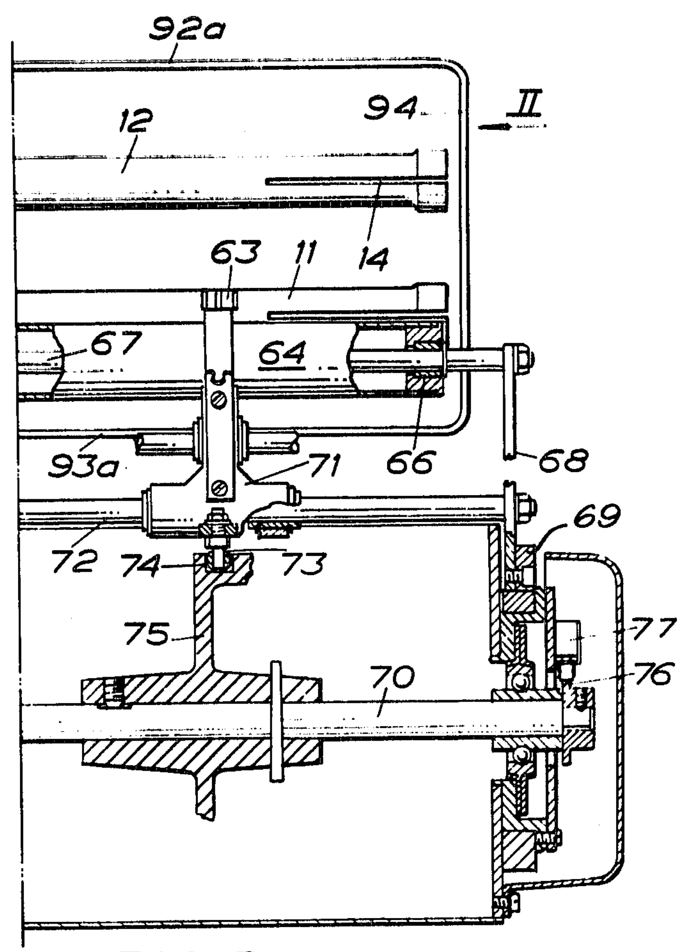



-FIG. 1A-

INVENTOR:
GEORGE HIRST & BRIAN WHITELEY
BY
Norris & Bateman




-FIG. 1B-

INVENTOR:
GEORGE HIRST &
BRIAN WHITELEY
BY
Norris & Bateman

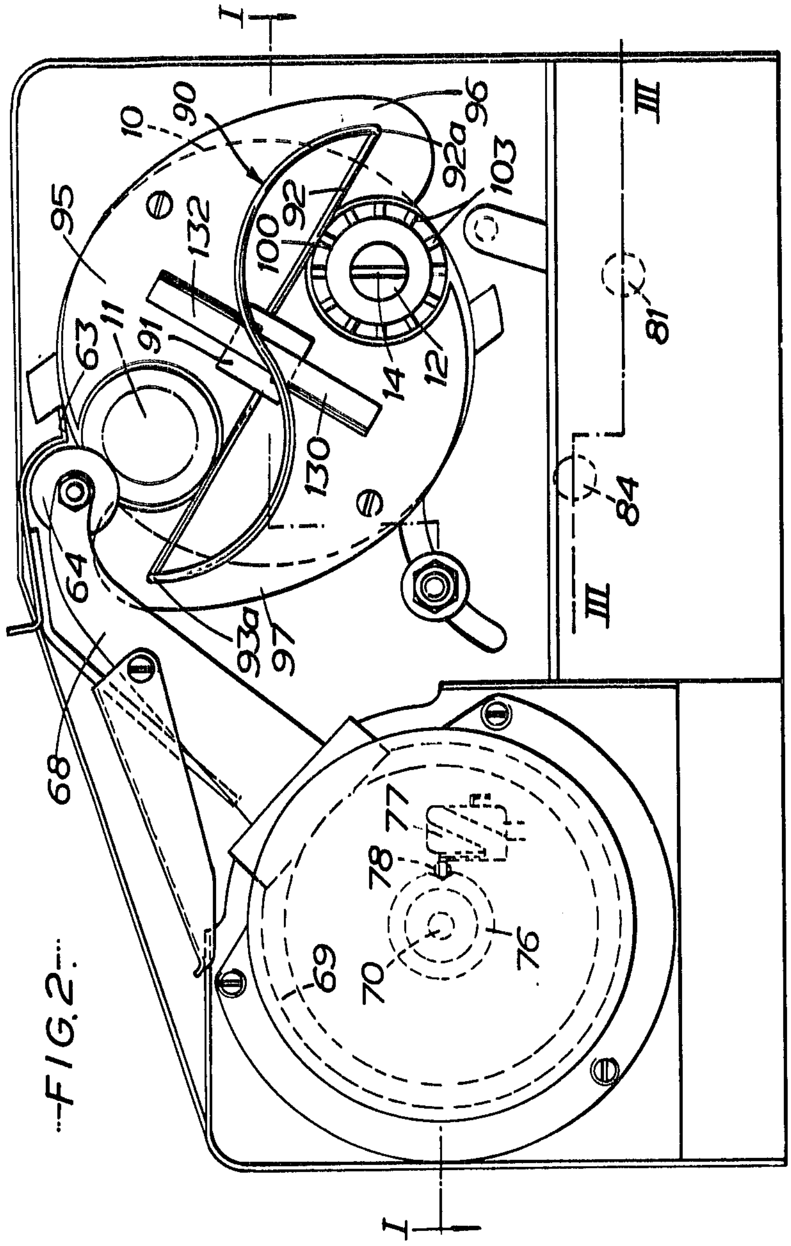



FIG. 2

INVENTOR:
GEORGE HIRST & BRIAN WHITELEY
BY
Norris & Bateman

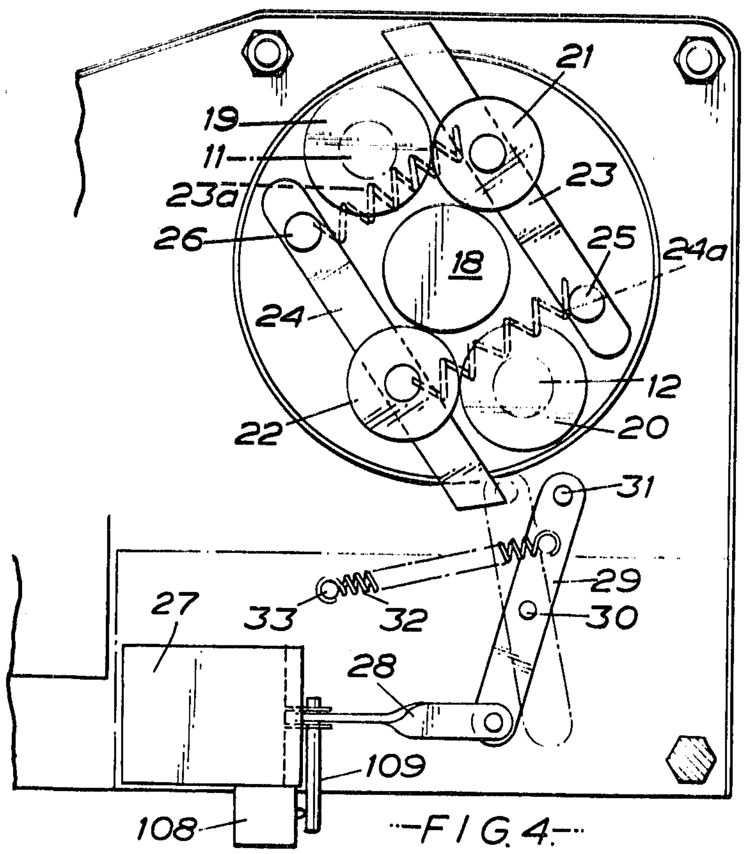



FIG. 4.

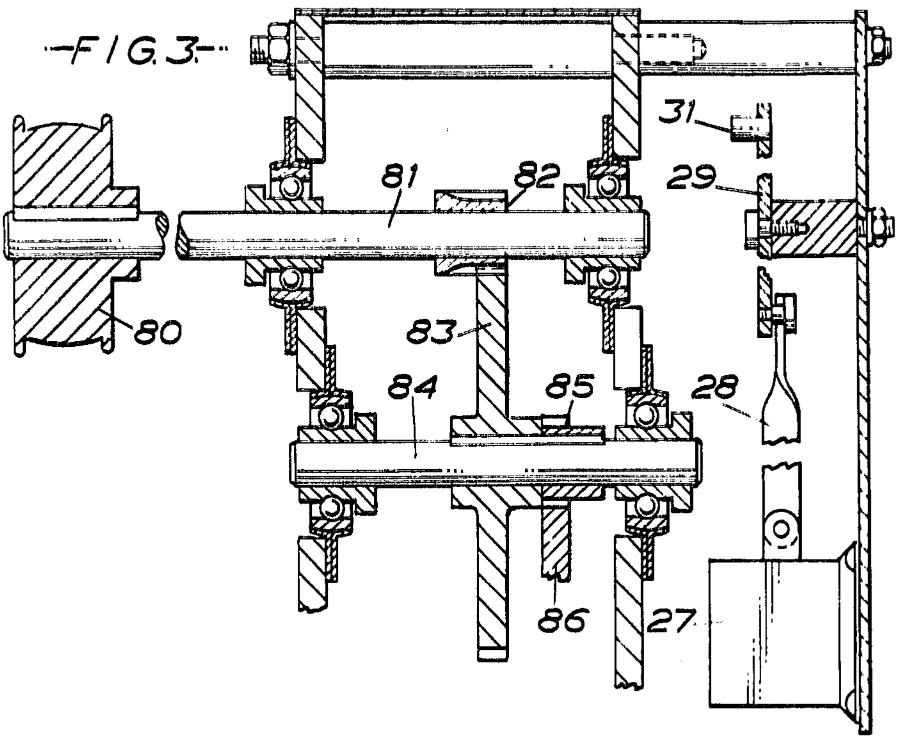
INVENTOR:

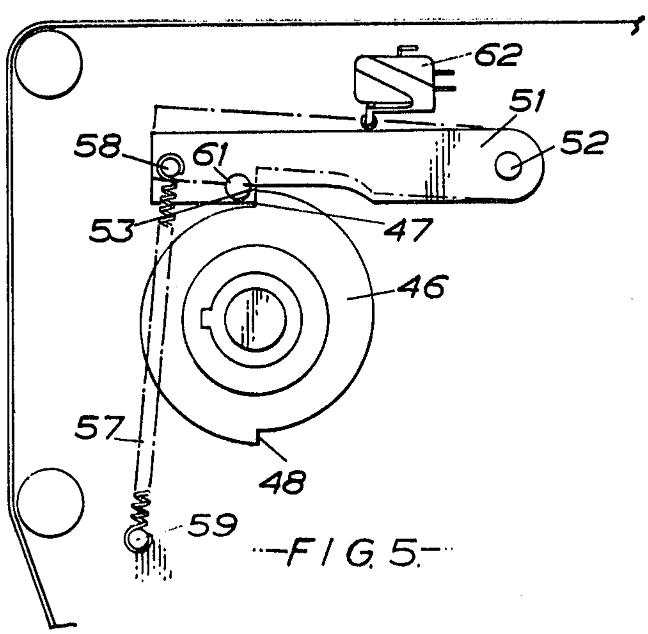
GEORGE HIRST & BRIAN WHITELEY

BY

Norris & Bateman

-FIG.3-




-FIG.5-

INVENTOR:

GEORGE HIRST & BRIAN WHITELEY

BY

Norris & Bateman

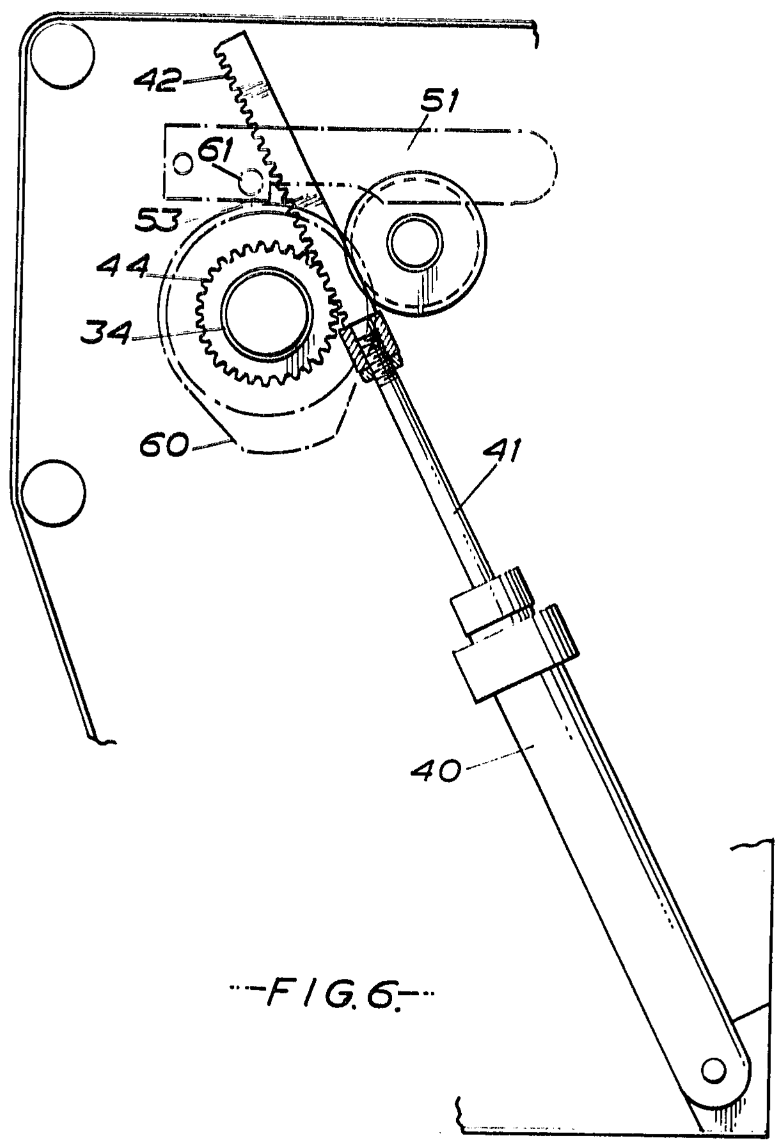
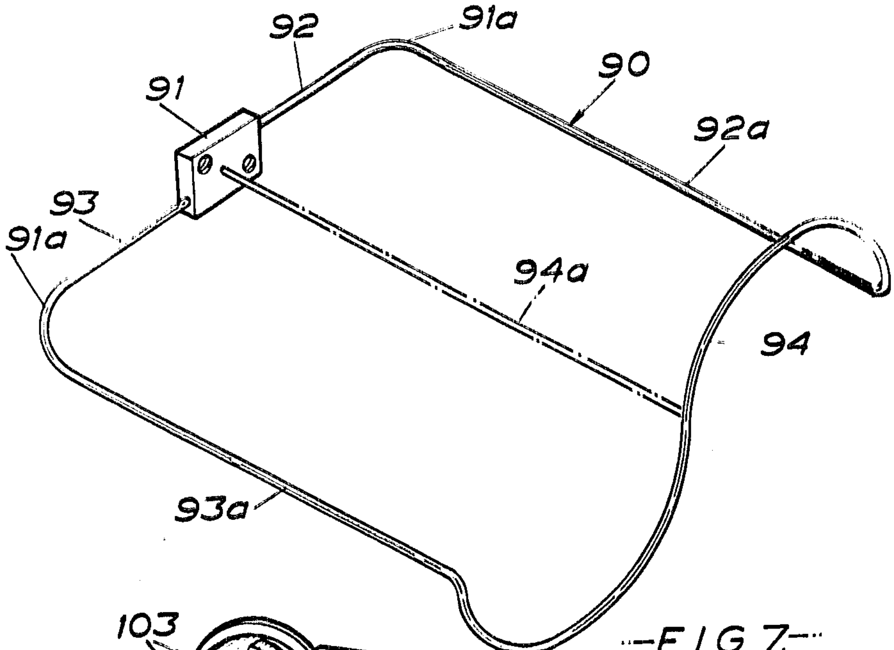
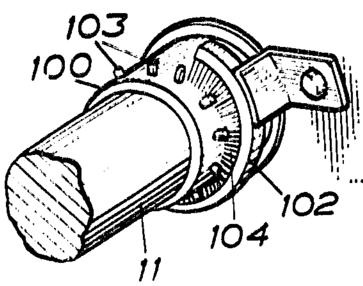



FIG. 6.

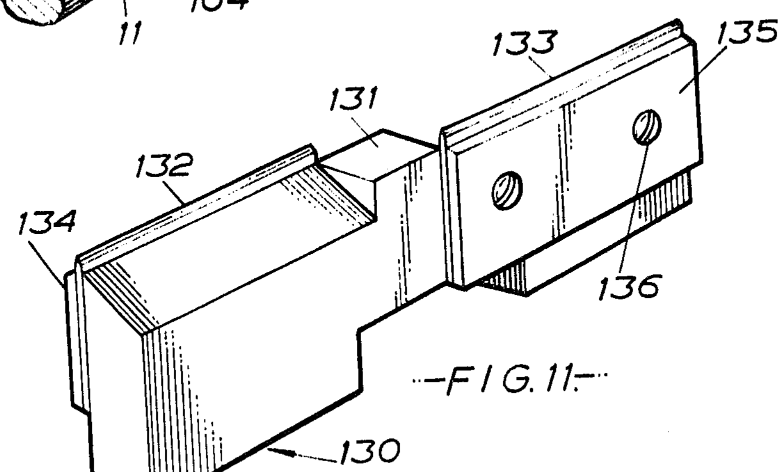
INVENTOR:
GEORGE HIRST & BRIAN WHITELE
BY
Norris & Bateman




—FIG. 7.—

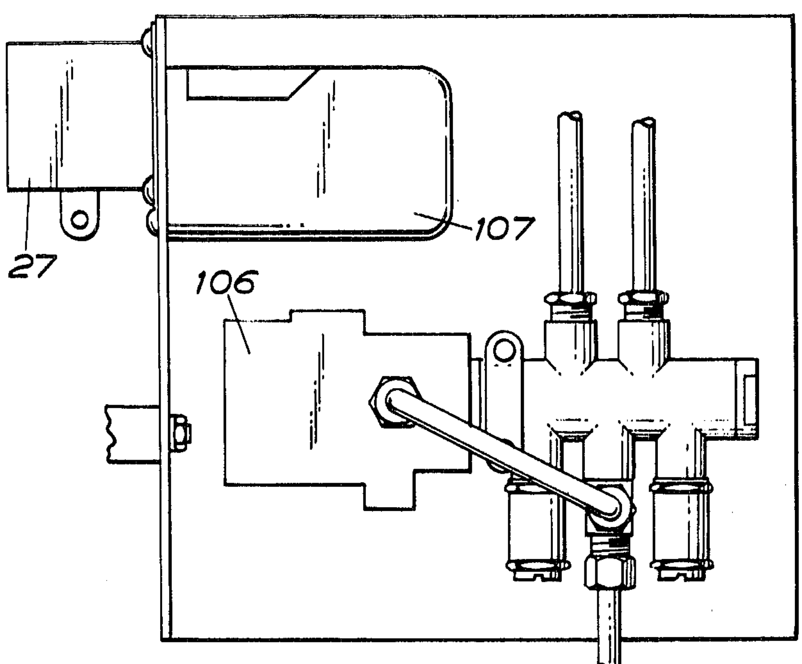



—FIG. 10.—




—FIG. 11.—

INVENTOR:
GEORGE HIRST & BRIAN WHITELEY
BY
Norris & Bateman

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INVENTOR:
GEORGE HIRST & BRIAN WHITELEY
BY
Norris & Bateman

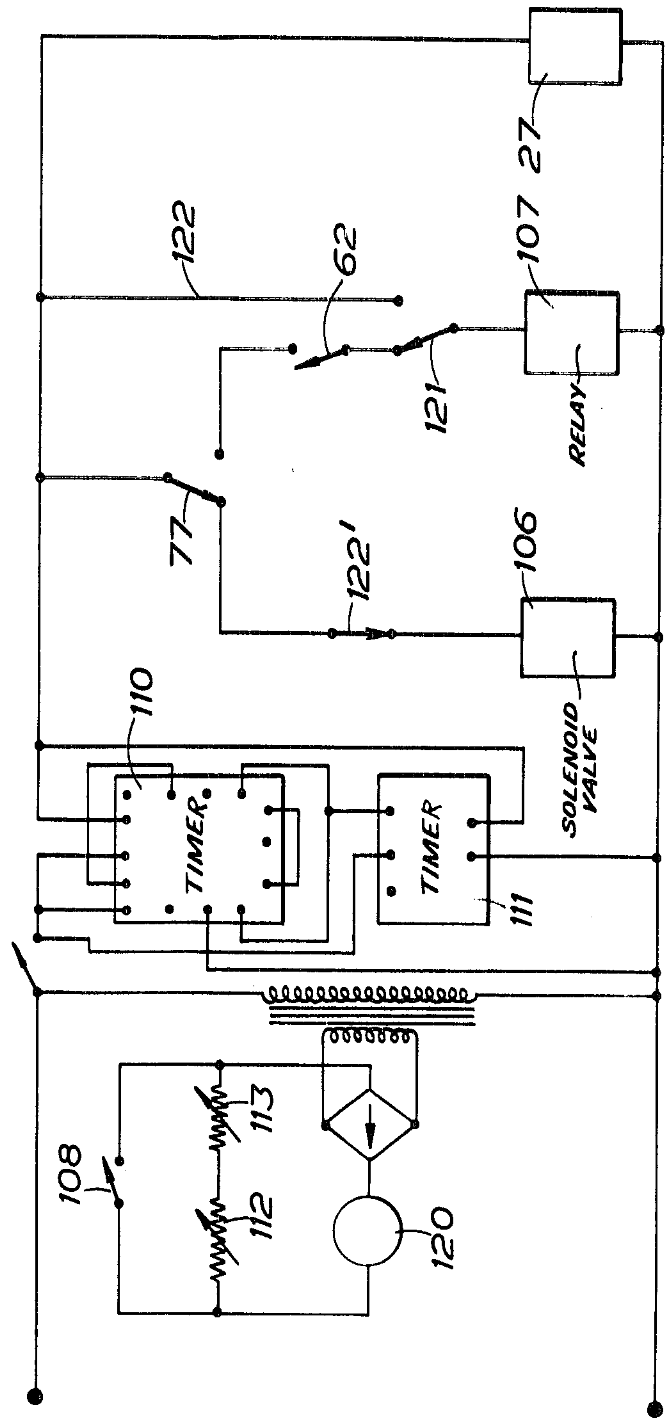


FIG. 9

INVENTOR:

GEORGE HIRST & BRIAN WHITELEY

BY

Norris & Bateman

## TEXTILE THREAD-WINDING APPARATUS

Thread-winding apparatus is used in the textile industry to wind all kinds of threads on to various carriers such as bobbins, pirns and tubes. The present invention is concerned with textile thread-winding apparatus generally, and while in this specification reference will be made to winding on to tubes, it is to be understood that other types of carrier could be used. Furthermore, the term "thread" is intended to include not only twisted yarns, but also untwisted or partially twisted slubbings and filaments. A practical embodiment of the invention has indeed been designed to wind narrow tapes of plastics material (e.g. polypropylene) and this is an indication of the breadth of the term "thread" as used herein.

When a carrier has been filled with the wound thread, it has to be removed and replaced by an empty carrier. Obviously, it is advantageous if this can be done automatically without stopping the winding machine. This is especially the case if the machine is arranged to deliver the thread continuously irrespective of whether it is being wound on to a carrier or not.

This invention relates to winding apparatus in which there is a winding station and at least one reserve station, there being automatic mechanism for bringing an empty carrier placed on a reserve station to the winding station, and for moving the filled carrier from the winding station to a reserve station so that the filled carrier can be removed from the reserve station and replaced by an empty one, manually, at any time while the winding process is in operation without stopping the machine.

Although there is no particular difficulty in moving the filled carrier to the reserve station and the empty carrier to the winding station, there are difficulties of some magnitude in ensuring a correct changeover of the thread from the full carrier to the empty carrier. It is the principal object of the invention to provide automatic winding apparatus which is adapted to deal with the problem of thread changeover.

According to this invention a textile thread-winding apparatus has a mechanism for moving a filled thread carrier from a winding station to a reserve station, and for moving an empty carrier from a reserve station to the winding station and deflector means adapted to be placed in an operative relationship with the empty carrier when the latter arrives at the winding station to guide the thread then extending from a supply source to the filled carrier on to a thread catcher rotatable with the empty carrier.

The deflector means may take the form of a substantially rigid member movable into a position where it deflects the thread from its natural (free) path, and having a surface which engages with the thread, this surface being so shaped that the tension of the thread causes the thread to move over the surface towards the position where it engages on the thread catcher.

The winding apparatus may include a reciprocable thread guide for traversing the thread along the carrier as it is being wound, in which case, the apparatus may be adapted to use the traverse of the thread by the thread guide to move the thread over the surface of the deflector on to the thread catcher. Preferably, the apparatus includes means for moving the deflector member with the empty carrier to engage with the thread between the thread guide and the filled carrier as the empty carrier arrives at the winding station.

Preferably, the deflector comprises a wire rod extending parallel with the longitudinal axis of the empty carrier and curved inwardly towards the axis of the carrier at the thread catcher end of the carrier. If the apparatus has a laying on roller which presses the thread on to the carrier at the winding on station, then the laying on roller will be movable towards and away from the axis of the carrier to allow for build up of the thread package. In that case, cam means are preferably associated with the mechanism for moving the carrier to move the laying on roller outwardly to allow the deflector to pass between it and the empty carrier when a change takes place.

According to another preferred feature of the invention, driving means are provided for rotating a carrier about its own axis for the purpose of thread winding. The driving means is



preferably of a friction type to permit slip to occur when a predetermined load is exceeded. It is also preferred that the driving means shall be so arranged that it is capable of rotating a carrier at both the winding and reserve stations and during the transition from one stage to the other. Further, it is preferred to provide control means whereby the drive to a carrier at the reserve station can be started and stopped as required by the changeover cycle of the apparatus.

According to yet another preferred feature of the invention, the driving means for rotating the carrier includes a variable torque coupling adapted to transmit an increased torque during that part of the changeover cycle when a carrier is being rotated at the reserve station.

According to a still further preferred feature of the invention, there is a turret rotatable about its own axis, and having at least two thread carrier mountings, any one of which can be brought to the winding station (when another will be at the reserve station) by rotation of the turret, there being means for locking the turret in any of the positions where one of the carriers mountings is at the winding station.

The turret rotation mechanism may include a reciprocable prime mover, operating on the turret through a unidirectional drive transmitter, so that only movement of the prime mover in one direction is converted into rotation of the turret. With such an arrangement the means for locking the turret may comprise a resiliently loaded pawl engageable with a shoulder on a part rotatable with the turret to resist motion of the turret beyond the desired position when the prime mover moves in the driving direction.

At each carrier position on the turret there is preferably a spindle adapted to be rotated from a constantly rotated drive shaft, coaxial with the turret, through a friction drive. This friction drive may include a spring loaded member normally in the driving position but disengageable by a drive release device at the reserve station.

Mechanism for rotating the turret is preferably fluid operated (hydraulic or pneumatic) and may be a ram and cylinder device with a rack fixed to the ram engaging a pinion.

According to yet another preferred feature of the invention, the winding apparatus has a thread-transversing mechanism for traversing the thread axially of the carrier during the winding process, and control mechanism is provided whereby the operation of the turret-turning mechanism is only possible when the thread is about to traverse towards the thread catcher. This can be achieved by a switch or valve controlling the turret-turning mechanism and operated by a cam driven by the traversing mechanism.

For some threads it may be adequate to rely on tension in the thread between the thread catcher and the carrier which has just moved to the reserve station to break the thread to permit winding on to the empty carrier to commence. However, it is preferred to provide a thread cutter positioned so that thread extending from the carrier which is just arriving at the reserve station to the thread catcher will cross the cutter and be severed by it. The cutter may have a blade or it may comprise an electric resistance wire adapted to be heated to sever the thread when a current is passed through it.

A winding head of a machine for winding polypropylene tape on to tubes for use in loom shuttles, which machine is constructed in accordance with the invention, will not be described by way of example only, with reference to the accompanying drawings in which:

FIG. 1A is a partly sectional plan of the winding head, taken on the line I—I in FIG. 2,

FIG. 1B is a partly sectional plan complementary to FIG. 1A,

FIG. 2 is an end view looking in the direction of arrow II in FIG. 1B,

FIG. 3 is a sectional elevation on a line III—III in FIG. 2, showing a driving mechanism,

FIG. 4 is an end view of a spindle drive mechanism,

FIG. 5 is an end view of a turret-locking mechanism,

FIG. 6 is an end view of a turret-turning mechanism,

FIG. 7 is a perspective view of a thread guide,

FIG. 8 is a view underneath the machine showing certain control elements.

FIG. 9 is an electrical diagram showing the control circuit,

FIG. 10 is a detail view of a thread catcher, and

FIG. 11 is a detail view of a thread cutter.

Only a single-winding head is illustrated in the drawings, but it will be appreciated that in practice, a number of these heads are provided on the winding machine. Since all the heads are identical, it is only necessary to describe one in detail. The winding machine is positioned adjacent a continuous extrusion machine producing the polypropylene tapes and one tape is fed to each winding head. It should be understood that the invention could be used on a winding machine having only a single-winding head, with a corresponding single thread supply.

There is a positive thread feed from the extruder, but the winding machine is driven at a speed such as to maintain tension in the thread.

As seen in FIGS. 1A, 1B and 2, there is a spindle turret **10** rotatable about its own longitudinal axis, and mounting two spindles **11** and **12** at positions mutually at 180° to each other around the axis of the turret. Each of the spindles **11** and **12** is adapted to receive a tube (not shown) and is split at **14** so that it can contract slightly when the tube is fitted to ensure that the tube is firmly gripped on the spindle. It will be understood that other methods of holding a tube on to the spindle could be employed. For example, a spring tube holder of the kind well known for holding textile tubes on creels, spindles and the like could be provided on the spindle to grip the tube on its inside.

The machine is driven by an electric motor (not shown) and there is a belt drive to a pulley **15** coaxial with the turret **10**.

The pulley **15** is keyed on to an input shaft **16** of a coupling **120**, the driven member of which is keyed on to a spindle drive shaft **17**. The coupling **120** is a magnetic particle coupling which uses a ferromagnetic powder as the drive medium. The important feature of this type of coupling for the purpose of this invention is that the coupling can slip, but the torque transmitted is entirely dependent on the applied excitation current. Consequently, during operation the torque output of the coupling can be altered by altering the applied current.

The other end of the shaft **17** carries a friction drive pulley **18** (see FIG. 4). Each of the spindles **11** and **12** is provided with a pulley **19**, **20** and there are idler pulleys **21**, **22** each having a rubber tire, which both engage with the drive pulley **18**, and respectively engage with the pulley **19** and **20**. So long as either of the idler pulleys remains in contact with its spindle pulley **19** or **20**, it will transmit drive from the drive pulley **18** to its spindle.

FIG. 4 shows that each idler pulley **21**,**22** is carried on a lever **23**, **24** pivoted on the turret at **25**, **26** these levers are loaded by springs **23*a*** and **24*a*** to press their respective pulleys **21** and **22** into engagement with the drive pulley **18** and the spindle pulleys **19** and **20**. The spindle in the position indicated in FIGS. 1B, 2 and 4 as **11** is in the winding on station while the spindle **12** is in the reserve station—but it will be appreciated that this will be reversed if the turret **10** is rotated through 180°.

At the side of the machine remote from the winding on station, there is a solenoid **27** the control of which will be described later. The armature of the solenoid is connected by a link **28** with one end of a two-armed lever **29** pivoted on a fixed part of the machine at **30**. The other arm of the lever **29** has a spigot **31**, which is capable of engagement with the end of whichever of the levers **23** and **24** is at the reserve station. A tension spring **32** is attached at one end to the lever **29**, and at its other end it is anchored to a pin **33** fixed on the machine. This spring pulls the lever **29** to engage the spigot **31** on the lever **23** or **24**, and the spring **32** is strong enough to overcome the spring loading of the lever **23** or **24**, so that it disengages the idler pulley **21** or **22** from the spindle pulley **19** or **20** as indicated by the chain dotted line in FIG. 4.

Thus the drive to the spindle at the reserve station is normally interrupted, but if the solenoid **27** is energized, it pulls the lever **29**, to release the lever **23** or **24**, and this reconnects the spindle drive. Consequently, it is possible to apply rotation to the reserve station spindle by energizing the solenoid **27**. There is no permanent connection between the lever **29** and the levers **23** and **24** so that the latter are free to rotate with the turret, and during such rotation both spindles will continue to rotate, because each idler pulley will remain in driving contact with the drive pulley **18** and the pulley **19** or **20**.

The turret **10** is fixed to a tube **34** supported in journal bearings **35** and **36**, and the drive shaft **17** passes through this tube and is free to rotate in a needle bearing **37** and a ball bearing **38**.

The mechanism for turning the turret is illustrated in FIGS. 1A and 6, and in this instance it is pneumatically operated, although it should be understood that hydraulic or purely mechanical (e.g. crank) operation is possible. A pneumatic cylinder **40** is mounted below the turret, and its piston rod **41** carried a toothed rack **42** which meshes with a pinion **44** rotatable on the tube **34**. The pinion **44** is compounded with the driving part of a freewheel device **45**, and the driven part of this device is keyed on to the tube **34**. The arrangement of the freewheel drive is such that drive is only transmitted to the tube **34** when the piston rod **41** is projected to push the rack **42** upwardly, and this produces rotation of the turret **10** in the anticlockwise direction as viewed in FIG. 4.

The mechanism for locking the turret at its two possible positions is illustrated in FIG. 5. A cam disc **46** is keyed on to the tube **34** and this disc has two identical halves each rising from a low point to a high point with a sudden step **47**, **48** at the junction between one high point and the adjacent low point.

A stop lever **51** is pivoted at **52** to the frame, and this lever occupies a position above the cam disc **46**. A detent **53** on the lever **51** is engageable with either of the steps **47** and **48** to prevent rotation of the cam disc **46**. A tension spring **57** is anchored to the lever **51** at **58** and to a fixed part of the frame at **59**. Normally, the spring **57** pulls the stop lever **51** downwardly and this holds the detent **53** in engagement with one of the steps **47**, **48**. A release cam **60** is fixed on a freewheel device at **45**, and is engageable with a pin **61** projecting from the stop lever **51** (see also FIG. 6).

When the rack **42** rotates the pinion **44** in the clockwise direction due to retraction of the piston rod **41**, the cam **60** engages with the pin **61** towards the end of rotation of the cam, and lifts the lever **51** to disengage the detent **53** from the step **47**. The cam **46** is then free to rotate, and this means that the turret **10** can also rotate. An interlock switch **62** is positioned above the lever **51**, and is closed by that lever when the cam **60** lifts it to release the turret.

When the piston rod **41** is retracted, it does not rotate the cam **46** because the latter is held by the detent **53**, and the freewheel device **45** allows the pinion **44** to rotate without the cam **46**. When the rod **41** is projected however, the freewheel device transmits drive and the cam **46** is rotated (it having been freed by the cam **60** lifting the lever **51**) and the turret **10** is rotated with it. Sufficient "land" at the top of the lift of the cam **60** must pass under the spigot **61**, to hold the lever **51** in its raised position during the initial movement of the cam **46** to allow the step **47** or **48** to pass the detent **53**. Thereafter the detent drops on to the periphery of the cam **46** but simply rides on it until it engages the next stop **48** or **47** after 180° rotation of the turret.

The arrangement so far described provided means for mounting the tubes on the two spindles, means for bringing the tubes one at a time to the winding on station, and means for rotating the spindle at the winding on station to wind the tapes on to it.

Referring again to FIGS. 1 and 2, the tape is brought from the supply station, through a traversing guide **63**, and over a laying on roller **64** which presses the tape on to the tube on the spindle at the winding on station to ensure that a firm package is produced.

 

The laying on roller is freely rotatable on needle bearings **65** and **66** on a spindle **67** which is carried by arms **68** fastened to a part **69** which is capable of turning about the axis of a traversing shaft **70** arranged parallel with the shaft **17**.

The traversing guide **63** is mounted on a slider **71** slidable on a fixed rod **72** arranged parallel with the shaft **70**. A roller follower **73** carried by the slider **71** engages in a groove **74** in a reversed helical cam **75** fixed to the shaft **70**. Only part of the cam **75** is shown in FIG. 1, but it will be understood that this cam is of a type well known in the textile industry for traversing the slider **71** and its guide **63** backwards and forwards along the length of the tube to lay the tape evenly along the tube.

At one end of the shaft **70**, there is a cam **76** rotatable with the shaft. This cam operates a plunger switch **77**, and has a notch **78** which allows the switch to close each time the guide **63** is almost at the outer end of its traverse (i.e. the right hand end as seen in FIG. 1). The traversing mechanism itself is driven, independently of the drive to the spindles, by a belt drive from the motor on to a pulley **80** (FIG. 3) keyed on a shaft **81** parallel with the shaft **17**. A pinion **82** on the shaft **81** drives a wheel **83** on the layshaft **84**, and a pinion **85** on the layshaft **84** drives a wheel **86** carried on a stub shaft **87**. The wheel **86** meshes with and drives a large wheel **88** keyed on to the traversing shaft **70**.

A thread guide device as shown in FIG. **7** is fitted to the turret **10** (see also FIGS. 1A, 1B and 2) and comprises a mounting block **91** into which are fastened the ends of a wire rod. The latter is bent to provide radial members **92** and **93** and two longitudinal members **92*a*** and **93*a*** joined by an S-shaped end portion **94**. If desired, a strengthening rod **94*a*** may be fitted between the block **91** and the center of the S portion **94**.

As shown in FIGS. 1A, 1B and 2, the device **90** is fitted to the turret **10** so that the longitudinal member **92*a*** is associated with the spindle **12** and the member **92*a*** is associated with the spindle **11**. Each member **92*a***, **93*a*** extends parallel with its spindle to a position near to the inner end where it sweeps round a curve **91*a*** towards its spindle.

A cam plate **95** is fixed to the turret and has lobes **96** and **97** at the positions where the guide members **92*a*** and **93*a*** are fitted. A roller **98** is carried by the laying on roller spindle **67** and this roller engages on the peripheral surface of the plate **95**. When the turret is rotated, from the position shown in FIG. 2, the lobe **96** will push the laying on roller assembly away from the turret to allow the guide member **92*a*** to pass to the underside of the laying on roller. In doing this, the tape which passes through the guide **63** and over the roller **64** is pressed down and lies on the outside of the wire guide **92*a***.

Fixed on the cam plate **95** at the center is a thread cutter unit **130**, shown in detail in FIG. 11. A block **131** has two cutter blades **132** and **133** clamped respectively on to its opposite sides by clamp plates **134** secured by screws **136**. The disposition of the blades **132** and **133** is clearly shown in FIG. 2 and it will be observed that they are close to the pins **103** on the spindles **11** and **12**.

A ring **100** (see FIG. 10) is fixed to the inner end of each spindle **11**, **12** and a series of short pins **103** projects from each of these rings. These pins provide a thread-catching device. A part annular member **102** is fixed to the turret and embraces part of the ring **100**, there being bristles **104** projecting inwardly from the member **102** which serve to trap tape caught on one of the pins **103** to ensure that the tape cannot escape from the pins once it has been caught.

A solenoid-controlled pneumatic valve **106** (FIG. 8) is fitted in the circuit of the cylinder **40**, and there is also a relay **107** for the control circuit.

The electrical control gear besides the apparatus already described includes a normally open switch **108** (FIG. 4) which is adapted to be closed by a pin **109** which joins the armature of the solenoid **27** to the link **28**. Consequently, the switch **108** is closed each time the solenoid pulls down the lever **29** to allow drive to be connected to the spindle at the reserve station. There is also an automatic time delay switch **110** which is set to the period between carrier changeovers (i.e. the time during which tape will be wound on to one tube) and a time delay switch **111** which control the period allowed for the changeover to take place.

The overall operation of the machine will not be described. Supposing that the parts are in the position shown and that tape is being wound on to a tube on the spindle **11**. The length of tape delivered is determined by the setting of the timer **110**, although it will be appreciated that it could be measured by some kind of detector on the winding machine. When the required length has been wound on to the tube, an electrical signal appears at the timer **110**.

This signal allows current to flow through the solenoid **27** to release the lever **24** so that drive is transmitted from the driving shaft **17** to the spindle **12**. Therefore the tube at the reserve station (which will be an empty tube) begins to rotate.

When the solenoid **27** is energized, it causes the switch **108** to be closed, and this short circuits variable resistances **112** and **113** arranged in series with the magnetic particle coupling **120**. The resistances **112** and **113** are set so that the coupling will transmit only sufficient torque to keep the correct tension in the tape, the winding apparatus operating with constant torque. When the resistances **112** and **113** are cut out, the torque transmitted by the coupling **120** is greater and is adequate to drive both spindles **11** and **12**.

Also when the signal appears at the output of the timer **110**, current flows via the traverse switch **77** and a relay contact **122** to the air valve solenoid **106**. The latter is actuated, so that it retracts the rod **41** of the cylinder **40**, thus rotating the pinion **44** and the cam **60**. The latter releases the stop lever **51** so that the turret is free to rotate, and also closes the interlock switch **62**.

The machine continues to wind thread on to the tube on the spindle **11**, but at the same time the spindle **12** is being brought up to the correct winding speed. Just after the thread has reached the outer end of its traverse (i.e. when the slider **71** is about to move towards the turret) the cam **76** closes the switch **77**. Current then ceases to flow through the air valve solenoid **106**, and consequently the air supply to the pneumatic cylinder **40** is reversed, so that the rod **41** is projected to the extended position shown in FIG. 6 and this rotates the turret **10** through 180°.

Current can then also flow through the switches **62** and **77** so that the relay **107** is energized. The relay operates a latching switch **121** in the electrical circuit, and this latches on the relay via a conductor **122**, so that it remains energized until the timer **111** operates to cut off the current through the conductor **122**. When the relay **107** is actuated, it opens the relay contact **122'** and this maintains the solenoid valve **106** in the position such that the rod **41** is held in its projected position and cannot attempt to reoperate.

During the rotation of the turret **10**, the spindle **12** is brought into the winding on station, and the guide rod **92*a*** pushes the tape extending from the laying on roller **64** to the tube on the spindle **11** (now at the reserve station) downwardly. The tape thus becomes deflated and runs on the outside of the guide wire **92*a***. By the time the changeover has taken place, the tape will be travelling inwardly, and at the end of its inward traverse, it slides around the curved part **91*a*** of the guide wire because it is being pulled taut by the continued rotation of the spindle **11**.

The tape then becomes caught on the pins **103** and begins to wind on to the spindle **12** and then, due to the traverse of the guide **63**, on to the tube on the spindle **12**.

Since the tape is then being wound on to the tube on the spindle **12**, but at the same time, the spindle **11** is still rotating and attempting to wind the tape on to its tube, the length of tape between the pins **103** of the spindle **12** and the tube on the spindle **11** is stretched taut across the cutter blade **132** (then in the opposite position to that illustrated in FIG. 2) and the tape is severed. The tail is then wound on to the full tube on the spindle **11**.

After a short time delay determined by the timer **111**, the solenoid **27** is deenergized and this allows the spindle **11** to stop so that it can be removed manually when desired and replaced by a fresh empty tube. The release of the solenoid **27** causes the switch **108** to be opened, and this switches the coupling control circuit to the winding condition so that the torque output of the coupling is reduced to that required for winding on the thread. Furthermore, the relay **107** is deenergized and this allows the contact **122'** to close and the relay contact **121** to revert to its set position. Since the fall of the lever **51** when the turret **10** is rotated will open the interlock switch **62**, all the electrical circuit is restored to normal and the timer **110** begins to time the winding on to the tube on the spindle **12**.

Various modifications are possible in the construction and operation of the machine described above. In particular, the severing of the tape or thread is susceptible to being realized in a variety of ways. In some cases, the thread will be severed simply due to the tension caused by the continued rotation of the spindle which has just moved to the reserve station after the thread has been caught on the thread catcher of the spindle just arrived at the winding on station. Consequently, the cutter would not be required.

The significance of the variable torque coupling in relation to this question of thread severing should not be overlooked. This coupling allows an increased torque to be transmitted as previously described during the changeover period. Consequently, the power applied to drive the spindle which has just moved to the reserve station is adequate to hold the thread taut enough for severing by a cutter (and in some instances is sufficient to break the thread), but during the winding on period, the power is reduced so that the package is not wound too tightly.

Furthermore, the method of driving the two spindles during the changeover period by the arrangement illustrated in FIG. 4 is very useful in enabling

a. the spindle which is moving into the winding on position to be brought up to speed, and

b. the other spindle to be rotated to hold the thread taut.

Instead of using a cutter with blades such as that shown in FIG. **11**, the cutter may have an electric resistance wire which is heated so as to be capable of severing the thread when the latter is stretched over it. Furthermore, the cutter, with either a blade or a heated wire, may be positioned differently. For example it could be pressed into engagement with the cylindrical surface of the ring **100** (FIG. **10**). In one such arrangement there are two rows of pins **103** between which there is an annular groove in the ring **100**, and the cutter engages in the groove. When a thread is caught on the two rows of pins, it must cross the groove at some point, and it will be cut when this part of the thread passes the cutter.

In the embodiment described above with reference to the drawings, the winding on spindle and the traversing cam are driven from the same motor through two separate belt drives to the pulleys **15** and **80** and this results in a random relationship between the winding on and the thread traverse. Even if the drives are coupled together by a positive driving mechanism such as a chain drive, there will be the same random relationship due to the slipping action of the clutch **120**. If a precisely controlled wind is required then the output of the coupling **120** must be geared to the traversing drive shaft **81**, but this calls for a more powerful clutch **120**.

It will be appreciated that a single set of electrical timers such as **110** and **111**, can be used to operate the changeover of a series of thread winding stations as shown in FIGS. **1A**, **1B** and **2** on a single machine.

We claim:

1. A textile thread-winding device having a winding station and a reserve station and comprising support means; first and second thread carrier mountings on said support means; said support means being mounted for movement between a first position, whereat said first thread carrier mounting is at said winding station and second thread carrier mounting is at said reserve station, and a second position, whereat said first thread carrier mounting is at said reserve station and said second thread carrier mounting is at said winding station; driving means for rotating whichever of said mountings is at said winding station; first and second thread catches mounted respectively at said first and second thread carrier mountings and being rotatable about their respective axes, and first and second deflectors mounted on said support means for movement therewith, said deflectors being respectively positioned in proximity to said first and second thread carrier mountings, and arranged so as to deflect thread passing to a carrier on the associated mounting when that mounting is at said winding station, onto said thread catcher associated with that mounting.

2. A textile thread-winding apparatus as claimed in claim **1**, further comprising a laying on roller normally urged towards a carrier at said winding station, but mounted for movement away from said winding station to allow for build up of the thread package, and first and second cam means associated respectively with said first and second deflectors, said cam means being movable with said support means to lift said laying on roller away from said winding station to allow said associated deflector to pass said laying on roller.

3. A textile thread-winding apparatus as claimed in claim **1**, in which there is a reciprocable thread guide for traversing a thread along the length of a thread carrier at said winding station, said first and second deflectors being shaped so that when the thread guide carries a thread along the length of a deflector, the combination of the action of the thread guide and the shape of the deflector causes the thread to be guided onto the thread catcher.

4. A textile thread-winding apparatus as claimed in claim **1**, in which each of said deflectors comprises a wire rod extending substantially parallel with the longitudinal axis of the associated carrier and curved inwardly towards the axis of that carrier at the thread catcher end of that carrier.

5. A textile thread-winding apparatus as claimed in claim **1**, in which driving means are provided for rotating a carrier at each of said first and second mountings about its own axis for the purpose of thread winding.

6. A textile thread-winding apparatus as claimed in claim **5**, in which the driving means is of a friction type to permit slip to occur when a predetermined load is exceeded.

7. A textile thread-winding apparatus as claimed in claim **5**, in which the driving means is so constructed and arranged that it is capable of rotating a carrier at both the winding and reserve stations and during the transition from one stage to the other.

8. A textile thread-winding apparatus as claimed in claim **7**, in which control means are provided whereby the drive to a carrier at the reserve station can be started and stopped as required by the changeover cycle of the apparatus.

9. A textile thread-winding apparatus as claimed in claim **7**, in which the driving means includes a driving roller, and each mounting comprises a spindle each adapted to receive a thread carrier, said spindles being rotatable bodily about the axis of rotation of the driving roller during a changeover so as to maintain the drive from the driving roller to the spindles during the changeover.

10. A textile thread-windng apparatus as claimed in claim **9**, in which there is associated with each spindle an idler roller which engages with the driving roller to transmit drive from the driving roller to the spindle, the idler roller being mounted on a part movable with the spindle between its winding on and reserve stations this part being movable to permit disengagement of the idler roller and the driving roller at the reserve station.

11. A textile thread-winding apparatus as claimed in claim **10**, in which each idler roller is mounted on a pivoted lever resiliently loaded so that it normally holds the idler roller in engagement with the driving roller.

12. A textile thread-winding apparatus as claimed in claim **11**, in which a release member is provided which is adapted

for movement between an inoperative position where it is clear of the path of movement of all parts movable with the spindles during a changeover, and an operative position where it engages the pivoted lever and turns the latter to disengage its idler roller from the driving roller.

13. A textile thread-winding apparatus as claimed in claim 12; in which the release member is adapted to be operated by a solenoid.

14. A textile thread-winding apparatus as claimed in claim 13, in which the driving means includes a variable torque coupling adapted to transmit an increased torque during that part of the changeover cycle when a carrier is being rotated at the reserve station.

15. A textile thread-winding apparatus as claimed in claim 14, in which the variable torque coupling is a magnetic particle coupling.

16. A textile thread-winding apparatus as claimed in claim 15, in which a variable resistance is connected in series with the magnetic particle coupling to provide means for setting the normal (winding on) torque of the coupling and a switch is provided to short circuit the variable resistance, this switch being adapted to be closed during a changeover so that the coupling transmits increased torque during the changeover period.

17. A textile thread-winding apparatus as claimed in claim 1, in which said support means comprises a turret rotatable about its own axis, there being means for locking the turret in any of the positions where one of said carrier mountings is at the winding station.

18. A textile thread-winding apparatus as claimed in claim 17, in which the turret station mechanism includes a reciprocable prime mover, operating on the turret through a unidirectional drive transmitter, so that only movement of the prime mover in one direction is converted into rotation of the turret.

19. A textile thread-winding apparatus as claimed in claim 18, in which the means for locking the turret comprises a resiliently loaded pawl engageable with a shoulder on a part rotatable with the turret to resist motion of the turret beyond the desired position when the prime mover moves in the driving direction.

20. A textile thread-winding apparatus as claimed in claim 19, in which the mechanism for rotating the turret is fluid operated.

21. A textile thread-winding apparatus as claimed in claim 20, in which the mechanism for rotating the turret is a ram and cylinder device with a rack fixed to the ram engaging a pinion.

22. A textile thread-winding apparatus as claimed in claim 17, in which there is a thread-transversing mechanism for traversing a thread axially of a carrier, at said winding station, and control mechanism is provided whereby the operation of the turret-turning mechanism is only possible when the thread is about to traverse towards said thread catcher.

23. A textile thread-winding apparatus as claimed in claim 1, in which there is provided a thread cutter positioned so that thread extending from a carrier which is arriving or has arrived at said reserve station to said thread catcher will cross the cutter and be severed by it.

24. A textile thread-winding apparatus as claimed in claim 23, in which said thread cutter has a fixed blade.

25. A textile thread-winding apparatus as claimed in claim 24, in which said thread cutter comprises an electric resistance wire adapted to be heated to sever a thread when current is passed through it.

26. A textile thread-winding apparatus as claimed in claim 1, in which said thread catcher comprises a series of pins projecting radially from a member rotatable with each of said first and second carriers.

27. A textile thread-winding apparatus as claimed in claim 1, in which periodically operated means is provided to change over said support means between said positions and the time between successive changeovers is controlled by an electrical timer in said periodically operated means.

28. A textile thread-winding apparatus comprising a support having a plurality of thread carrier means rotatably mounted thereon, means mounting said support for rotation between a position wherein said a first thread carrier means is located at a winding station where incoming thread from a supply source may be wound thereon and a second thread carrier means is located at a reserve station where a wound thread package may be removed therefrom and a second position wherein the locations of said thread carrier means may be reversed with an empty second thread carrier means moving into said winding station, means for rotating said support between said positions, means for driving the thread carrier means at said winding station, and thread deflector means mounted on and movable with said rotatable support adapted upon movement of the empty second thread carrier means toward said winding station to intercept said incoming thread and guide it directly into winding relation with said second thread carrier means.

29. A textile thread-winding apparatus as defined in claimed 28, wherein said means for rotating said support comprises time controlled means adapted to rotate said support at predetermined intervals.

30. A textile thread-winding apparatus as defined in claim 29 wherein said driving means is adapted to selectively rotate either one or both thread carrier mountings and time controlled means is provided for initiating rotation of said second thread carrier means before it arrives at said winding station and for stopping rotation of said first thread carrier means after it leaves said winding station during a changeover cycle.

31. A textile thread-winding apparatus according to claim 28, wherein means is provided at said second thread carrier means for catching the thread to be wound thereon, and means on said support effective after the thread has been caught at said second thread carrier means for severing the thread extending between said thread carrier means.