United States Patent [19]

Byrt

[11] **3,752,412**

[45] **Aug. 14, 1973**

[54] **WINDING OF CONTINUOUS WEBS ON TO REELS**

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[73] Assignee: **Masson Scott Thrissell Engineering Limited,** Bristol, England

[22] Filed: **Feb. 7, 1972**

[21] Appl. No.: **224,133**

[30] **Foreign Application Priority Data**

Feb. 5, 1971 Great Britain 4,044/71

[52] **U.S. Cl.** ..... **242/56 A**

[51] **Int. Cl.** **B65h 19/26,** B65h 19/28

[58] **Field of Search** ..... 242/56 A, 56 R, 56.6

[56] **References Cited**

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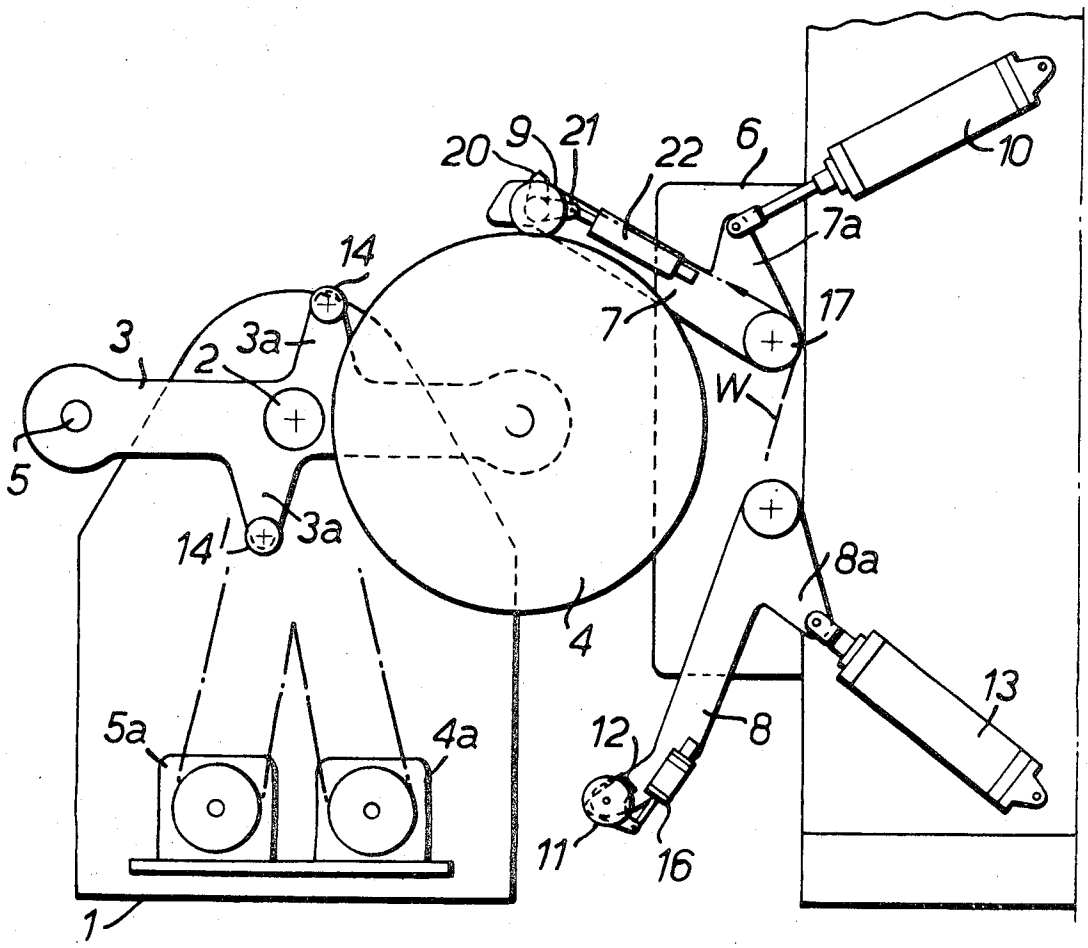
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Assistant Examiner—Edward J. McCarthy
Attorney—Irvin S. Thompson et al.

[57] **ABSTRACT**

Apparatus for transferring a continuous web of sheet material being wound onto a reel to a fresh core employs a rider roll to press the web as it is being wound and a guide roll for the web during transfer. Conveniently the reel and core are on a turnover stand and during transfer, when the reel is moved away from the rider roll, the guide roll is engaged with the web between rider roll and reel to avoid too long an unsupported run. It is also used to assist in wrapping the web around the new core and a web cutter is mounted in close association therewith. The sequence of movements of reel, core, rolls and cutter can be automatically controlled.

5 Claims, 10 Drawing Figures



Patented Aug. 14, 1973 3,752,412

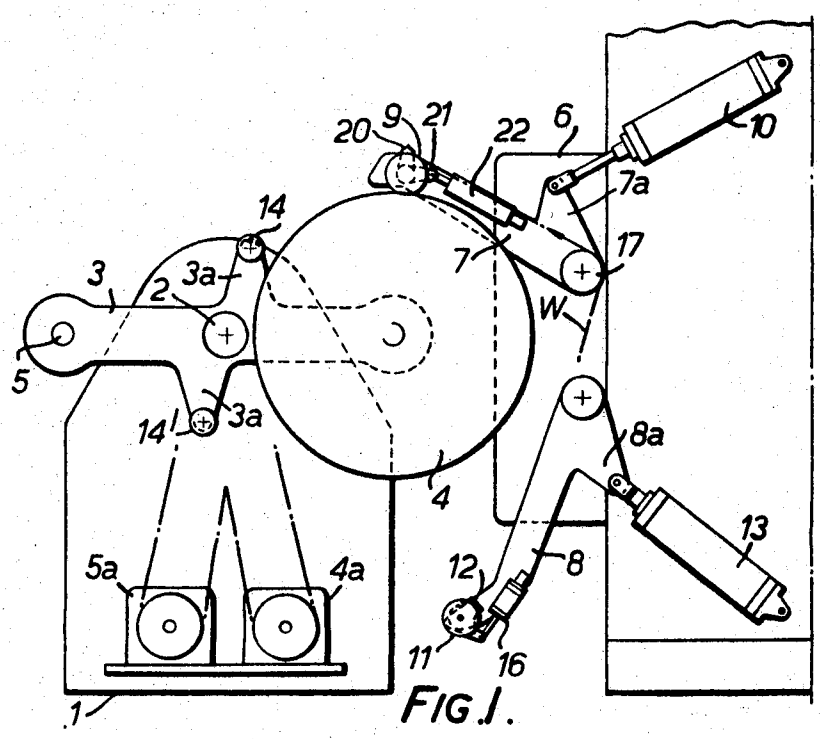


FIG. 1.

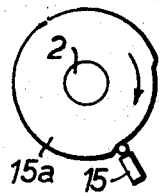


FIG. 2a.

FIG. 2.

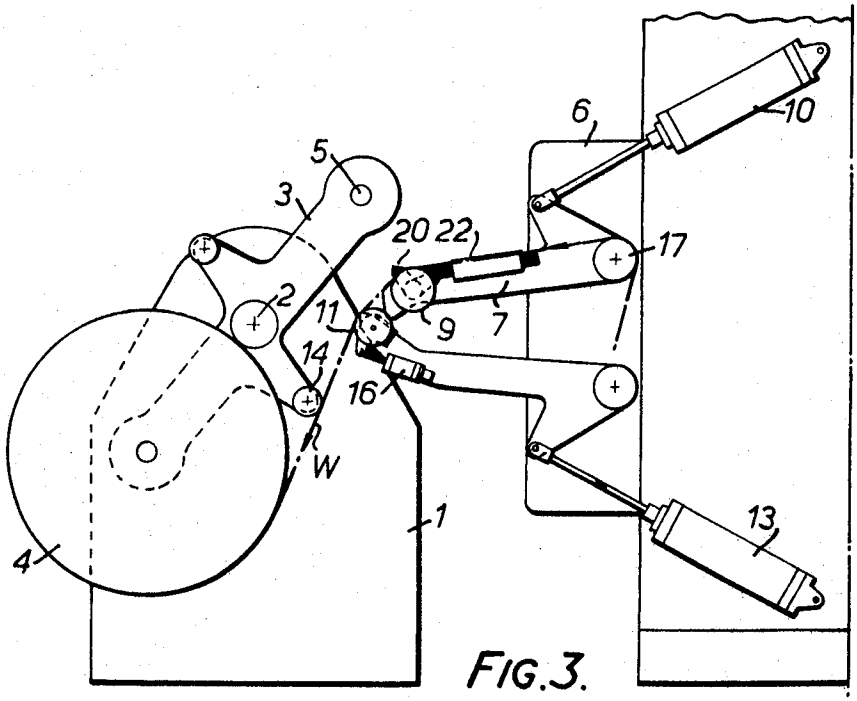


FIG. 3.

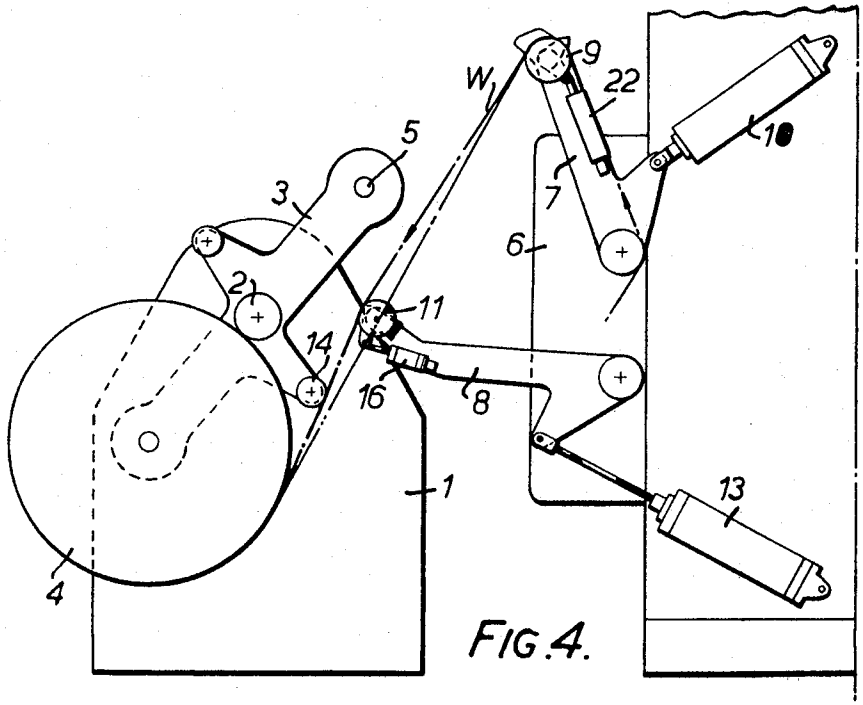


FIG. 4.

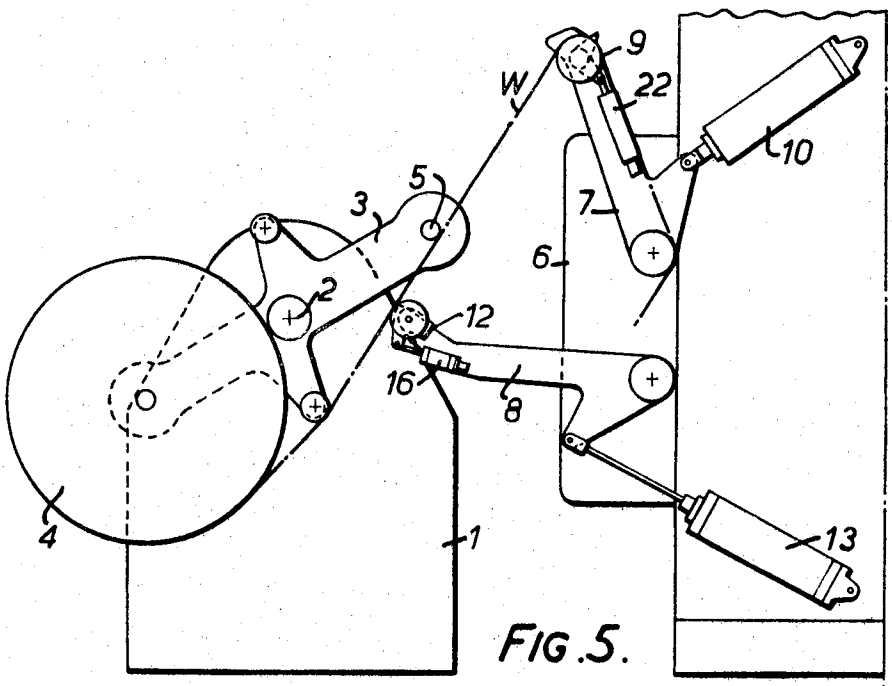


FIG. 5.

FIG. 6a.

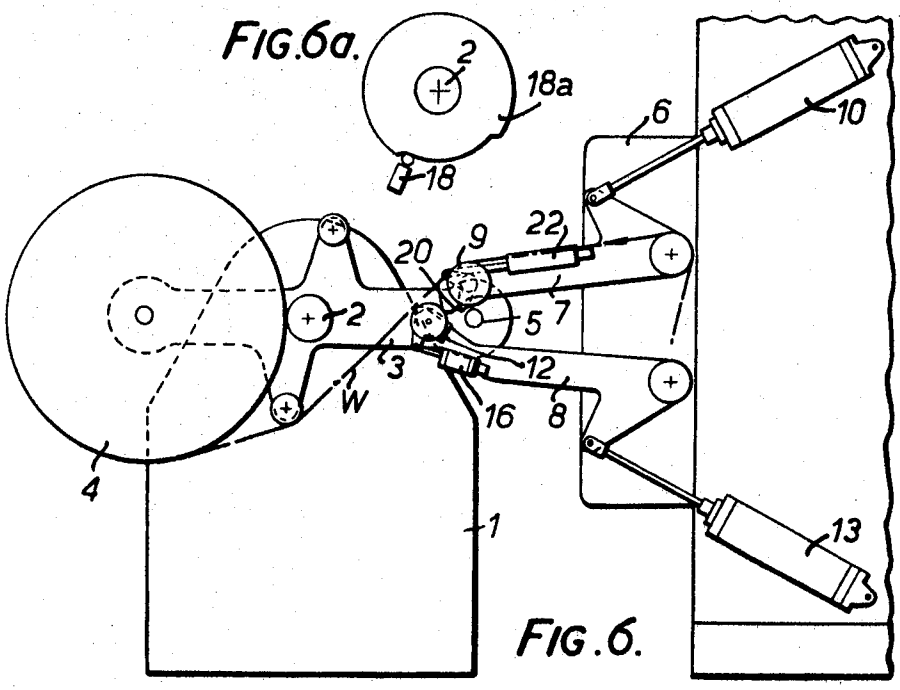


FIG. 6.

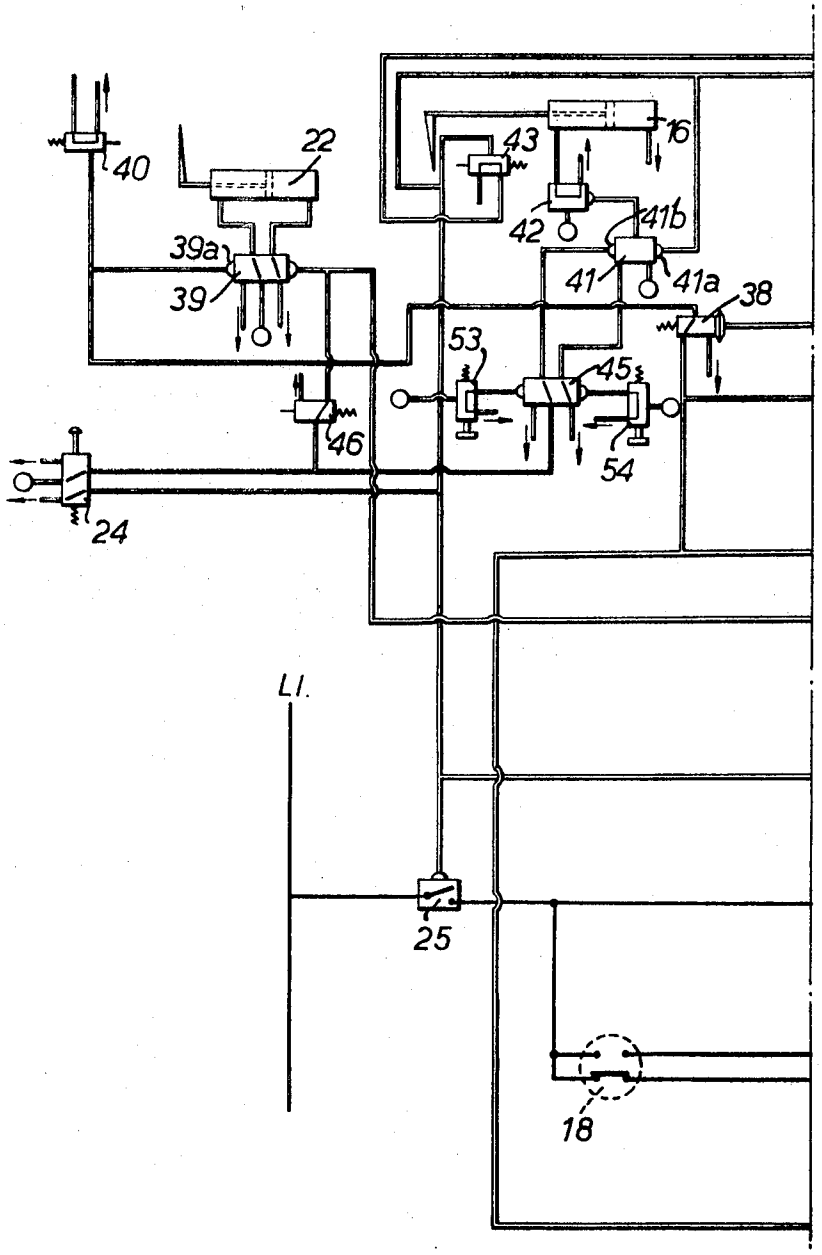


FIG. 7A.

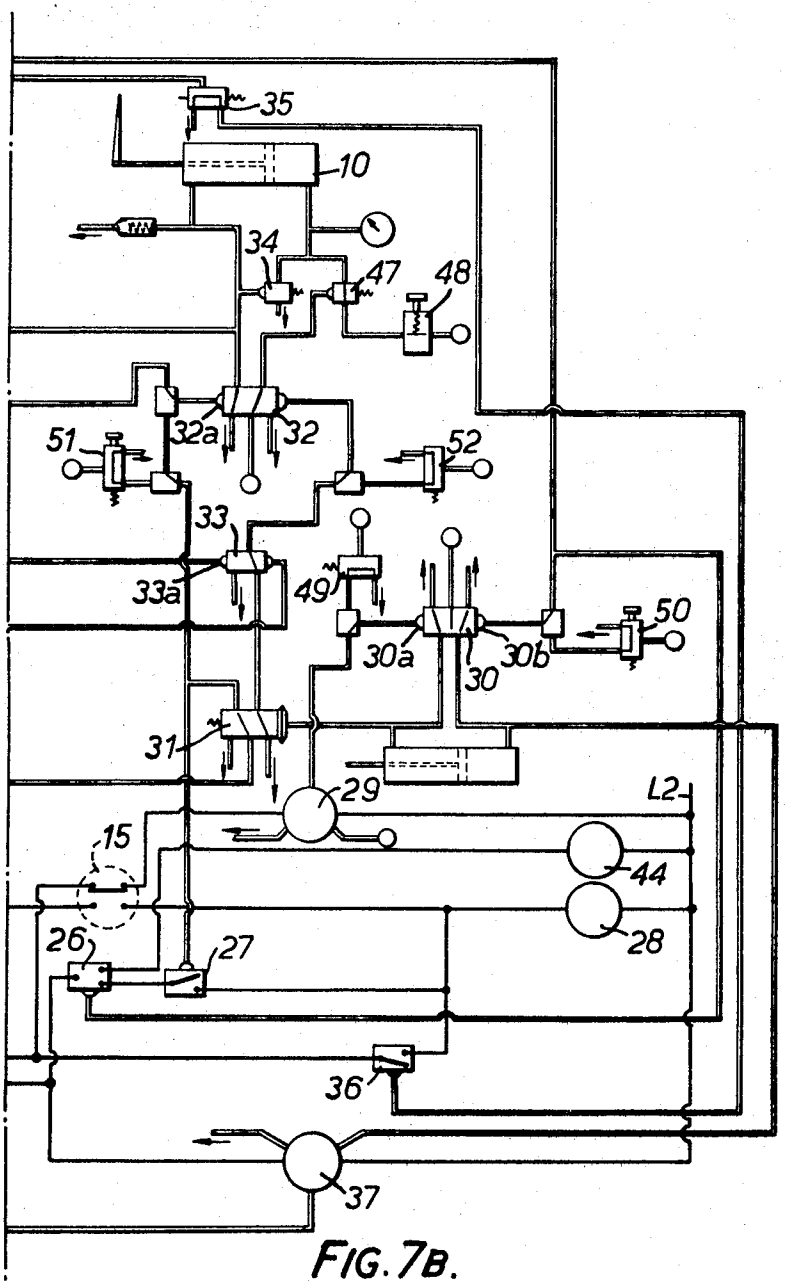

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FIG. 7B.

WINDING OF CONTINUOUS WEBS ON TO REELS

This invention relates to the winding of continuous webs on to reels, and particularly to methods and apparatus for the transfer of the running web from a completed reel to a fresh reel core.

It is common practice for apparatus for performing a continuous winding operation to include some form of turnover reel stand. These reel stands provide stations for supporting two or more reel cores. When one reel of web material has been completed it is necessary to transfer the winding operation from the running reel to a new core. To achieve this it is necessary to rotate the supports carrying the running reel and the new core so that the running reel is removed from its normal winding position and replaced by the new core. During this period of interchange it is not uncommon for the length of span of web from the last guide roller to the winding reel to become excessively long. This has the detrimental effect, on lightweight materials such as cellophane, polythene and tissue paper, of causing piping or fluting of the web across its width. This results in creasing on the winding reel and in some cases leads to web breakages.

It is an object of the invention to reduce or eliminate this disadvantage.

According to one aspect of the present invention there is provided a method of winding a continuous running web of sheet material on to a plurality of reels in sequence, wherein before the web is wound on a reel it is led around a rider roll which rides upon the outermost winding of the reel, and the transfer of the running web from a completed reel to a fresh reel core is effected by moving the reel and rider roll apart to draw out a length of web between them, introducing a guide roller into the path of this length of web from the side opposite to the reel, bringing the fresh reel core into the path of this length of web in close proximity to the guide roller so that the web is caused to envelop the greater part of the periphery of the fresh reel core, and actuating a knife and transfer mechanism to cut the web between the fresh reel core and the guide roller and to transfer the leading end of the cut portion to be wound upon the fresh reel core.

Preferably the reel and the fresh reel core are mounted and rotated at opposite ends of the pivoted arms of a turnover stand, the arms being first pivoted through a predetermined angle to draw out the length of web, whereupon the guide roller is introduced and the rider roll is withdrawn, the arm being then pivoted through a further angle to bring the fresh reel core into the path of the web. After the fresh reel core has been brought into the path of the web, and before cutting, the rider roll is preferably returned to ride upon the outer surface of the web as it passes around the fresh reel core.

According to another aspect of the present invention, there is provided apparatus for carrying out the above-described method comprising a turnover reel stand having pivoted arms at the respective ends of which a reel and a reel core can be mounted and rotated, a rider roll having a pivoted mounting so as to be capable of riding upon the outermost winding of a reel mounted at the adjacent ends of the turnover stand arms, means for leading a web around the rider roll and on to the reel, a guide roller having a pivoted mounting such that, when the turnover stand arms have been rotated to move the reel and rider apart, the guide roller can be introduced into the path of the web between the reel and rider roll in close proximity to the position assumed by a fresh reel core mounted at the other ends of the turnover stand arms on completion of 180° movement of the arms, so as to cause the web to envelop the greater part of the periphery of the fresh reel core, and a knife and transfer mechanism associated with the guide roller mounting for cutting the web between the fresh reel core and guide roller and for transferring the leading end of the cut portion to be wound upon the fresh reel core.

The pivotal mounting of the rider roll may comprise a pair of arms pivoted on a fixed part of the apparatus. Pneumatic cylinder means is preferably provided for effecting pivotal movement of the pair of rider roll mounting arms.

The pivotal mounting of the guide roller may also comprise a pair of arms pivoted on a fixed part of the apparatus, and further pneumatic cylinder means may be provided for effecting pivotal movement of the pair of guide roller mounting arms.

The knife and transfer mechanism (e.g., a brush) may be rotatably mounted on the guide roller mounting arms, and another pneumatic cylinder means may be provided for actuating the knife and transfer mechanism. Cams may be disposed on the pivot shaft of the turnover stand arms and arranged to actuate switches controlling the pneumatic cylinders in proper sequence.

The invention may be performed in various ways and one embodiment will now be described by way of example and with reference to the accompanying drawings, in which:

FIG. 1 is a diagrammatic elevation of a turnover reel stand and web transfer apparatus,

FIG. 2 is a similar view, showing the first stage of the web transfer,

FIG. 2(*a*) illustrates a cam on the turnover stand pivot shaft,

FIGS. 3 to 6 are similar views to FIG. 1 showing the next four stages,

FIG. 6(*a*) illustrates a second cam on the turnover stand pivot shaft, and

FIG. 7 is a diagram of the control circuit for the apparatus.

It will be understood that the arrangement to be described is substantially symmetrical about the longitudinal centre line of the web and that reference will therefore be made to two elements where only one is shown. The rollers and reels are single and they are all axially parallel.

FIG. 1 shows a turnover reel stand frame 1 supporting a horizontal pivot shaft 2. Arms 3 are centrally mounted at the ends of the shaft 2 and between their respective ends a running reel 4 and a fresh reel core 5 are mounted, being rotatable by motors 4*a* and 5*a* (shown only in FIG. 1) respectively. The arms 3 have lugs 3*a* diametrically opposite and adjacent the pivot shaft 2 to support a pair of web guide rollers 14 and 14'. The shaft 2 is also fitted with two cams (FIGS. 2(*a*) and 6(*a*)) 15*a* and 18*a* which respectively control limit switches 15 and 18 in a manner to be described below.

Associated with the reel stand is a support structure 6 for pivotally mounting a pair of rider roll arms 7 and a pair of guide roll and cutter arms 8. The arms 7 are fitted between their free ends with a roller 9 known as

a rider roll for pressing against the surface of the winding reel to reduce the amount of air trapped between the layers of web in the wound reel to produce a hard reel without the need for high web tensions. The necessary force to press the roller **9** against the reel surface is provided by a pair of pneumatic cylinders **10** that act between the structure **6** and projections **7***a* on the arms **7**. The pivot shaft for the arms **7** is fitted with a web guide roller **17**, the web itself being indicated by W. A web back-up bar **20** is mounted on bell-crank levers **21** pivotally supported on the axis of the rider roll **9** at the ends thereof, this bar being movable from an inoperative to an operative position by means of pneumatic cylinders **22** carried by the arms **7**.

The pair of arms **8** pivoted on the structure **6** support between their free ends a guide roller **11** and a web severing knife and brush mechanism **12**. The arms **8** can be brought from an inoperative to an operative position by means of a pair of pneumatic cylinders **13** that act between the structure **6** and projections **8***a* on the arms **8**. As described in more detail later, at the appropriate time the knife mechanism **12** is operated to sever the web and transfer it to the new core. This is accomplished through the actuation of a pair of pneumatic cylinders **16** mounted on the arms **8**.

FIG. **1** shows the situation obtaining near the end of the winding of reel **4**. When it is desired to transfer the web to the already mounted new core **5** the operator depresses, and holds in, a control button **24** (FIG. **7**) of the pneumatic-electric control circuit. In FIG. **7**, the air conduits are shown as double lines, while the electrical conductors are single lines, the power supply being applied to bus bars L_1 and L_2.

The actuation of the button **24** feeds air to the pressure switch **25** which closes to complete an electrical circuit via limit switch **18** and pressure switches **26** and **27** to relay **28**. This closes, resulting in the motor **5***a* which drives the fresh core **5** starting up and accelerating the new core to the point where its surface speed matches the speed of the web travelling to the reel **4**. Simultaneously with this the pivot shaft **2** starts to rotate in a clockwise direction, as seen in the Figures, through an angle of 130°, immediately closing the cam operated limit switch **15** to hold the relay **28** closed. The rider roll **9** follows the movement of the reel **4** to an extent limited by the stroke of the pneumatic cylinders **10**.

At the 130° position the pivot shaft **2** changes over the switches **18** and **15** by means of the cams **18***a* and **15***a* to break the circuit to the relay **28** and stop the rotation of shaft **2**. The changeover of the switch **18** may be accomplished at any time during the 130° rotation as it will not then immediately affect the holding on of the relay **28** or any other part of the circuit. This situation is shown in FIG. **2**. It will be seen that the path of web W between guide roller **17** and winding reel **4** is interrupted by the rider roll **9**, and that a length of the web has been drawn out between the reel **4** and the rider roll **9**.

Changeover of the switch **15** completes the electrical circuit via switches **25, 18** and **15** to solenoid valve **29**, which then applied pressure to a pilot port **30***a* of valve **30**, causing the latter to change over and actuate both pneumatic cylinders **13**, only one being shown in FIG. **7**. These extend and raise the arms **8** from the inoperative to the operative position as illustrated by FIG. **3**. The web run from the roller **17** to the winding reel **4** is then supported by rolls **9, 11** and **14**. Upon completion of the stroke of cylinders **13** the pressure on the pilot port **31***a* of diaphragm valve **31** falls to permit that valve to changeover, releasing switch **27** and operating valve **32** via interlock valve **33** to retract cylinders **10** and thus raise the arms **7** to the position shown by FIG. **4**. The rear of each cylinder **10** exhausts through associated poppet valve **34**. If the arms **8** had not been raised as described above there would be an unbroken web span from roll **9** to the winding reel (see dotted line FIG. **4**). This could lead to problems of creasing. With the roll **11** in the position indicated by FIG. **4**, however, this long span is broken into two approximately equal spans with the second span also contacting roller **14**.

When the rider roll arms **7** have been fully raised, limit valve **35** is operated to pass a signal to pressure switch **36**, which closes to complete the electrical circuit via switches **25, 18** and **36** to the relay **28**. This causes the pivot shaft **2** to recommence clockwise rotation. During this rotation the new core **5** begins to deflect the web W as shown by FIG. **5**. When the shaft **2** has rotated through 50°, i.e. a total of 180° from the position shown in FIG. **1**, the limit switch **18** is operated by the cam **18***a* mounted on shaft **2** to break the circuit to the relay **28** and stop the rotation of pivot shaft **2** with the new core **5** occupying the position formerly occupied by the winding reel **4**. The changeover of switch **18** also breaks the circuit to solenoid valve **29**, thereby exhausting the pilot port **30***a* of valve **30**, but completes an electrical circuit through switches **25** and **18** to solenoid valve **37**. Air pressure from this valve **37** is then applied to the pilot ports **32***a* and **33***a* of valves **32** and **33**, and the latter changes over to exhaust the other pilot port **32***b* of valve **32**, allowing the latter also to change over. This causes cylinders **10** to re-extend to press the rider roll **9** against the new core. At this stage the web W is enveloping the new core for the greater part of its circumference as shown by FIG. **6**. The extending motion of cylinders **10** releases the valve **35** to exhaust the air on switch **36**, and when the arms **7** come to rest the pressure on diaphragm valve **38** falls sufficiently to allow the latter to change over and pass a pressure signal from valve **37** via valve **38** to pilot port **39***a* of valve **39**. This changes over to cause the back-up bar cylinders **22** to extend to bring the bar **20** to the cutting position. At the end of the stroke of the cylinders **21**, limit valve **40** is operated, which allows a pressure signal to pass from the valve **37** via valve **38** and valve **40** to pilot port **41***a* of interlock valve **41**. This changes over to operate valve **42** and to cause the knife cylinders **16** to retract and drive the knife and brush transfer mechanism **12** through the web to complete the transfer of winding on to the new core **5**.

The full movement of the cutter trips limit valve **43** which allows a pressure signal to pass from control button **24** via valve **43** to switch **26** and pilot port **30***b* of valve **30**. Pressure on switch **26** completes an electrical circuit through switches **25, 18** and **26** to a relay **44**, whose actuation changes the tension control from the old to the new reel. The valve **30** changes over to retract cylinders **13** to their inoperative position as shown in FIG. **1**. Pressure is also applied, due to the changeover of valve **30**, to pilot port **31***a* of the valve **31**, and so pressure is also on switch **27**. However no electrical circuit is completed since valve **26** is under pressure from valve **43**. The solenoid valve **37** exhausts via the

valve **30**. The operator, having observed that the arms **8** are fully retracted, can then release the button **24**.

Since valve **37** is exhausted, the pilot port **41***a* of interlock valve **41** which was under pressure will also exhaust. The release of button **24** will send a pressure signal to the other pilot port **41***b* of valve **41** via valve **45** causing valve **41** to change over, and also retract cylinders **22** through valves **46** and **39**, the valve **46** being a limit valve actuated by full retraction of the arms **8**. Changeover of valve **41** will also retract the knife cylinders **16** and release valve **43**, the latter exhausting pressure switch **25** and the pilot port **30***b* of valve **30**. The switch **26** changes over and prepares the electrical circuit to relay **28** for the next changeover operation.

As the new reel builds up in diameter the arms **7** rise and exhaust the surplus air from the cylinders **10** through the poppet valve **47** and the self-relieving pressure regulator **48**. When the cylinders **10** are being operated, the valve **47** is closed by pressure at its pilot port **47***a* from the valve **32**.

The circuit is also provided with means for overriding the automatic operation sequence described above. The valve **30** which governs the raising and lowering of the arms **8** has associated extend and retract buttons **49** and **50** which when pressed admit pressure to the pilot ports **30***a* and **30***b* respectively. Likewise the valve **32**, which governs the extension and retraction of the cylinders **10** to lower and raise the rider roll, has associated extend and retract buttons **51** and **52**, and the valve **45**, which governs the knife cylinders **16**, has associated extend and retract buttons **53** and **54**.

It should be noted that although the arrangement described is for reels being rewound in a clockwise direction, it could equally well be applied to reels wound anti-clockwise, with an anti-clockwise rotation of the turnover stand pivot shaft **2**. It is also envisaged that in some cases units will be supplied to work in either direction merely by operating a selector switch and also interchanging the rider roll **9** with the roller **11** and knife assembly **12**.

What we claim is:

1. A method of transferring a continuous running web of sheet material being wound into a reel on to a fresh reel core, the reel and core being mounted and rotated at opposite ends of the pivoted arms of a turnover stand, wherein, before being wound upon the reel, the web is led around an idle rider roll which rides upon the outermost winding of the reel, and wherein the transfer of the running web from a completed reel to a fresh reel core is effected by pivoting said arms to move the reel apart from the rider roll to draw out a length of web between them, the rider roll remaining stationary, introducing a guide roller into the path of this length of web from the side opposite to the reel, moving the rider roll apart from the reel, further pivoting said arms to bring the fresh reel core into the path of the length of web between the guide roller and the rider roll in close proximity to the guide roller, and returning the rider roll to nip the web against the fresh reel core so that the web is caused to envelop the greater part of the periphery of the fresh reel core solely by two elements, namely the rider roll and the guide roller, and actuating a knife and transfer mechanism to cut the web between the fresh reel core and the guide roller and to transfer the leading end of the cut portion to be wound upon the fresh reel core.

2. A method according to claim **1**, wherein the introduction of the guide roller deflects the web and causes the length of web between the guide roller and the reel to engage an idler roller mounted on the arms of the turnover stand close to the maximum circumference of the wound reel, which idler roller further deflects the web.

3. Apparatus for transferring a continuous running web of sheet material being wound onto a reel on to a fresh reel core, comprising a turnover reel stand having pivoted arms at the respective ends of which a reel and a reel core can be mounted and rotated, an idler rider roll having a pivotal mounting so as to be capable of riding upon the outermost winding of a reel mounted at the adjacent ends of the turnover stand arms, actuating means for pivoting the rider roll mounting, means for leading a web around the rider roll and on to the reel, a guide roller having a pivotal mounting, actuating means for pivoting the guide roller mounting, a knife and transfer mechanism associated with the guide roller mounting for cutting the web between the fresh reel core and guide roller and for transferring the leading end of the cut portion to be wound upon the fresh reel core, and control means for sequentially operating the parts of the apparatus so that for web transfer the turnover stand arms are rotated to move the reel apart from the rider roll, the guide roller is introduced into the path of the web between the reel and rider roll in close proximity to the position to be assumed by a fresh reel core mounted at the other ends of the turnover stand arms on completion of 180° movement of the arms, the rider roll is moved away from said position, said 180° movement is completed, said rider roll is returned so as to cause the web to envelop the greater part of the periphery of the fresh reel core, and the knife and transfer mechanism is actuated.

4. Apparatus according to claim **3**, wherein further idler rollers are carried by the arms of the turnover stand, each in close proximity to the maximum circumference of an associated wound reel and trailing the associated reel with respect to the direction of rotation of the arms, said further idler rollers being arranged to engage the web between the guide roller and the reel.

5. Apparatus according to claim **5**, wherein said control means are electro-pneumatic and cams disposed on the pivot shaft of the turnover stand arms are arranged to actuate switches controlling pneumatic cylinders in proper sequence.

* * * * *