

[72] Inventors **Walter Schmitt**  
**Bad Pyrmont;**  
**Wilhelm Schüttler, Klein Berkel, near**  
**Hameln, Germany**

[21] Appl. No. **814,426**

[22] Filed **Apr. 8, 1969**

[45] Patented **July 13, 1971**

[73] Assignee **Maschinenfabrik Stahlkontor Weser Lenze**  
**KG**  
**Gross Berkel, near Hameln, Germany**

[32] Priority **Apr. 8, 1968**

[33] **Germany**

[31] **P 17 74 101.4**

[56]

## References Cited

### UNITED STATES PATENTS

|           |        |                         |          |
|-----------|--------|-------------------------|----------|
| 2,586,832 | 2/1952 | Kohler.....             | 242/56   |
| 2,586,833 | 2/1952 | Kohler et al. ....      | 242/56   |
| 2,681,771 | 6/1954 | Haskell.....            | 242/56   |
| 2,703,682 | 3/1955 | Jacobs.....             | 242/64 X |
| 2,984,426 | 5/1961 | Johnson .....           | 242/56   |
| 3,207,452 | 9/1965 | Haskin, Jr. et al. .... | 242/64   |
| 3,365,992 | 1/1968 | Dreher .....            | 242/56 X |
| 3,383,062 | 5/1968 | Meihofer et al. ....    | 242/56   |
| 3,433,429 | 3/1969 | Schnitzspahn.....       | 242/56   |

Primary Examiner—Stanley N. Gilreath

Assistant Examiner—Werner H. Schroeder

Attorney—Edwin E. Greigg

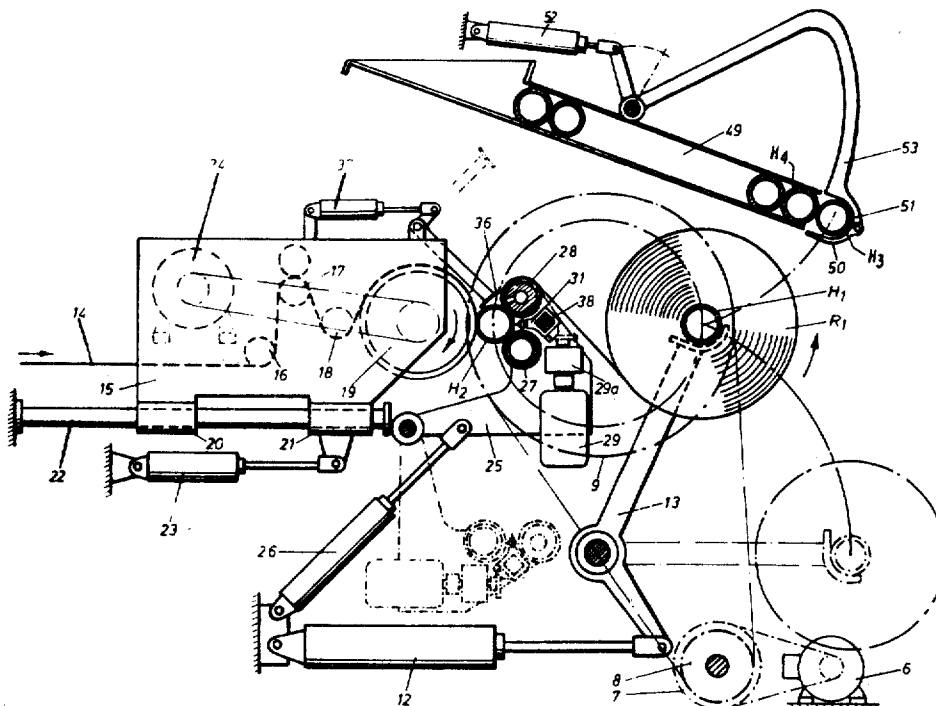
[54] **APPARATUS FOR REPLACING CORES AND SEVERING WEBS IN HIGH-SPEED MULTIPLE WINDING MACHINES**  
**13 Claims, 5 Drawing Figs.**

[52] U.S. CL. .... **242/56,**  
**242/65**

[51] Int. Cl. .... **B65h 19/20**

[50] Field of Search. .... **242/19, 56,**  
**56 A, 56.6, 64, 65, 67.1, 68.4**

**ABSTRACT:** In a multiple-winding machine with continuously advanced web material, an empty core is positioned upstream of the almost-completed core and held against the running web by axially grasping winding shafts and by rolls forming a three-point support. A self-aligning knife transversally severs the web on said empty core onto which the web is subsequently wound after an airblast maintains the new leading edge of the web thereon. The full core is then removed and two rolls forming two points of said three-pointsupport as well as said knife are swung away.



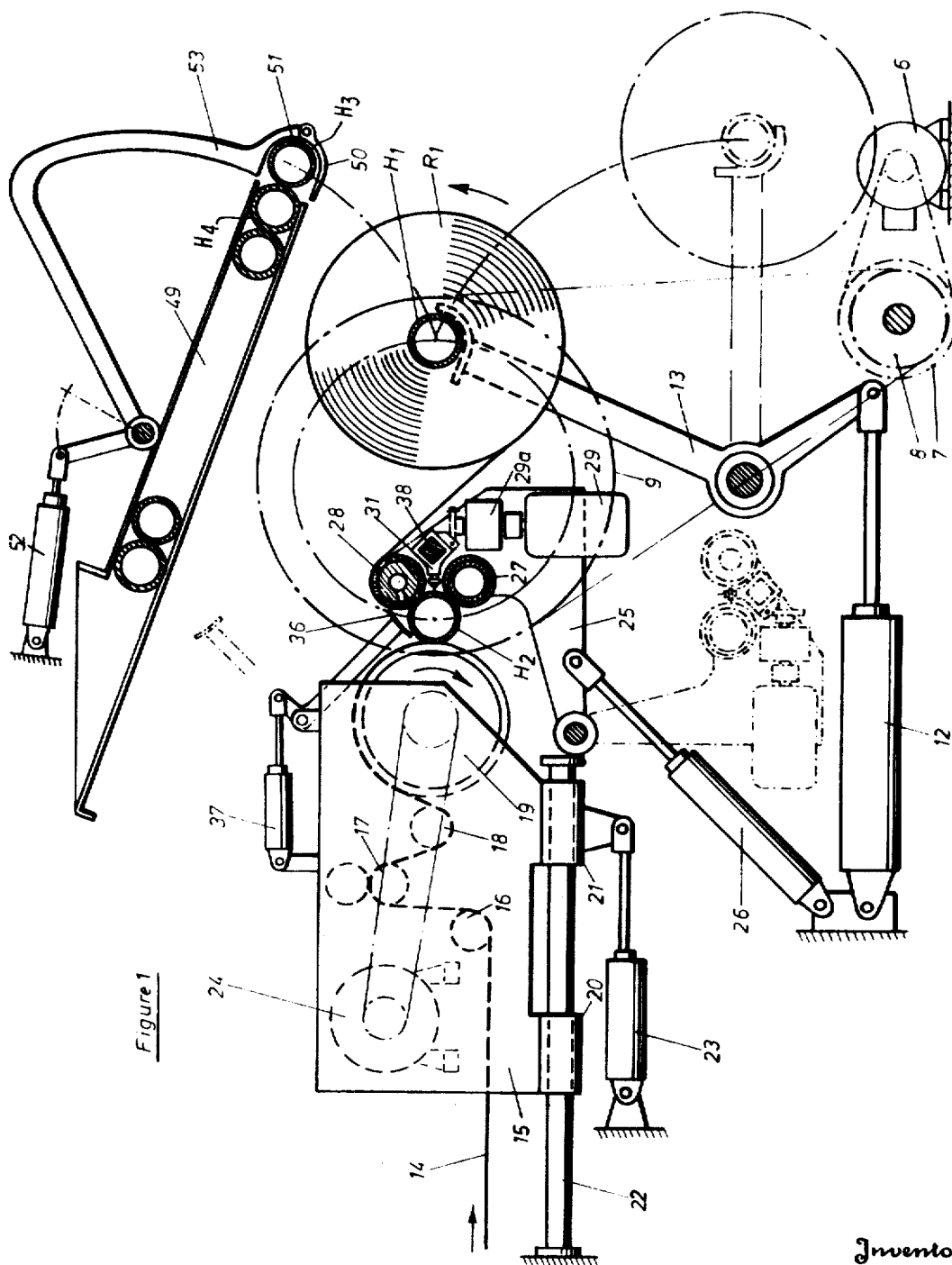


Figure 1

Inventors  
WALTER SCHMITT  
WILHELM SCHÜTTLER

*Edwin L. Greigg*  
Attorney

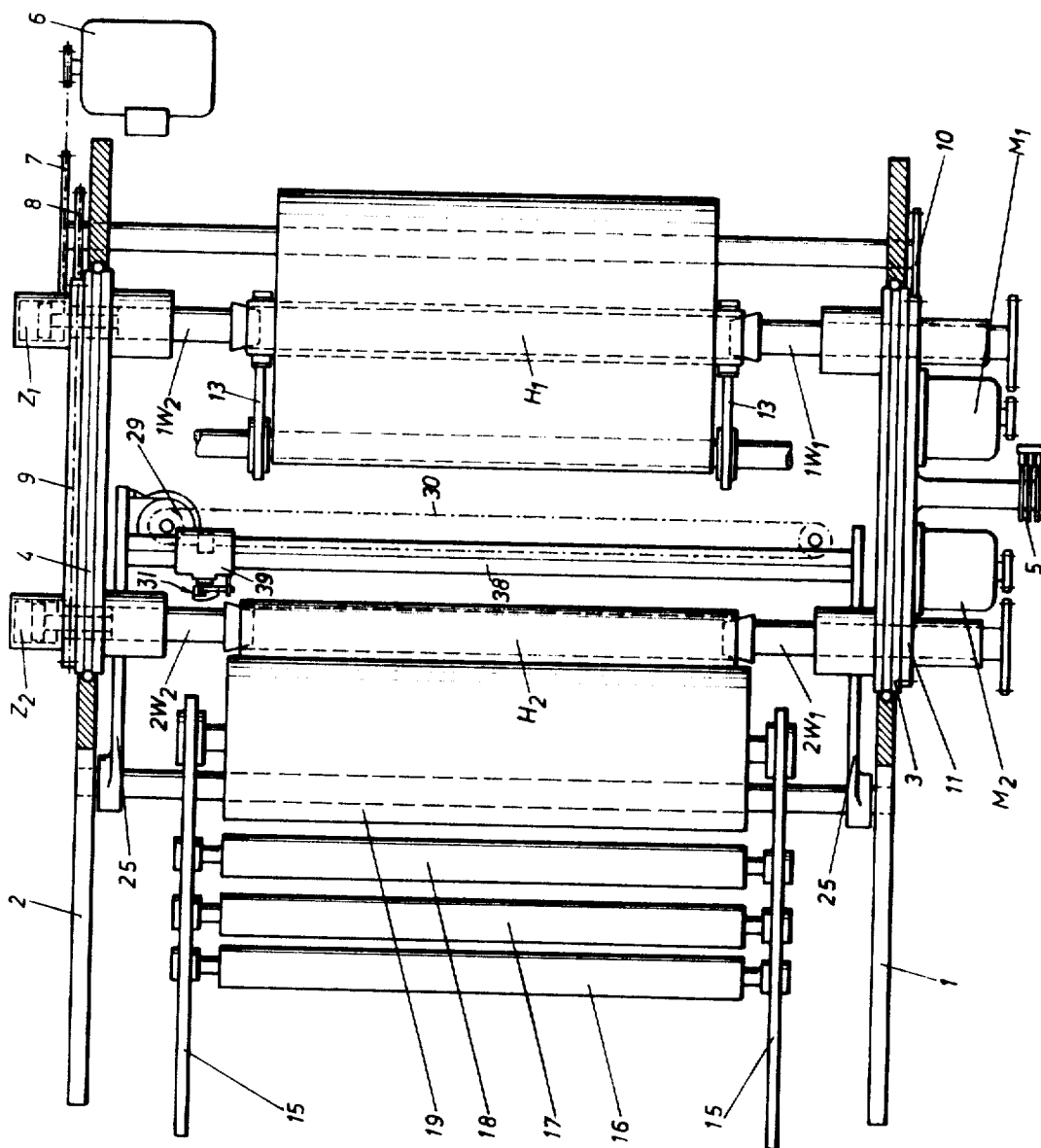
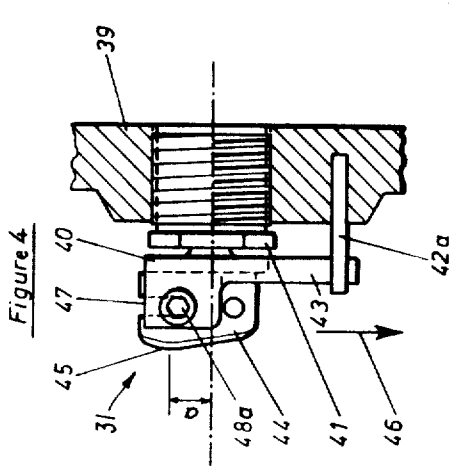
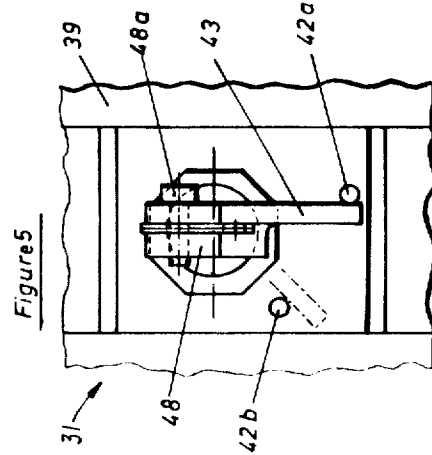
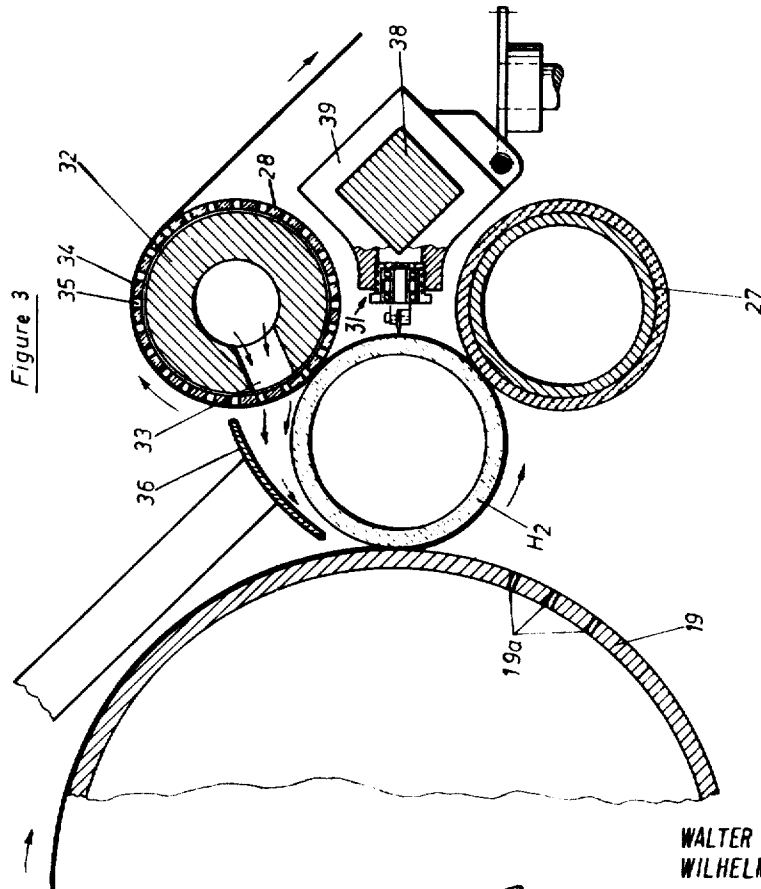


Figure 2

Inventors  
WALTER SCHMITT  
WILHELM SCHÜTTLER

By *John E. Greig*  
Attorney



Inventors

WALTER SCHMITT  
WILHELM SCHÜTTLER

By *Erwin E. Gregg*  
Attorney

## APPARATUS FOR REPLACING CORES AND SEVERING WEBS IN HIGH-SPEED MULTIPLE WINDING MACHINES

In multiple winding machines operating with continuously supplied webs it is important to transfer the travelling material from the full core to the empty core as quickly as possible in order to avoid waste, and furthermore to position the new leading end of the web on the empty core without any folds after the web has been cut transversely.

In multiple winding machines, wherein a fully wound core may be pivoted into a position of removal and at the same time an empty core is pivoted into the operating position by means of a core-engaging star or the like, it is known to allow the successive empty core, which is just swung into the operating position, to function at first as a guide roller for the web still being wound on the full core. Then, by means of a tilting frame, pressure rollers are urged against the web between the empty and the full core in such a manner that the web wraps around more than half the circumference of the empty core, and, subsequently, the web is severed by means of a cutting mechanism.

In the known core-changing mechanisms, the transverse cutting is effected by means of two knives or by means of a saw-type knife which cut the web across its whole width. Severing knives guided at right angles to the web and executing a razorlike cut are also known.

All these devices have the disadvantage, however, that they cut the web behind (i.e. downstream of) the empty core and the free end formed as a result has to be brought onto the empty core by an air current or other means. As a result, longitudinal and transverse folds develop in case of high-speed material feed. In addition, a smaller or larger reverse or back fold is often formed. Positioning the new leading end of the web on the empty core without the formation of folds is particularly difficult in the case of soft and thin materials.

Severing of the material on the core by means of a rotating bandsaw or by thermal separation has the disadvantage that such cutting operations may be effected only at relatively low speeds; otherwise an accumulation or gathering of the material occurs.

All these known mechanism can only be used to a limited extent if the leading end of the high-speed web is to be positioned without a reverse fold on cores of small diameter. In order to avoid a transverse fold, either the speeds have to be low or cores of a substantial diameter (at least 200 mm.) have to be used.

The bolts thus obtained are not yet ready for sale: in an additional operation the material has to be rewound on standard cores having an outside diameter of 70 to 80 mm.

It is, however, a desideratum to make immediately marketable bolts of materials supplied by upstream-arranged high-speed apparatus, such as calendars extruders, stretching and printing machines. It is particularly desirable in case of thermoplastic materials (such as hard or soft PVC, polyester or polyethylene having speeds up to 300 m./min., to be able to attach the leading end to empty cores, having an external diameter of 50 to 80 mm., without any reverse fold and longitudinal folds, as well as without resorting to the use of adhesive materials such as adhesive tapes. Folds formed in these materials during the insertion may make impressions through the layers wound subsequently and thus may render part of the bolt or reel useless.

Any preparation of the cores such as providing them with adhesive tapes or glue or the use of continuous winding shafts on which the cores are mounted, necessitates additional labor which, apart from the high costs, hampers a rapid operation which is, however, of decisive importance: at the required high speeds only a period of about 1 minute is available for completing the winding of a bolt ready to be shipped and for changing the cores.

## OBJECT, SUMMARY AND ADVANTAGES OF THE INVENTION

It is an object of the invention to provide an improved method of and apparatus for the changing of cores in winding machines, whereby all the aforesaid requirements may be met.

Briefly stated, according to the invention, on a swinging frame there are mounted a cutting mechanism and a pair of pressure rolls which, after an inward pivoting of the frame, forms together with a third pressure roll, a three-point support for the empty core positioned for the core change and gripped between winding cones. The three-point support prevents the empty core from sagging and running out of round. A knife which is adapted to sever the web on the empty core is mounted for limited rotation on a carriage or the like which guides the knife transversally during the cutting operation in such a manner that the knife sets itself automatically into the appropriate cutting direction determined by the transverse cutting speed and the speed of the web.

The use of three pressure rolls for centering the empty core during core replacement has the advantage that the cores may be inserted into the core-rotating mechanism by means of pneumatically actuated cones as a result of which a particularly rapid core change may be achieved. Further, despite the absence of a continuous winding shaft, this arrangement ensures that no sagging and running out of round of the empty core takes place which would prevent a clean severing of the web and would lead to the formation of folds. By severing the web on the empty core itself, the positioning of the material to be wound is facilitated in comparison with the known mechanisms in which the web is severed downstream of the empty core. The automatic alignment of the cutting knife in the correct cutting direction achieved by the rotatable knife holder ensures a clean cutting without an accumulation of the material.

The invention will be better understood and further objects as well as advantages will become more apparent from the ensuing detailed specification of a preferred, although exemplary embodiment taken in conjunction with the drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic side elevational view of the preferred embodiment which is a double winding machine with devices for supplying, transverse cutting and positioning the material on the empty core during core replacement, as well as for taking empty winding cores from a magazine;

FIG. 2 is a partial plan view of the machine of FIG. 1 with the magazine removed for clarity;

FIG. 3 is, on a larger scale, a cross-sectional view in side elevation of the parts serving for the centering of the empty winding cores, for the transverse cutting and for the positioning of the web;

FIG. 4 is a plan view of the severing knife; and

FIG. 5 is a front elevational view of the severing knife.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning first to FIG. 2, there is shown the structure of a double winding machine comprising two rotary discs 3 and 4 mounted in the sidewalls 1 and 2. Disc 3 carries diametrically opposed winding cone shafts  $1W_1$  and  $2W_1$ , while disc 4 carries diametrically opposed winding cone shafts  $1W_2$  and  $2W_2$ . A core  $H_1$  is clamped between axially aligned cone shafts  $1W_1$  and  $1W_2$ , while a core  $H_2$  is, spaced from core  $H_1$ , clamped between axially aligned winding cone shafts  $2W_1$  and  $2W_2$ . Torque-responsive electric motors  $M_1$  and  $M_2$ , mounted on rotary disc 3 and energized through slip rings 5, serve to rotate winding cone shafts  $1W_1$  and  $2W_1$ , respectively. The winding cone shafts  $1W_2$  and  $2W_2$  may be displaced axially by means of respective pneumatic cylinders  $Z_1$  and  $Z_2$  carried by the rotary disc 4, in order to bring the cones into and out of engagement with the associated winding cores  $H_1$  and  $H_2$ , respectively. The

discs 3 and 4 may be rotated by means of a motor 6 through chain wheels 7, 8, 9 and 7, 10, 11, respectively. It is to be understood that instead of discs 3, 4, a pair of crossmembers may be used for supporting two or more winding shafts.

Turning now to FIG. 1, a full core  $R_1$  may be swung into the position of final removal (shown in broken lines) by means of a pair of crank arms 13 which may be caused to pivot by a pneumatic cylinder 12.

Guide rollers 16, 17, 18 and a pressure roll 19, mounted in a frame consisting essentially of a pair of sidewalls 15, serve to advance the material 14 to be wound. The frame 15 is displaceably mounted on a stationary guide rod 22 by means of ball bearing slides 20, 21 and is movable by a pneumatic cylinder 23. The pressure roll 19 is driven by a motor 24 which is synchronized with a motor advancing the material to be wound from an upstream-arranged web-making machine (not illustrated). The pressure roll 19 is provided, over its whole circumference, with holes 19a (only three shown in FIG. 3) through which any air drawn in between the roll and the web may escape into the interior of the roll, the side walls of which are provided with large air outlets (not shown). A swinging frame 25 is pivotally mounted in the side walls 1, 2 (FIG. 2) and is movable by means of a pneumatic cylinder 26. Frame 25 carries devices for the centering of the empty winding core  $H_2$  and for the transverse cutting and positioning of the web thereon. These devices comprise two pressure rolls 27 and 28 and a knife mechanism 31. The latter is driven by a motor 29 through an electromagnetic clutch 29a and a chain drive 30 (FIGS. 2-5). The pressure roll 27 is loosely held by the swinging frame 25. The pressure roll 28 also serves to direct an air stream onto the empty core  $H_2$ ; and for this purpose the roll 28 is provided with an internal, relatively turnable and securable hollow axle 32 through the center of which the air stream may flow. The axle 32 is provided with a radial air outlet passage 33 extending axially over substantially the whole length of the hollow axle. The roll assembly 28 further comprises a roll 34 which surrounds loosely the hollow axle and which is provided with bores 35 over its whole circumference. A baffle plate 36 for guiding the airflow is pivotally mounted on the frame 15 and is movable by a pneumatic cylinder 37 also secured to frame 15.

The knife mechanism comprises a carriage 39 which is slidably mounted on a rectangular guide rod 38, a knife holder 40 and a threaded sleeve 41, functioning as a bearing member. The latter is fixedly secured in carriage 39 and, with the interposition of ball bearings (not shown), rotatably carries knife holder 40. The knife holder 40 is provided with a stop lever 43 cooperating with two fixed stops 42a and 42b secured to the carriage 39. The knife 44 may be inserted between the knife holder 40 and a clamp member 48 through a slot 47 and may be secured by means of a screw 48a. With respect to the direction of movement (arrow 46) of the knife during the cut, its cutting point 45 lies at a distance  $a$  behind the pivotal axis of the knife holder 40. Said axis lies in the cutting plane and is normal to the cutting direction.

Mounted above the double winding machine is a core magazine 49, the outlet of which is closed by a gate formed of an arcuate end portion 51 of a crank arm 53 and a flap 50. The gate 50, 51 may be swung away from said outlet by means of a pneumatic cylinder 52 connected to crank arm 53. The inner face of arcuate portion 51 and flap 50 are together adapted to cradle the leading core  $H_1$  in magazine 49.

#### OPERATION OF THE PREFERRED EMBODIMENT

Turning once more to FIG. 1, the apparatus is shown in a phase of operation in which material is being wound on the almost full core  $H_1$ . With the exception of frame 25 together with the centering, severing and positioning mechanisms, all parts are in a position shown in solid lines. Frame 25 is in its position illustrated in broken lines.

The material 14 is advanced from the web-making machine (not shown) through the guide rollers 16, 17, 18, the pressure

roll 19 and the empty core  $H_2$  to the reel  $R_1$  on the core  $H_1$ . The pressure roll 19 is driven at a constant speed by the motor 24. The torque-responsive winding motors  $M_1$  and  $M_2$  adapt their r.p.m. to the web speed which, in turn, is a function of the increasing diameter of the reel  $R_1$ .

Shortly before the reel  $R_1$  is fully wound, a length-measuring device (not shown) transmits a signal to the pneumatic cylinder 26 which swings the frame 25 into the position illustrated in full lines in FIG. 1. Then the web no longer runs directly from the empty core  $H_2$  to the reel  $R_1$  but is first trained by the pressure rolls 19 and 28 about more than half the circumference of the empty core  $H_2$  and is then allowed to proceed over the pressure roll 28 to the reel  $R_1$ . Simultaneously, the pressure rolls 19, 27 and 28 center the empty core  $H_2$ , thus preventing the same, gripped only by the cones of the pneumatically actuated winding cone shafts  $2W_1$  and  $2W_2$  and not mounted on a continuous winding shaft, from sagging and running out of round. If the empty winding core were to sag or run out of round it would prevent a clean transverse cutting of the material and also, folds would be formed. Since the torque-responsive motor  $M_2$  adapts its speed to the speed of the web and the pressure roll 19 driven by the motor 24 is urged against the winding core  $H_2$  by means of the pneumatic cylinder 23, an absolute synchronism is obtained between the web and the winding core  $H_2$ , and a true running thereof, even if it is thin walled, is ensured.

When the reel  $R_1$  is fully wound, the aforementioned length-measuring device transmits a signal which energizes the electromagnetic clutch 29a, whereupon the continuously running motor 29 rapidly drives the knife mechanism 31 by means of the chain drive 30 transversely across the material 14 over the empty core  $H_2$ . The web 14 is thus severed. Since the cutting point 45 of the knife 44 is spaced from the pivotal axis of the knife holder 40, a force exerted on the knife by the cut edge of the web in the direction of its advance produces a torque on the knife holder which thus turns about its axis and causes the knife 44 to align itself with the correct cutting direction which depends on the speed of the web and the speed of the transversely travelling knife (FIGS. 4 and 5). A clean severance of the web is thus ensured. The distance of the knife 44 from the carriage 39 may be adjusted by turning the threaded sleeve 41. If cardboard cores are used, the knife is preferably adjusted in such a manner that it cuts 0.1—0.2 mm. deep into the core, thus ensuring that the web is securely severed. The transversal cut must be effected so rapidly that the cut edge of the web is as little slanted as possible. The optimum cutting speed is two to three times the speed of the material. A minimum slant in the cut enhances a satisfactory positioning of the web on the empty core.

In order to ensure that the leading portion even of thick web material remains on the core after the cutting operation, air guided by baffle plate 36, is blown through the pressure roll 28 onto the core  $H_2$  just downstream of the cutting path of knife 44.

After the winding of only a few layers on the core  $H_2$ , the position thereof is sufficiently stabilized so that its three-point support provided by the pressure rolls 19, 27 and 28 may be removed. Thus, the frame 25 is swung away upon actuation of pneumatic cylinder 26 into its position shown FIG. 1. Simultaneously, the baffle plate 36 is moved by pneumatic cylinder 37 into its position shown in broken lines in FIG. 1.

Shortly after the web is severed and the trailing cut edge thereof is wound on the full reel  $R_1$ , the cones of the winding cone shafts  $1W_1$  and  $W_2$  supporting the core  $H_1$  are separated by retracting shaft  $1W_2$  upon actuation of pneumatic cylinder  $Z_1$ . Thereupon the full reel  $R_1$  is swung with crank arms 13 moved by pneumatic cylinder 12 into its position of final removal shown in broken lines in FIG. 1. Thereupon, the crank arm 53 with core  $H_3$  cradled by gate 50, 51 is swung clockwise by means of the pneumatic cylinder 52 thus bringing core  $H_3$  into the position previously assumed by the core  $H_1$ . The cone of the winding shaft  $1W_2$  is driven towards shaft  $1W_1$  until the two cones axially grasp the core  $H_3$ . The crank

arm 53 is now swung backwards (counterclockwise) during which the core  $H_3$  held by the winding cones opens temporarily the flap 50 of the gate 50, 51 so that the latter may entirely clear core  $H_3$ . The magazine 49 is held closed by the crank arm 53 during its movement. Upon return into its position of rest, the gate 50, 51 receives core  $H_4$  which is now the leading core in magazine 49.

While the core  $H_2$  is now being wound, the pressure roll 19 presses with a constant force against the reel of increasing diameter. During this increase, the frame 15 with the drive motor 24 and the guide rolls 16, 17, 18 is continuously urged backwards along the guide rod 22 on the ball bearing slides 20, 21. Shortly before a desired diameter of the reel on core  $H_2$  is obtained, or a predetermined length of wound material is reached, the motor 6 is energized and thus rotates the discs 3, 4 through 180° so that the empty core  $H_3$  is swung towards the pressure roll 19 and the core  $H_2$ , while continuing to be wound, is swung into the winding position.

All of the aforescribed operations constituting one working cycle may be suitably timed and controlled in a known manner by an electronic programmer or the like.

What I claim is:

1. In a core-exchanging apparatus associated with a multiple winding machine operating with high-speed web feed, the improvement comprising,

A. a first shaft means adapted to axially engage an empty or first core at its ends and to rotatably hold the latter upstream of a second core on which said web is being wound,

B. a movable first frame adapted to assume an operative and an inoperative position,

C. a first pressure roll continuously rotatably urged against said first core when the latter is in a position as defined under (A),

D. a second and a third pressure roll rotatably carried by said first frame and

E. a knife mechanism carried by said first frame including a severing knife adapted to travel transversally of said web; said first, second and third pressure rolls, when said first frame is in its said operative position, engaging said first core and constituting a three-point support therefore and causing said web to be trained thereabout; said knife, when said first frame is in its said operative position, adapted to sever, during the course of its transverse travel in a cutting direction, said web on said empty core.

2. An improvement as defined in claim 1, wherein said severing knife is pivotable about an axis contained in its cutting plane, said knife includes a cutting point located behind said axis when viewed in said cutting direction.

3. An improvement as defined in claim 2, wherein said knife mechanism includes

A. a carriage adapted to travel transversally of said web,

B. a bearing member secured to said carriage,

C. a holder held in said bearing member and pivotable about said axis and

D. said severing knife affixed to said holder.

4. An improvement as defined in claim 3, including means for adjusting said severing knife along said axis.

5. An improvement as defined in claim 4, wherein said means for adjusting said severing knife along said axis is a threaded engagement between said bearing member and said

carriage.

6. An improvement as defined in claim 1, including means for directing a fluid stream through at least one of said second and third pressure rolls onto said first core immediately downstream of the transverse path of travel of said severing knife.

7. An improvement as defined in claim 6, wherein at least one of said second and third pressure rolls surrounds a coaxial, stationary and angularly adjustable hollow axle provided with a radial passage extending substantially over the length of said axle; the pressure roll surrounding said hollow axle is provided with a plurality of openings along its entire circumference; said fluid stream adapted to enter said hollow axle axially, and to pass through said openings from said radial passage.

8. An improvement as defined in claim 1, wherein said first pressure roll is arranged upstream of said second and third pressure rolls, said first pressure roll is rotatably held in a second movable frame yieldingly urged towards said first core.

9. An improvement as defined in claim 1, wherein said first pressure roll is arranged upstream of said second and third pressure rolls and is provided with perforations to vent the air trapped between said first pressure roll and said web trained thereabout.

10. An improvement as defined in claim 8, wherein said second frame carries a motor for driving said first pressure roll synchronously with motor means advancing said web from a web-making machine.

11. An improvement as defined in claim 1, wherein said first shaft means is formed of two spaced and axially aligned conical stub shafts; further including a second shaft means spaced from said first shaft means and formed of two spaced and axially aligned conical stub shafts for holding said second core on which said web is being wound; a first torque-responsive motor for driving said first shaft means and a second torque-responsive motor for driving said second shaft means.

12. An improvement as defined in claim 11, further including

A. means for removing said second core from said second shaft means after said web is severed by said knife,

B. means for positioning an empty or third core on said second shaft means after said second core has been removed therefrom, and

C. rotatable support means holding both said first and said second shaft means, said rotatable support means is adapted, while said web is being wound on said first core and after said third core is positioned on said second shaft means, to be displaced in such a manner that said first and second shaft means exchange positions.

13. A method of exchanging cores in a multiple high-speed web-winding machine comprising the following steps:

A. positioning and axially supporting an empty, first core upstream of a second core on which a running web is being wound,

B. providing a three-point support for said first core by means of three pressure rolls whereby said running web is trained about said first core and

C. rotating said first core

D. severing said running web on said first rotating core by moving, axially parallel therewith, a severing knife pivotable about an axis contained in its cutting plane.