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Dambroth

[11] **3,817,467**

[45] **June 18, 1974**

[54] **DEVICE FOR CONTINUOUS WINDING OF CONTINUOUSLY RUNNING WEBS OF MATERIAL**

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[22] Filed: **June 30, 1972**

[21] Appl. No.: **267,811**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 45,057, June 10, 1970, abandoned.

[30] **Foreign Application Priority Data**

June 11, 1969 Germany 1929570

[52] **U.S. Cl.** ..... **242/56 R,** 242/66

[51] **Int. Cl.** **B65h 19/20,** B65h 17/08

[58] **Field of Search** ..... 242/56 R, 56 A, 65, 66

[56] **References Cited**

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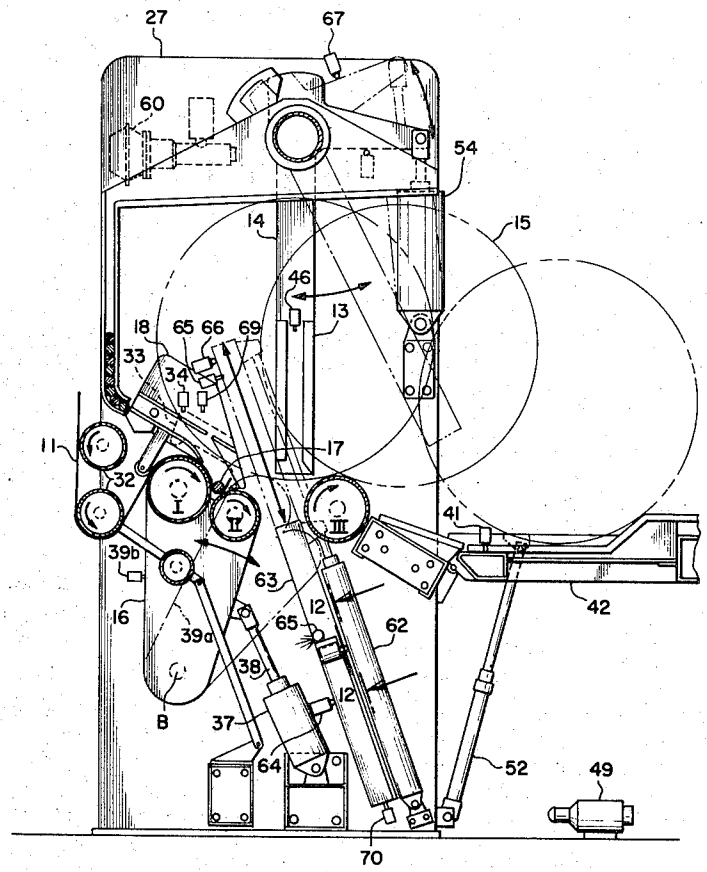
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[57] **ABSTRACT**

A multiple roller winding apparatus for the continuous winding of a continuously moving web of material. The material is wound onto take-up rollers which are fed from a magazine to driving rollers, and are disposed during the winding operation in a wedge formed between the driving rollers. A cutting means is provided for cutting the web of material when it reaches a predetermined diameter, and a feed means is utilized to start the web of material on a new take-up roller. An intake roller and an auxiliary winding roller are pivotably mounted on the winding apparatus and are movable between two different positions with respect to a stationary delivery roller so that in a first position a starting wedge is formed by the intake roller and auxiliary roller, and in the second position a wedge is formed between the intake roller and the delivery roller in order to complete the winding operation.

6 Claims, 12 Drawing Figures



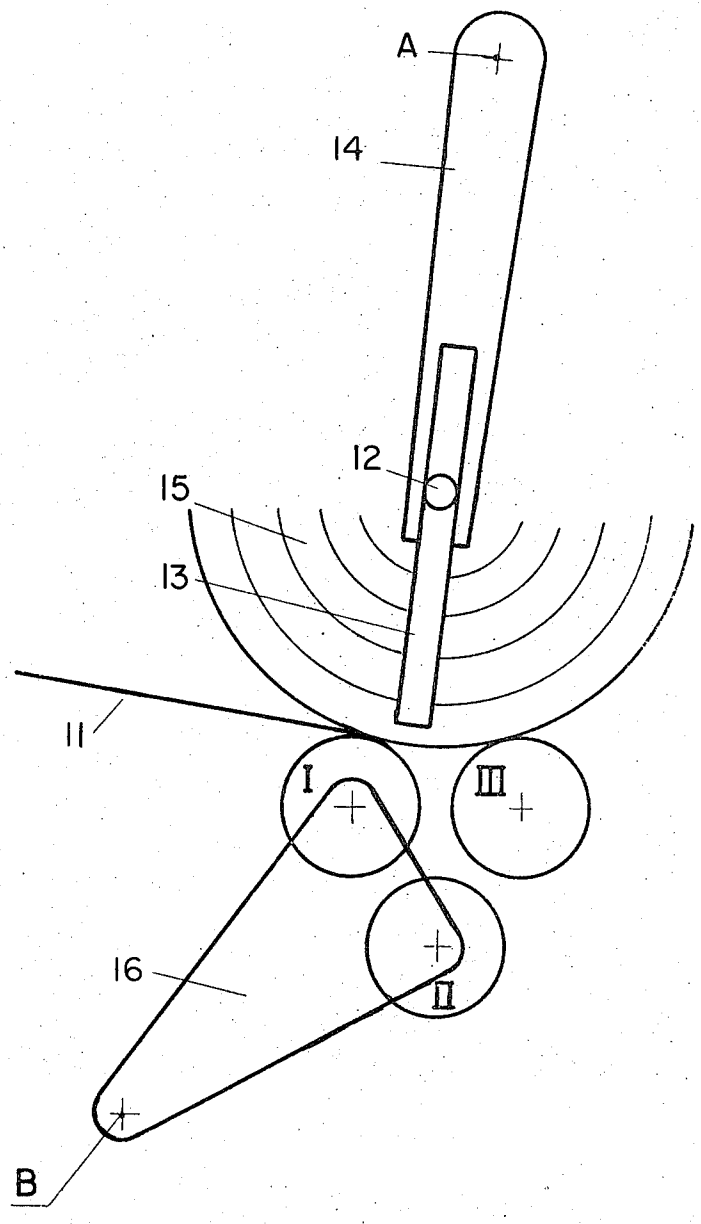


Fig. 1

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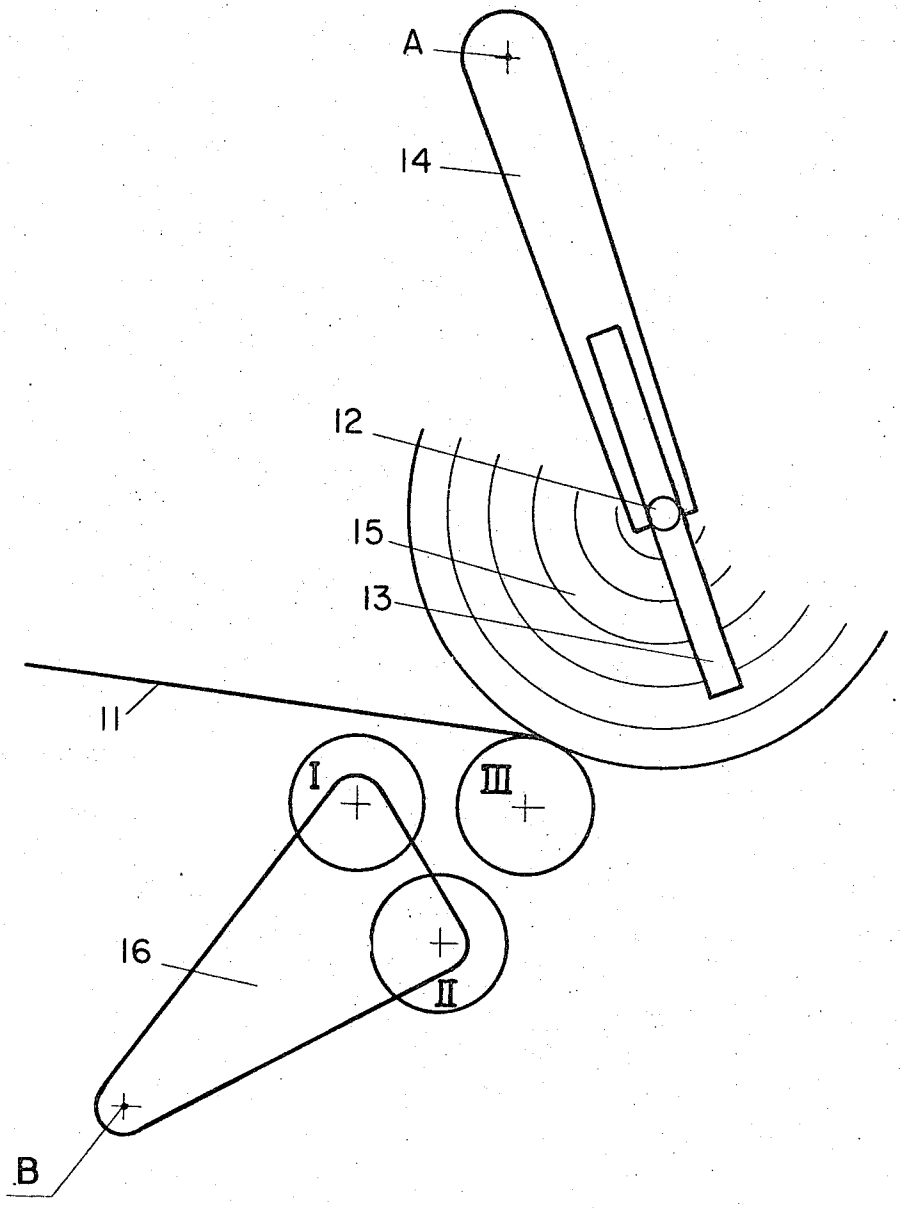


Fig. 2

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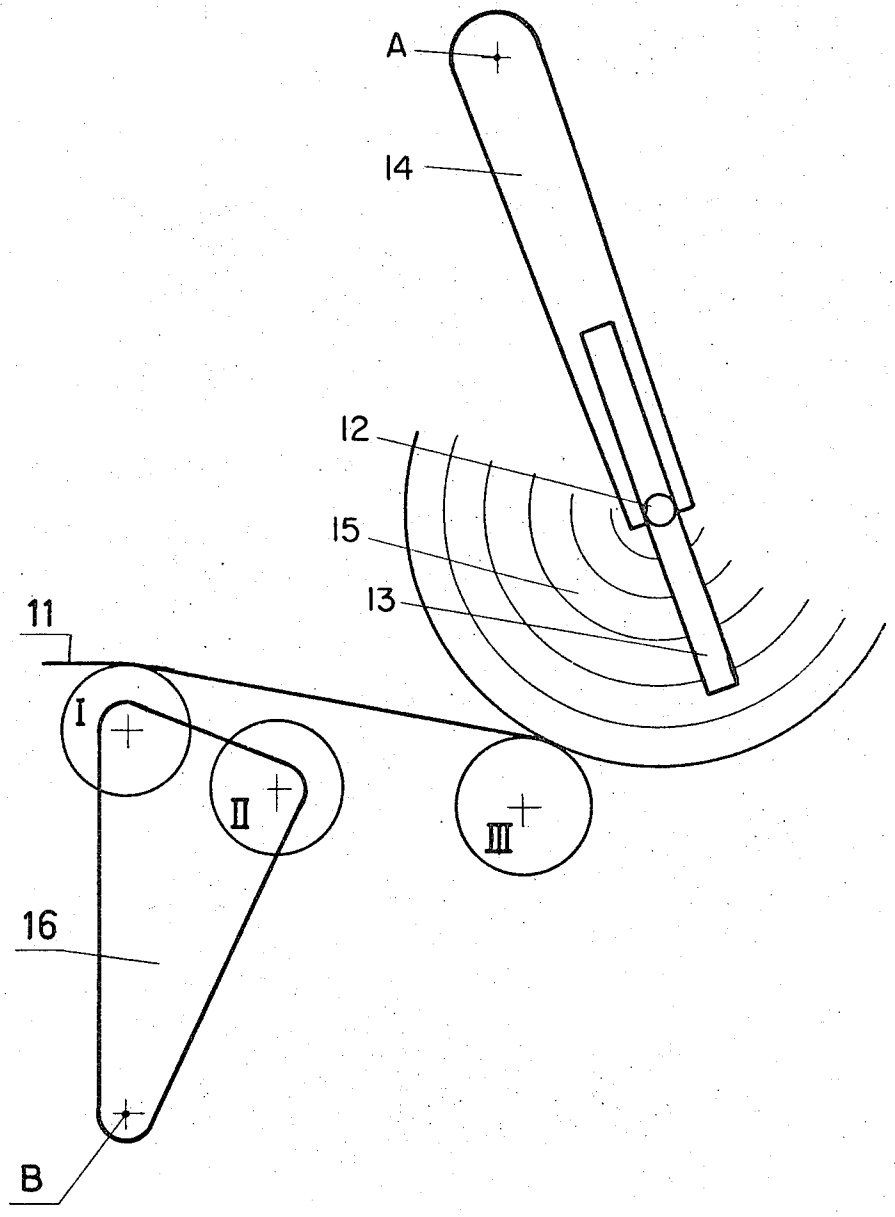


Fig. 3

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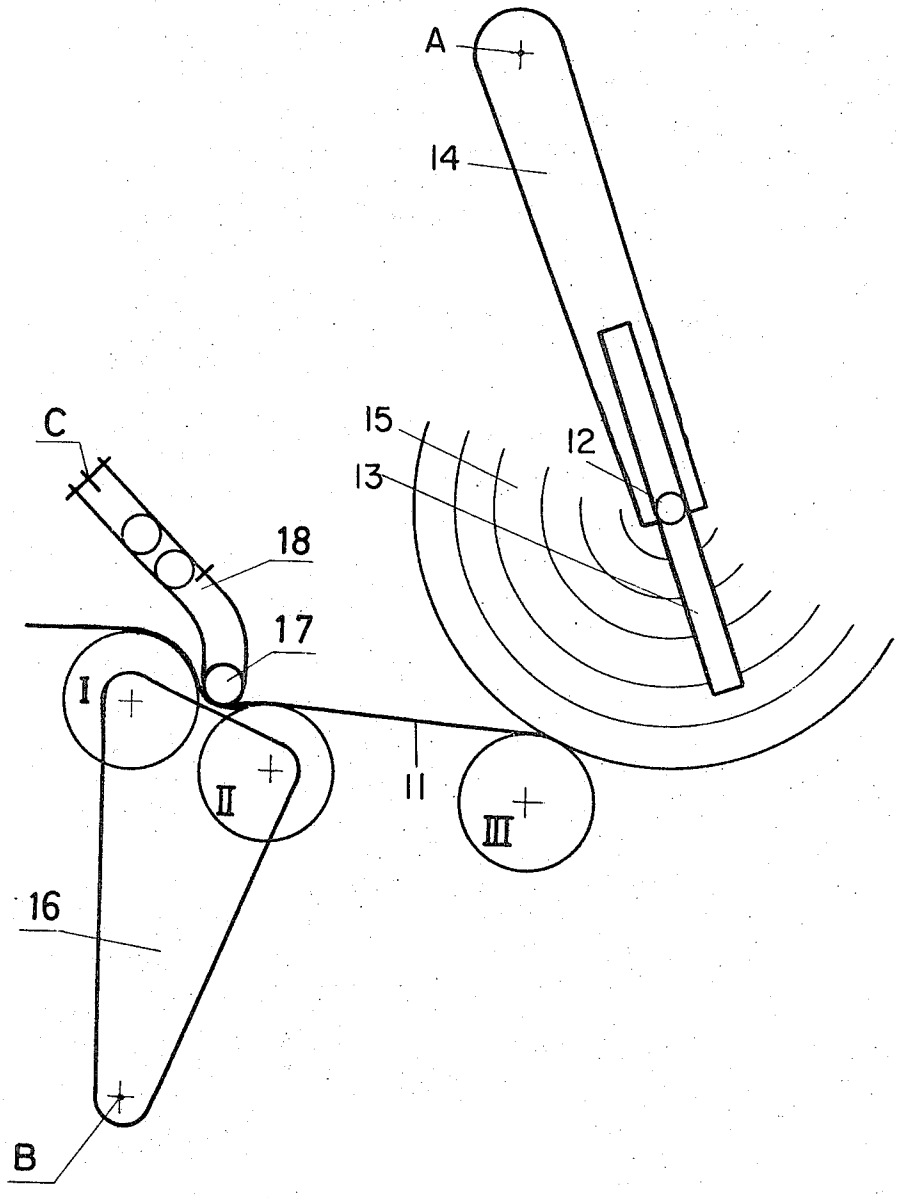


Fig. 4

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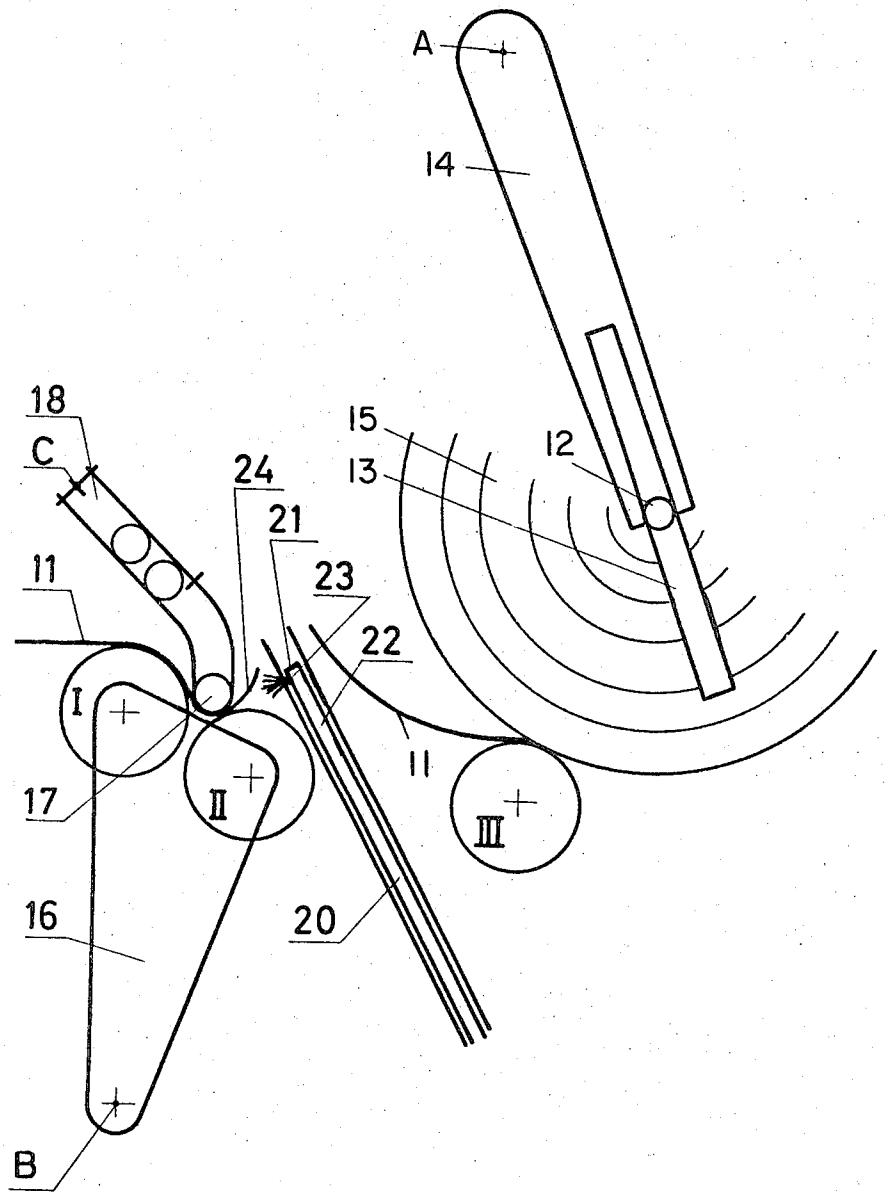


Fig. 5

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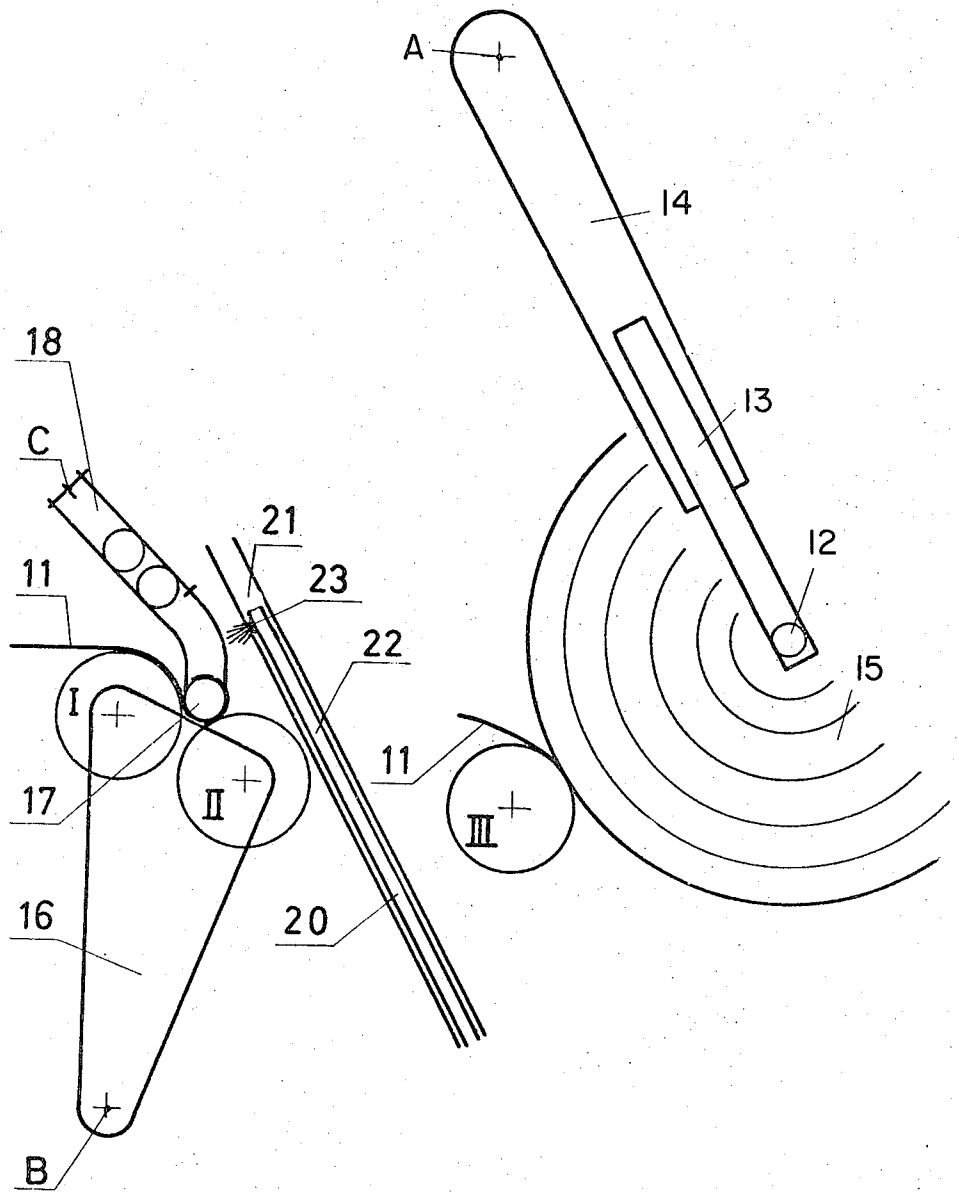


Fig. 6

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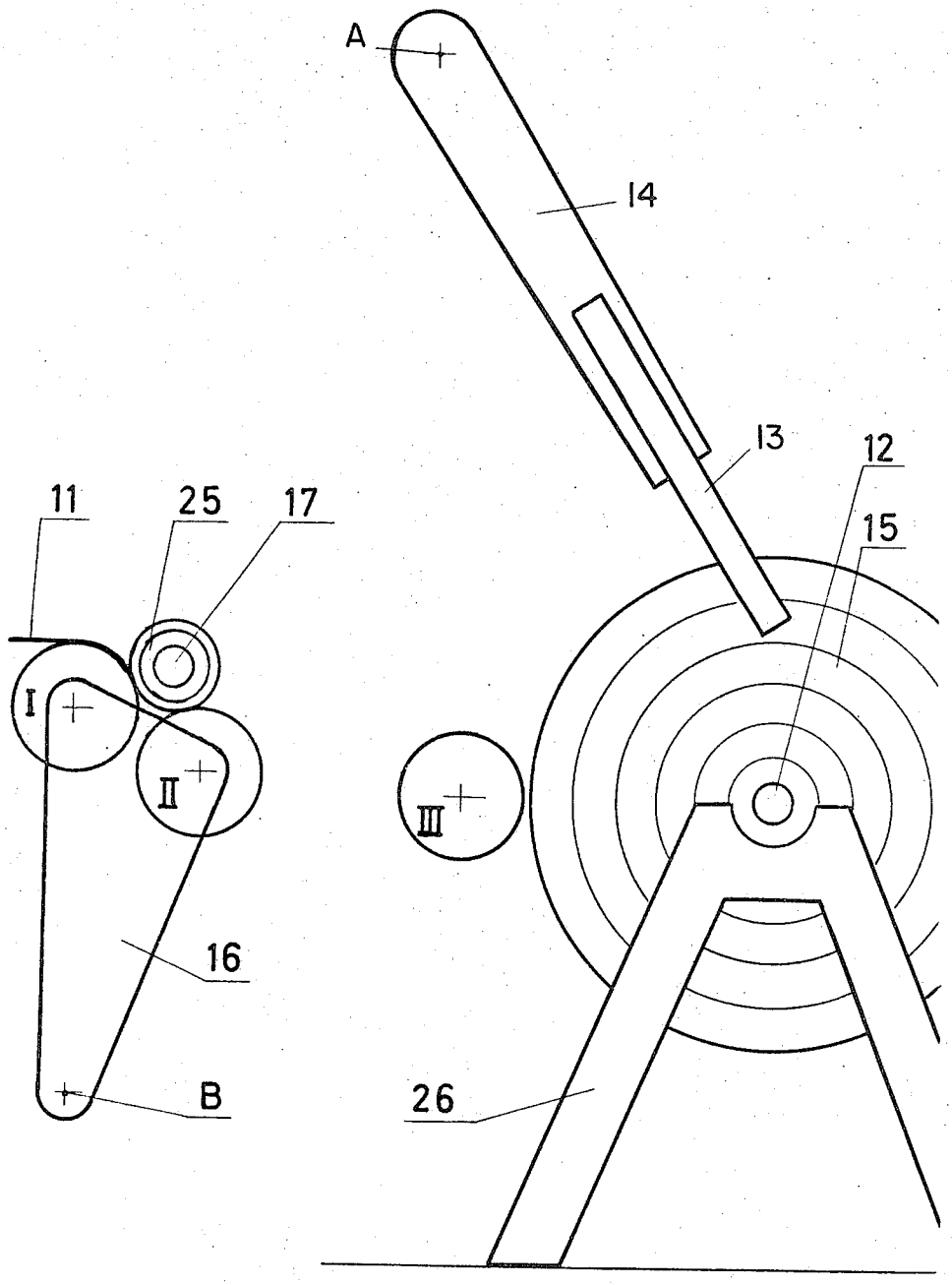


Fig. 7

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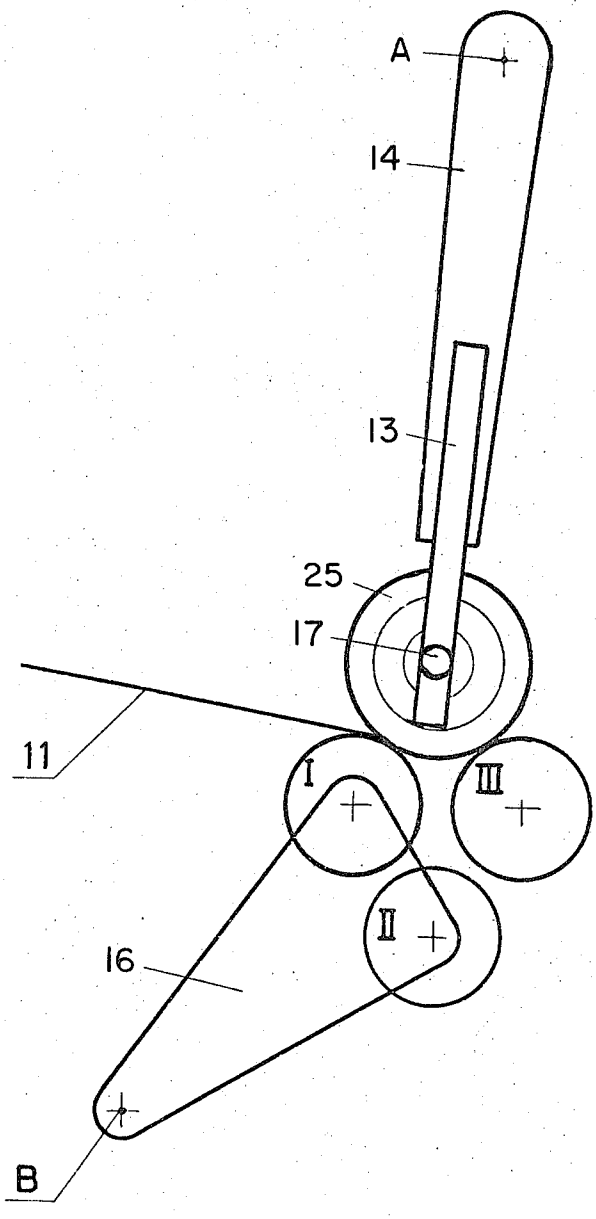


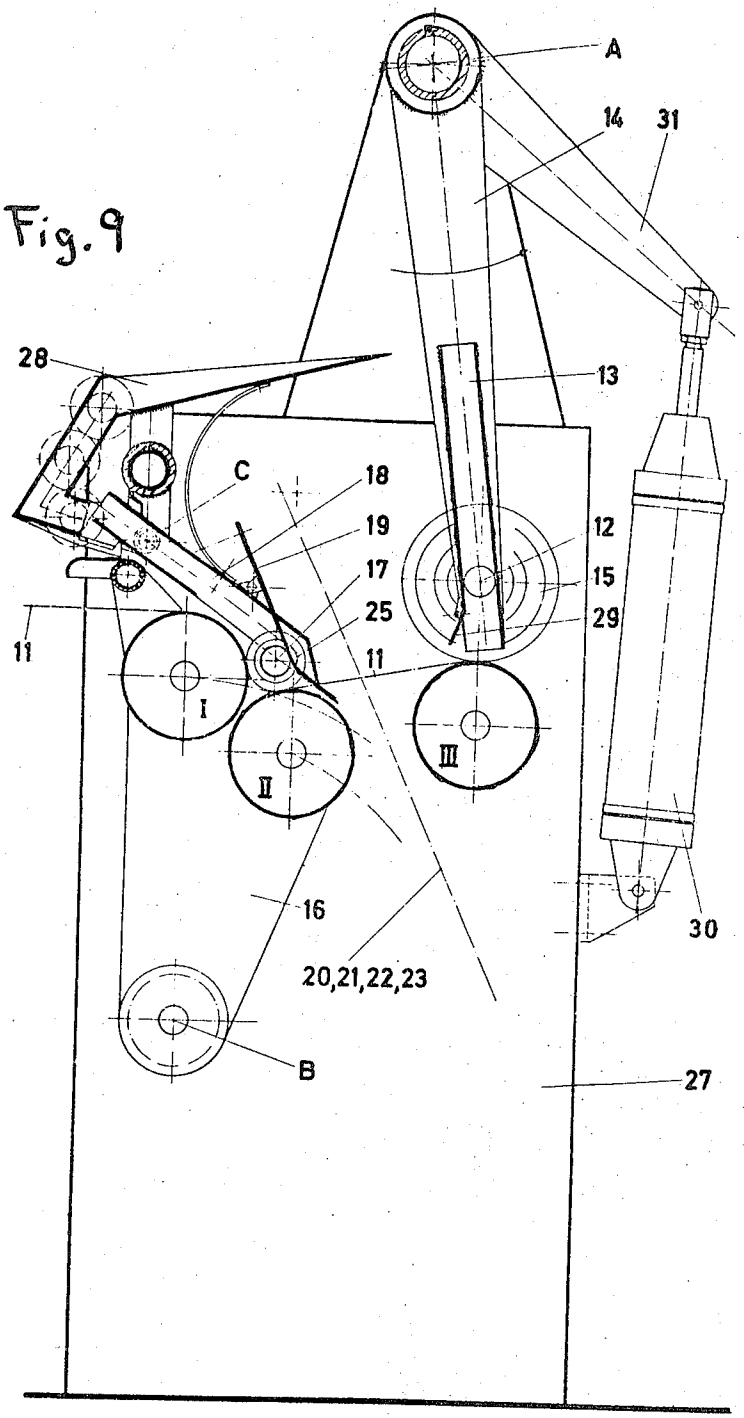
Fig. 8

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Fig. 9



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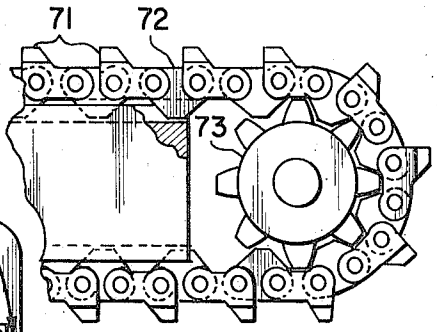

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Fig. 12.

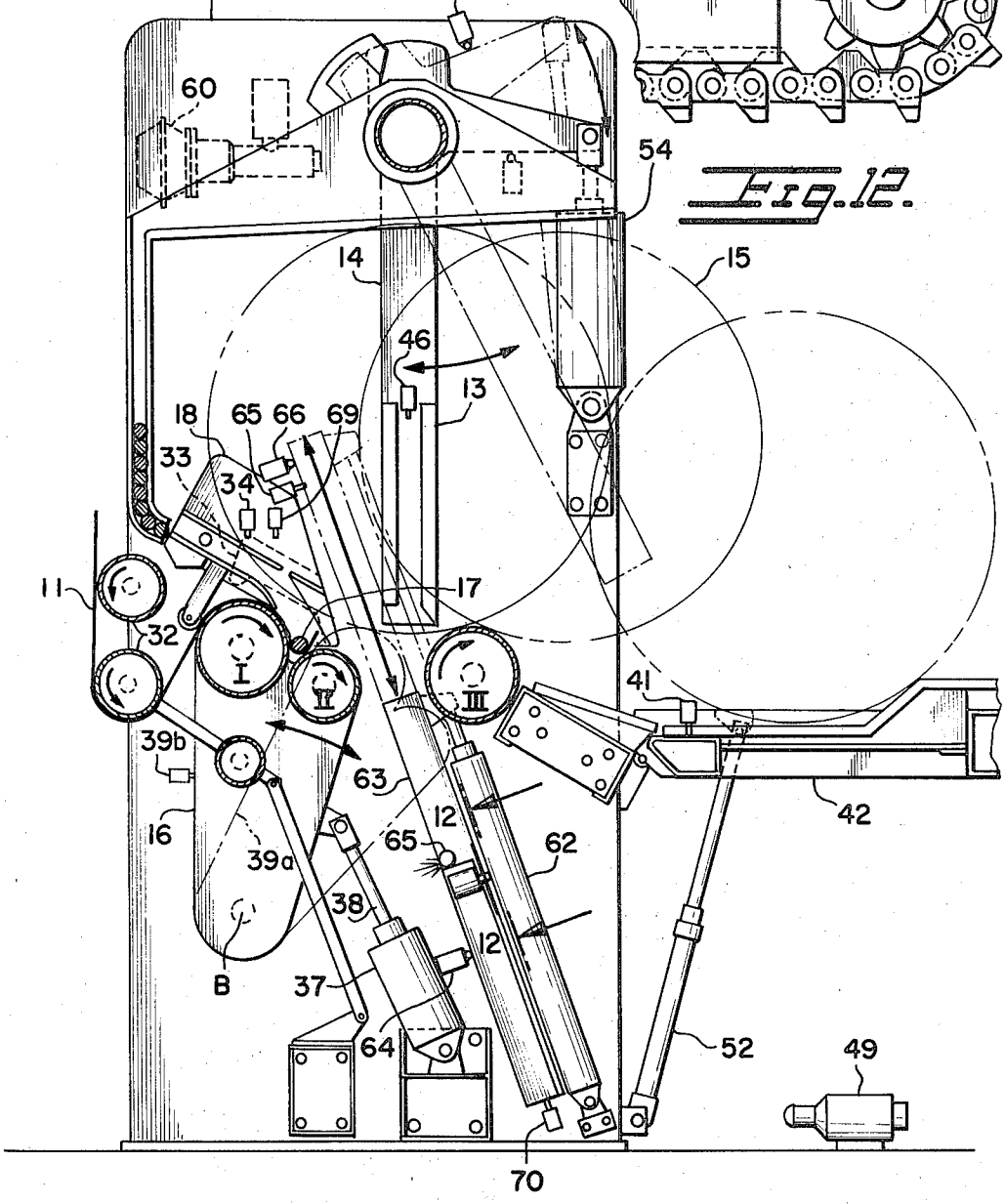

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Fig. 10.

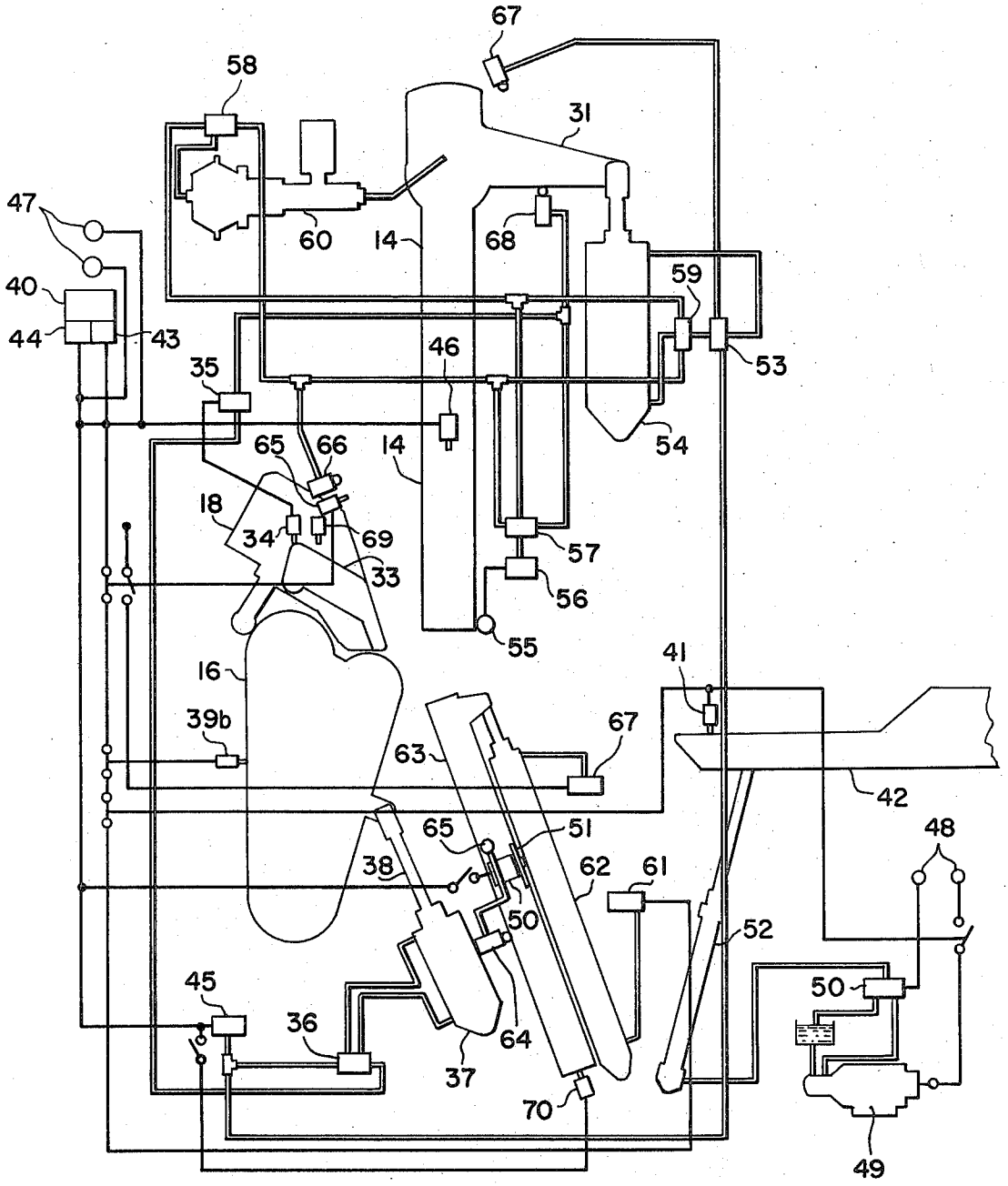

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Fig. 11.

DEVICE FOR CONTINUOUS WINDING OF CONTINUOUSLY RUNNING WEBS OF MATERIAL

This application is a continuation-in-part of my co-pending patent application, Ser. No. 45,057, filed June 10, 1970, entitled "Device for Continuous Winding of Continuously Running Webs of Material" and since abandoned.

The present invention relates to winding devices, and in particular to a multiple roller winding apparatus for continuously winding moving webs of textile material onto a plurality of winding spools.

When treated webs of material are wound onto winding spools, the speed of the webs of material and the tension of the webs of material, must be constant. Conventional winding devices, however, do not maintain constant web speed and tension, and these devices are thus unable to provide web rolls of uniform firmness. These conventional devices are also expensive to manufacture, and are prone to mechanical breakdown.

Accordingly, the present invention provides a multiple roller winding apparatus which overcomes the above-mentioned disadvantages of conventional devices. The winding apparatus comprises a material intake roller, and an auxiliary winding roller, both of which are rotatably mounted in a pivotable mounting member, so as to form a wedge or depression therebetween. The rollers are disposed opposite a stationary delivery roller which forms, with the intake roller, a wedge in which the final winding of a roll of material takes place. The auxiliary winding roller and the delivery roller are rotated at speeds slightly greater than the speed of the intake roller in order to maintain constant tension on the web of material being wound. The winding apparatus further comprises cutting means, which may be a plurality of rotatable cutting knives, for cutting the web of material being wound when the roll of material reaches a predetermined thickness. Air feed means mounted on the winding apparatus provide one or more pressurized air streams directed towards the severed end of the web of material to start the web of material on a new spool.

It is therefore an object of the present invention to provide a winding apparatus in which the tension and speed of a moving web of material are constant.

It is also an object of the present invention to provide a winding apparatus which is simple in design, easy and inexpensive to manufacture, and which is simple and reliable in its operation.

Other objects and features of the present invention will become apparent from the following detailed description taken in connection with the accompanying drawings which disclose several embodiments of the invention. It is to be understood, however, that the drawings are designed for the purposes of illustration only, and are not intended as a definition of the limits and scope of the invention.

In the drawings, wherein similar reference numerals denote similar elements throughout the several views:

FIGS. 1–8 illustrate schematically the different stages of the winding operation carried out by the winding apparatus of the present invention;

FIG. 9 is a side planar view, partly in schematic form of a winding apparatus constructed in accordance with the present invention;

FIG. 10 is a side view of another embodiment of a winding apparatus constructed in accordance with the present invention;

FIG. 11 is a schematic diagram of the electro-mechanical control system for the winding apparatus illustrated in FIG. 10, and

FIG. 12 is a fragmentary front view of one embodiment of a cutting means for the winding apparatus of the present invention.

Referring to the drawings, specifically to FIGS. 1–8, there is shown web of material 11 which is wound onto a take-up roller or spool 12 in the gusset-shaped interval between intake roller I and the stationary delivery roller III. The take-up spool is guided in guide tracks 13 which from part of pivot arms 14 which pivot about pivot axis A. The intake roller I rotates at a constant speed which corresponds to the speed of the discharge of the web of material from an immediately preceeding treatment stage. In order to obtain a firm winding of the material on takeup spool 12, delivery roller III rotates at a speed which is slightly greater than the rotational speed of the intake roller.

When the thickness of the material wound on roller 12 reaches a predetermined diameter, pivot arms 14 swivel material 15 on roller 12 away from intake roller I. Roller 12 is rotated for a short period of time by delivery roller III during which time the web of material is severed and the roll of material 15 is removed from pivot arms 14. When the roll of material is swung away from intake roller I, as shown in FIG. 2, mounting member 16, upon which intake roller I and auxiliary winding roller II are rotatably mounted, are pivoted about pivot axis B into a vertically-disposed position, as illustrated in FIG. 3. A vertically-disposed pivotable magazine 18 is then pivoted downwardly about pivot axis C, which is preferably located above the intake roller, so that a new take-up spool 17 is deposited in the wedge formed between intake roller I and auxiliary winding roller II. The take-up spool is retained in the wedge between the rollers by a flexible retaining means 19, illustrated in FIG. 9. These retaining means may be flexible, metallic, frame-shaped or bow-shaped straps rigidly mounted on magazine 18 so as to retain the winding spools between the intake and auxiliary rollers. The retaining means are mounted stationary on the magazine, and may have a slightly L-shaped configuration.

Auxiliary winding roller II rotates at a speed which is slightly greater than that of the rotational speed of intake roller I. Since delivery roller III also rotates at a speed greater than that of the speed of intake roller I, a firm winding of the web 11 on the winding spools is achieved.

After spool 17 has been deposited between the intake and auxiliary winding rollers, it is rotated by the movement of web of material 11. The retaining means prevent the new take-up spool from being lifted from the wedge between the rollers due to the tension in the web of material. Intake roller I and auxiliary roller II also rotate the new take-up spool. The retaining means serves to insure that the new take-up spool engages rollers I and II so that sufficient frictional force is maintained to rotate the spool. Delivery roller III rotates the web of material 15 on winding spool 12.

When the diameter of the roll of material on spool 12 reaches a predetermined thickness, cutting means 20, which may be an incandescent filament 21, a cutting

knife, or a plurality of rotating cutting knives, is guided upwardly from below the web of material between auxiliary winding roller II and delivery roller III in order to sever the web, as illustrated in FIG. 5. It should be noted that any other type of suitable conventional cutting means may be utilized to cut the web of material. The cutting means is mounted on a feed means 22, which moves upwardly in guide tracks. The feed means includes a plurality of individual air nozzles 23, which are coupled to a pressurized gas source. One elongated slot may also be used instead of the plurality of air nozzles. Sometime before the cutting operation begins, the air nozzles are supplied with air under pressure so that the web of material being cut will be tensioned initially by the streams of air to aid the cutting of the web of material. After the web is cut, the new leading edge 24 of the web is forced upwardly around the new take-up roller 17 to start the web of material on the new winding roller. The air stream from nozzles 23 continues as the feed means 22 moves upwardly so that the web of material is wound uniformly around spool 17. Magazine 18 is then pivoted upwardly away from spool 17 to a vertically disposed position, and the new roll of material 25 is wound on spool 17 in the wedge between rollers I and II. Delivery roller III simultaneously rotates the completed roll of material 15, and pivot arms 14 pivot the roll of material away from roller III out of contact therewith until the roll 15 drops from guide tracks 13 onto a receiving means 26, shown in FIG. 7.

The location of axis point A above delivery roller III insures that the severance of web of material 11 occurs almost totally without tension. The discharge of roll 15 onto receiving means 26 also occurs without tension due to the position of axis point A. Pivot arms 14 are then moved back to their normal winding position above roller III in preparation to receive the new roller 17 in guide tracks 13. As pivot arms 14 are pivoted, mounting members 16 pivot roller I and II and wind-up spool 17 to the winding position below pivot arms 14 so that spool 17 is received in guide tracks 13 as material 15 increases in diameter and lifts spool 17 upwardly into guide tracks 13. Material 25 is wound by rollers I and III as shown in FIG. 8, and the entire winding operation described above is repeated.

A partial schematic side view of the winding apparatus of the present invention is illustrated in FIG. 9. Mounting members 16 for rollers I and II are pivotably mounted about pivot axis B on side wall 27 of the winding apparatus. The pivot arms 14, magazine 18, and mounting members 16 are in the positions illustrated in FIG. 4. Magazine 18, and retaining means 19, are shown in the starting position of the winding operation of the web of material on spool 17 before web 11 is cut by the cutting means. In this starting position, retaining means 19 presses the takeup spool 17 between rollers I and II so that the spool is not lifted from the wedge therebetween by web 11. The distance traveled by the cutting and feeding means is indicated by dotted line 20–23. A stationary supply magazine 28 is provided on the winding apparatus for supplying new take-up spools to magazine 18. Flanges 29 are provided on the lower ends of pivot arms 14 for guiding the take-up spools into guide tracks 13. Pivot arms 14 are coupled to a hydraulic piston cylinder 30 by a rigid arm 31.

FIGS. 10-12 illustrate a pneumatically or hydraulically controlled winding apparatus constructed in accordance with the present invention. At the start of the winding operation, mounting members 16 are vertically disposed and a take-up spool 17 is disposed in between rollers I and II, as previously described. The web is guided from the pretreatment stage to rollers I and II by guide rollers 32, which are rotatably mounted on the winding apparatus side wall 27. A mechanical or optical scanner (not shown), which may be a plurality of switches and levers or photocells, or a combination thereof, is mounted on the winding apparatus to scan the diameter of the roll of material being wound. As the material is wound on the spool, the diameter of the roll increases and pivots magazine 18 upwardly. When the roll of material being wound between rollers I and II reaches a diameter of approximately 120mm, the magazine engages and actuates switch 34, which energizes magnet valve 35 which controls control valve 36 of the hydraulic or pneumatic cylinder 37. Valve 36 admits either air or hydraulic fluid to cylinder 37. Piston arm 38 is withdrawn into cylinder 37 so as to pivot mounting members 16 about pivot axis B towards stationary delivery roller III. The mounting members are pivoted until the position indicated by dotted lines 39a in FIG. 10 is reached, whereupon spool 17 with the material wound thereon rests between winding roller I and delivery roller III. The magazine is pivoted upwardly simultaneously by a cylinder actuated by switch 34 to a vertically-disposed position. When mounting members 16 are pivoted towards delivery roller III, the mounting members disengage switch 39b to prevent an electrical impulse from being transmitted from meter counter 40 and activating any of the magnetic valves of the control system. This prevents the cutting means of the apparatus from being actuated when the mounting members 16 are not in a vertically-disposed position. Switch 41 also prevents an impulse from being transmitted by meter counter 40 when receiving platform 41 is in a downwardly disposed, lowered position. Switches 39b and 41 are coupled to terminal 43 of meter counter 40.

The winding of the material on take-up spool 17 continues, and the ends of the spool are received in pivot arms 14 in guide tracks 13. The winding continues until an impulse from terminal 44 of meter counter 40 energizes magnet valve 45. Switch 46 is mounted on pivot arms 14 to limit the maximum diameter of the roll of material which may be wound on the spool. This prevents the ends of the spool from rising out of guide tracks 13. The scanner of the device also scans the diameter of the roll of material as it is being wound on spool 17 on pivot arms 14. The meter counter is coupled to the scanning device and measures the diameter of the roll of material on the winding spool. It may be programmed to transmit an electrical impulse when the diameter reaches a predetermined value.

The winding of the webs of material on take-up spool 17 continues until an impulse is received by magnet valve 45 from terminal 44 of meter counter 40, the scanner, or switch 46. Terminals 47 are coupled to terminals 48 which are connected to an electric hydraulic pump 49, and magnet valve 50. When the impulse is transmitted from terminal 44 of meter counter 40, electric motor 50 which powers cutting means 51, and electric hydraulic pump 49, are actuated. Magnet valve 50 is also activated, and hydraulic cylinder 52 raises platform 42 upwardly to the illustrated horizontal position for receiving the roll of material 15. When the platform

is pivoted upwardly and reaches its horizontal position, switch **41** is engaged by the platform, and shuts off pump **49.** It should be noted that the hydraulic system utilized to activate cylinder **52** is separate from the system utilized to activate the other components of the winding apparatus. The hydraulic pump may be coupled to the scanner of the winding apparatus, so that platform **42** is raised when roll of material **15** reaches a predetermined diameter for receiving the roll of material, and then lowered to allow the roll of material to roll into a collection bin. Magnet valve **45** is coupled to magnet valve **36** and magnet valve **53.** This valve indirectly controls the supply of air or hydraulic fluid to cylinder **37** through valve **36.**

The same impulse which is transmitted from the meter counter to activate hydraulic pump **49** and motor **50** energizes magnet valve **45** which in turn energizes magnet valve **36,** and causes cylinder **37** to pivot mounting members **16** into their vertically disposed position. When the mounting members reach their proper position, switch **39b** is engaged, and the cutting means safety shut-off is no longer affected. At the same time, a new take-up spool is admitted to magazine **18,** the magazine is pivoted downwardly by the cylinder and roller I, and the spool is discharged therefrom. The new take-up spool is disposed between rollers I and II, and is retained in the wedge formed therebetween by the retaining means **33.** Magnet valve **45** also simultaneously activates magnet valve **53,** which admits air to cylinder **54,** which is pivotably coupled to pivot arms **14.** Cylinder **54** pivots roll of material **15** towards roller III. The pivotable movement of the roll of material is stopped by a photodetection device **55** which is coupled to magnet valve **56** which controls magnet valve **57,** and magnet valves **58** and **59.** Magnet valve **58** controls brake cylinder **60** which applies a brake drum to brake cylinder (not shown) coupled to pivot arms **14.** At the same time, magnet valve **59** admits air to cylinder **54** to stop movement of the piston contained therein.

When the winding apparatus has reached the above-described position, magnet valve **61** is energized by an impulse from terminal **44** of meter counter **40,** the scanner, or switch **46,** and admits air to cylinder **62.** Cylinder **62** moves the cutter **51,** which is mounted on a frame **63,** upwardly in guide tracks towards the web of material spanning the distance between roller II and roller III. When the cutter **51** reaches the web of material, the web is severed, and frame **63** releases a roller lever valve **64** which admits air to feed means **65** which may be an elongated cylindrical-shaped pipe having a plurality of air nozzles or a slit provided therein for directing the air towards the severed end of the web of material and forcing the web around the new take-up roller provided between rollers I and II. During upward movement of the piston of cylinder **60,** the cylinder is drained by direct outlets provided in the cylinder.

When the frame **63** reaches the full extent of its upward travel, switch **65** and roller lever valve **66** is engaged. The switch interrupts the impulse transmitted by terminal **43** from meter counter **40,** to valve **61,** shuts off motor **54,** cutter **51,** and switches off magnet valve **67** which is coupled to cylinder **62.** Air is then admitted to cylinder **62,** above the piston thereof, and frame **63** is retracted downwardly into its original position. As the cutting means retracts, roller lever valve **64** shuts off the supply of air to feed means **65,** and roller lever valve **66** shuts off the supply of air to brake cylinder **60** through valve **58,** and admits air to magnet valve **57,** thus shutting off valve **56** which is controlled by photodetector **55.** The brake cylinder **60** is thus released, and the roll of material **15** is pivoted outwardly by cylinder **54** until the roll of material slips from guide tracks **13** onto receiving platform **42.** As the pivot arms **14** are pivoted outwardly, their coupled arm **31** engages magnet valve **67,** which admits air to magnet valve **53** and returns it to its original position. Cylinder **54** is then activated by the air admitted thereto by valve **53,** and pivots pivot arms **14** back towards its original vertically-disposed position. When arm **31** engages roller lever valve **68,** the valve is actuated and admits air to magnet valve **57** to return it to its original position so that photodetector **55** may trigger the next pivotable movement of arms **14** by means of valve **56.** Activation of valve **68** shuts off the supply of air to cylinder **54,** and the pivot arms rest in their vertically-disposed position. The above-described mechanical operation is repeated for each winding of a roll of material on a winding spool.

The winding apparatus also includes a safety switch **69** which shuts off power to the machine if a starting roll of material exceeds a predetermined diameter, such as **120**mm which is the diameter of material which triggers the operation of the machine. Safety switch **70** is also provided on the winding apparatus, and prevents damage to the machine caused by mechanical failure. The switch shuts off magnet valve **45** until frame **63** has reached its fully retracted position. Magnet valves **53** and **36** are thus inoperative, and cylinders **37** and **54** cannot be reversed, when the cutting means is not in its fully retracted position. The pivot arms thus remain in their outwardly-disposed position, and mounting members **16** remain in their vertically-disposed position, until the frame engages switch **70.**

Magazine **18** may be pivoted automatically by a pneumatic or hydraulic cylinder (not shown) which is controlled by switch **39***b* and switch **34.** The pivotable portion of the magazine stores only one roller at a time and may be provided with pneumatic lever arms which disengage the rollers from the magazine. The vertical portion of the magazine is stationary and stores the rollers which are received one by one by the pivotable portion of the magazine. In the embodiment illustrated in FIGS. **10–12,** the magazine is pivotably mounted on the winding apparatus towards its rearward portion, and has a downwardly extending mounting arm on which a rotatable wheel is secured for engaging roller I. The magazine is biased by a spring means (not shown) so that the end thereof disposed directly over the wedge between rollers I and II is moved upwardly by the spring whenever winding roller I does not engage the rotatable roller mounted on the magazine. A rigid cam member (not shown), comprising a cylindrical rod is disposed upwardly through an aperture provided in the magazine into the magazine channel at the rearward portion thereof adjacent the magazine opening next to the stationary magazine, so that only one winding core is admitted to pivotable magazine **18** at one time. Thus, during operation of the apparatus, when mounting members **16** are not in the described vertically disposed position, roller I does not engage the magazine roller and the spring pulls the pivotable magazine backwardly about its pivotable mounting so that the channel in magazine **18** admits a winding core from

the vertical magazine channel. As the spring pulls the magazine backwardly, the cam enters the pivotable magazine channel at a point which is slightly greater than the width of the winding cores so that only one winding core is admitted to the magazine while it is disposed in this position. When mounting arms **16** are returned to their vertically disposed position by cylinder **37**, roller I engages the mounting roller and pivots the magazine downwardly about its pivot point so that the end thereof is disposed directly above the wedge between the winding rollers and the cam disposed in the magazine channel is withdrawn. The winding roller disposed in magazine **18** then rolls down the magazine channel into the wedge formed between rollers I and II.

The retaining means **33** which secure the ends of the winding cores **17** between the winding rollers during the initial winding operation may be pivotably mounted sheet metal plates secured on magazine **18** at one end thereof. The plates are biased downwardly by spring means (not shown) so that the ends of the sheet metal plates engage the winding core and hold it securely between the winding rollers. The spring means operate on the winding core in a manner similar to a torsion spring. It should be noted that the vertical magazine of the machine illustrated in FIG. **10** is loaded by an operator manually until a desired number of winding cores are disposed in the vertical magazine. Magazine **18** will then automatically admit one winding core as needed acccording to the above-described operation.

FIG. **12** illustrates one embodiment of a cutting means which may be utilized to sever the web of material on the winding apparatus. A plurality of polygonal-shaped cutting blades **71** are disposed on the chain-link drive belt **72** which is rotated by gear **73** driven by an electric motor. Any number of motors may be utilized according to the requirements of the winding apparatus. As previously mentioned, a single cutting blade which is pneumatically or hydraulically projected upwardly, may also be used to sever the web of material.

It should be noted that although a winding apparatus having an automatic pneumatic control system has been shown and described, the entire winding apparatus may be controlled manually by an operator. In such a winding apparatus, the operator would provide the necessary starting signals for each of the described operations, such as, for example, the activation of the cutting means, the raising of platform **42**, etc., from a remote control panel. Motor **50**, pump **49**, and cylinders **52, 54, 37, 62** and **60** as well as the other pneumatically-activated components of the winding apparatus, would be controlled from a remote control panel by manual switches. The operator would activate each component of the winding apparatus at the proper time as a result of his visual observation of the stages of the winding operation. The automatic control system for the winding apparatus is, of course, one of many which may be utilized, and many conventional suitable methods of control are disclosed by the prior art.

While only several embodiments of the present invention have been shown and described, it will be obvious to those persons of ordinary skill in the art that many changes and modifications may be made thereunto without departing from the spirit and scope of the invention.

What is claimed is:

1. A multiple roller winding apparatus for continuously winding moving webs of material on winding spools, and including a supply magazine for supplying a plurality of winding spools on which the material is wound, and cutting means for cutting the web of material when a roll of material reaches a predetermined diameter, comprising:

first mounting means, pivotably mounted at one end thereof, and movable between a first position in which said mounting means is disposed vertically and a second position in which said mounting means is disposed at an angle to said first position:

a first drive roller, mounted on said mounting means;

a winding roller, mounted on said mounting means parallel and adjacent to said first drive roller, said drive roller and winding roller forming a wedge therebetween for receiving the winding spools on which the webs of material are wound, and said drive roller engaging the webs of material wound on a winding spool when said mounting means is disposed in said first position so as to wind the webs of material thereon;

a second drive roller, mounted on the winding apparatus parallel to said first drive roller and said winding roller, for engaging the webs of material wound on the winding spools when said mounting means is disposed in said second position, said first drive roller and said second drive roller forming a wedge therebetween for receiving the winding spools on which the webs of material are wound; and

second mounting means pivotably mounted on the winding apparatus, and disposed above said wedge between said first and second drive rollers, for receiving the ends of the winding spools on which the webs of material are wound.

2. The winding apparatus as recited in claim **1**, wherein said winding roller and said second drive roller are rotated at a rotational speed which is greater than the rotational speed of said first drive roller.

3. The winding apparatus as recited in claim **2**, wherein said first mounting means comprises a pair of pivotable plates, pivotably mounted on the winding apparatus at one end thereof, said first drive roller and said winding roller being mounted at the other end thereof parallel to each other.

4. The winding apparatus as recited in claim **3**, wherein said second mounting means comprises a pair of mounting arms, pivotably mounted on the winding apparatus vertically above said second drive roller, and including means for receiving the ends of the winding spools on which the webs of material are wound as the winding spools are rotated by said first and second drive rollers when said first mounting means is disposed in said second position.

5. The winding apparatus as recited in claim **4**, further comprising means for directing a stream of pressurized air at the severed end of the web of material when the web is cut by the cutting means, and guiding said end upwardly around the winding spool disposed in said wedge between said first drive roller and said winding roller when said first mounting means is disposed in said first position.

6. The winding apparatus as recited in claim **5**, wherein said cutting means comprises a blade carrier movable relative to said web and a plurality of cutting blades mounted on said carrier for movement relative thereto.

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