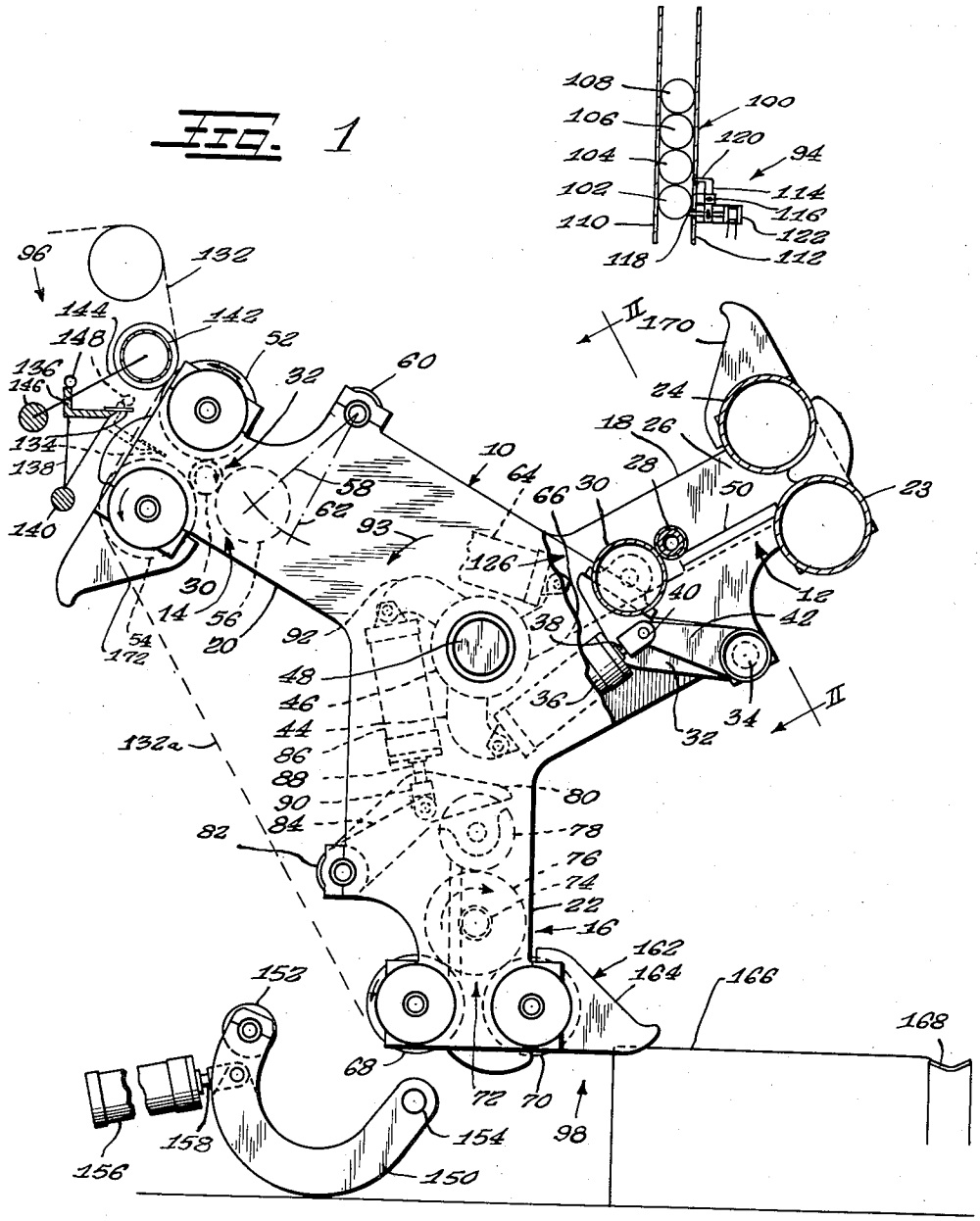
Feb. 7, 1961 E. J. JUSTUS ET AL 2,970,786

AUTOMATIC ROLL WINDER

Filed May 22, 1958

3 Sheets-Sheet 1

Fig. 1



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Fig. 4

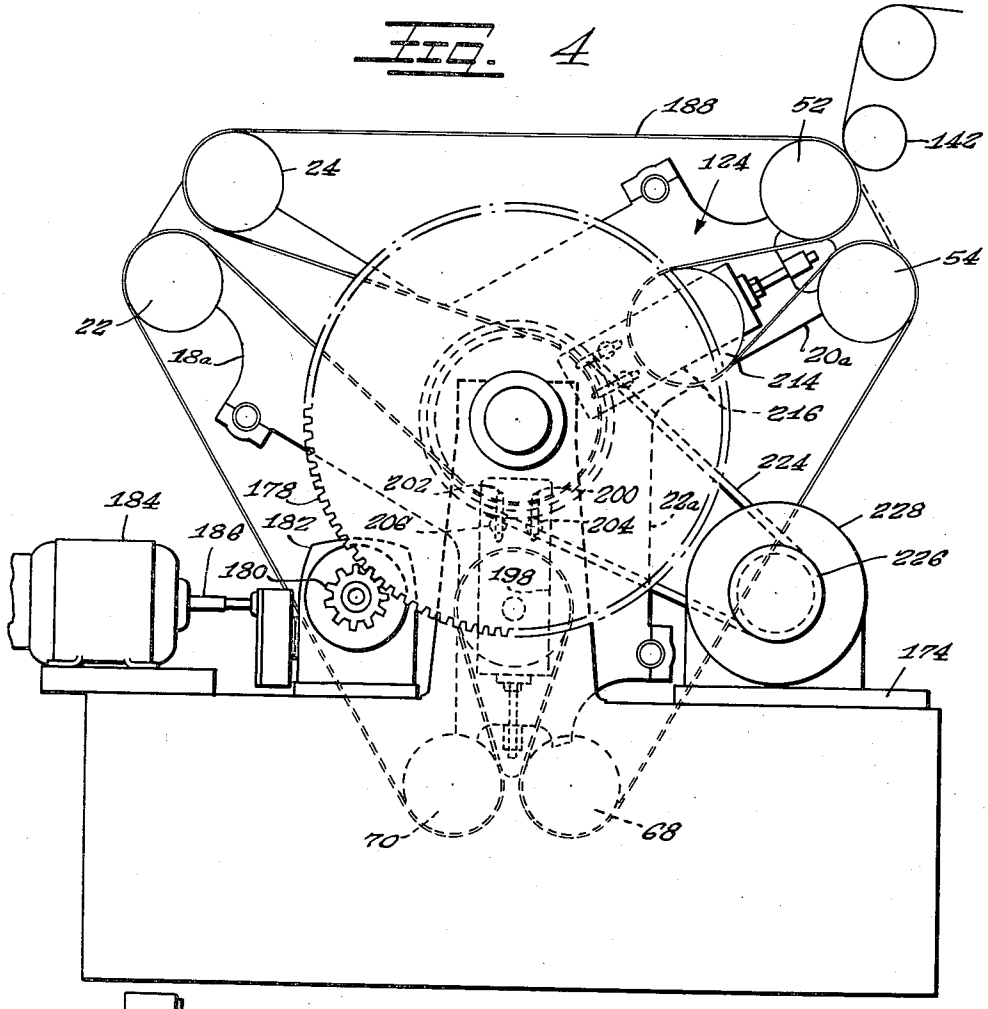
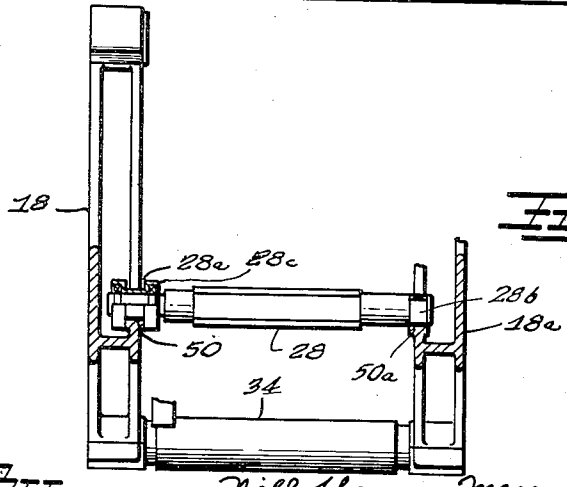


Fig. 2



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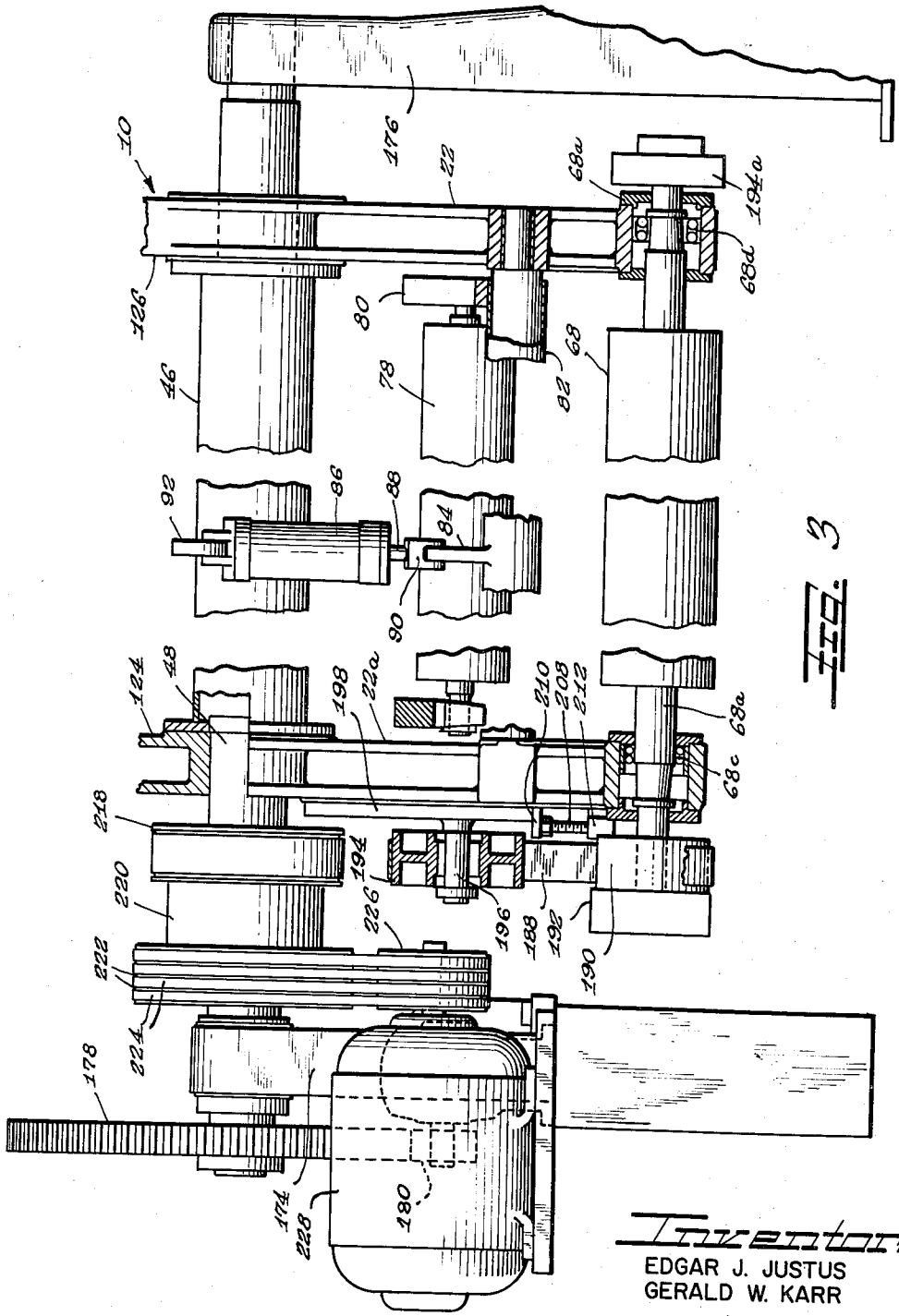


Fig. 3

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AUTOMATIC ROLL WINDER

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Filed May 22, 1958, Ser. No. 737,012

6 Claims. (Cl. 242—64)

The present invention relates to improvements in winding machines, and more particularly to an improved machine for automatically winding sequential rolls from a continuous supply web of material.

The present invention contemplates providing a carrier such as a rotating reel having a plurality of holding stations thereon for supporting individual cores on which a supply of web material is to be wound. Each of the holding stations on the reel includes a pair of winding rolls radially spaced from the center of the reel with the holding stations being circumferentially spaced at equal distances so that indexing the reel will bring the holding stations sequentially into operating stations. The holding stations also include a movable rider roll which moves between a core receiving position and a core holding position wherein the core is caged between the rider roll and winding rolls. The winding rolls are continuously driven by an endless belt to rotate the cores. As the holding stations are moved by indexing of the reel, they are brought to a core delivery station having apparatus for delivering unwound cores to the holding stations, to a transfer station having means for supplying endless web and having means for cutting the web when a core becomes wound and starting the cut end or a new core, and to a winding and ejecting station having means for finishing the winding of the core and for pushing the wound rolls from the holding stations.

An object of the invention is to provide an improved automatic roll winding machine well suited for winding rolls of paper or the like which is adapted to continuous high-speed winding operation.

Another object of the invention is to provide an improved roll winding machine achieving a smooth transferral of cores to be wound, to the machine, and a smooth ejection of the wound rolls from the machine.

Another object of the invention is to provide an improved winding machine of an automatic nature which automatically accomplishes the receiving of unwound cores, starting a cut end of a web onto an unwound core, winding the core into a roll, cutting the web for starting a new roll, and ejecting the wound roll from the machine.

Other objects and advantages will become more apparent with the teachings of the principles of the invention in connection with the disclosure of the preferred embodiment thereof in the specification, claims and drawings, in which:

Figure 1 is a side elevational view illustrating one end of an automatic winding machine embodying the principles of the present invention with parts removed and parts broken away for purposes of illustration;

Figure 2 is a sectional view taken substantially along line II—II of Figure 1;

Figure 3 is a front elevational view of the winding machine with parts broken away and removed for clarity; and,

Figure 4 is an end elevational view taken from the end of the machine opposite to that of Figure 1.

As shown on the drawings:

As illustrated in Figures 1 and 4, an indexible reel **10** is provided for carrying the cores to be wound through a series of operational stations to complete the winding of individual rolls. The reel is provided with a series of holding stations **12**, **14** and **16**, which are spaced radially outwardly from the center of the reel and are circumferentially spaced around the reel with the reel being provided with arms **18**, **20** and **22**.

As illustrated primarily in Figure 1, each of the holding stations on the reel is identical in construction. The holding station **12** is provided with a pair of winding or supporting rolls **23** and **24** which are parallel and spaced to define a winding nest **26** therebetween. A core **28** which is to be wound with a supply of web material is pushed into the nest **26** in driven relation with the winding rolls **23** and **24** by a rider roll **30**. The rider roll **30** is supported on its ends by arms **32**, **32** which are mounted on a pivotal shaft **34** to move the rider roll **30** between a core receiving position as shown in Figure 1, and a core winding position wherein the core is held in the nest, as illustrated at the holding stations **14** and **16**. The rider roll **30** is moved in its path to cage the core **28** in the winding nest **26** by a cylinder **36** carrying a piston therein, which has a piston rod **38** secured by a connector **40** to a crank arm **42** which is connected to the pivotal shaft **34**. The cylinder **36** is provided with connections at each end, which are not shown, for admitting or releasing pressurized fluid to the ends and controlling the position of the rider roll **30**.

The cylinder **36** is mounted on an arm **44** which projects radially outwardly from a hub **46** mounted coaxial with a center supporting shaft **48** for the reel **10**. Rails **50** and **50***a* are provided on each side of the machine to guide the core **28** as it is pushed toward the winding nest **26** by the rider roll **30**.

Each of the holding stations on the arms **18**, **20** and **22** of the reel **10** are similarly constructed.

The arm **20** rotatably supports a pair of winding or supporting rolls **52** and **54**, which are parallel to each other and are driven in rotation to rotate a core **30** which is being wound in a winding nest **32**, defined between the rolls **52** and **54**. The core is held in the nest by a rider roll **56**. The rider roll is supported on arms shown diagrammatically at **58** mounted on a pivotal shaft **60** and carrying a crank arm **62** which is operated by a cylinder **64** carrying a piston and having a piston rod connected to the crank **62**. Certain of these parts are omitted for simplification of the drawings, and inasmuch as each holding station is identically constructed, reference may be made to the different stations for various details. Cylinder **64** is carried on a radial arm **66** mounted on the hub **46**.

The holding station **16** is also substantially identically constructed, and the reel arm **22** carries winding or supporting rolls **68** and **70** which define a winding nest **72** between them. A core **74**, which is shown as having a roll of web material **76** wound thereon at the holding station **16**, is held in the nest **72** by a rider roll **78**. The rider roll is carried by arms **80** at its ends which are connected to a pivotal shaft **82** operated by a crank arm **84**. The crank arm is powered by a cylinder **86** having a piston slidably mounted hterein with a piston rod **88** secured to the crank arm **84** by a connector **90**. The cylinder is mounted on a radial arm **92** secured to the hub **46**.

The holding stations **12**, **14** and **16** are provided on the reel **10** and carried forwardly as the reel rotates or indexes in the direction of the arrow **93** to a series of operational stations **94**, **96** and **98**, arranged outwardly of the reel and provided with mechanism for coacting with the elements on the reel for winding rolls of web material.

The station 94 may be referred to as the core loading station, the station 96 as the transfer station, and the station 98 as the winding and ejecting station. At the core loading station 94, a magazine 100 is located carrying a plurality of fresh unwound cores 102, 104, 106 and 108. The magazine 100 is shown somewhat schematically as having vertical rails 110 and 112 for supporting the cores in stacked relation. At the lower end of the magazine is a core release rocker arm 114 which is pivoted at 116 and has pins 118 and 120 projecting into the path of the cores. The arm 114 is rocked by a solenoid 122, and when the solenoid is operated, the arm 114 will rock to draw the pin 118 out of the path of the core 102 and the upper pin 120 will block the path of the next core 104. When the lower core 102 drops downwardly and clears the pin 118, the rocker arm 114 will pivot back to the position shown, and the remainder of the stack will drop down with the lowermost core 104 being held by the pin 118.

The magazine may be provided with additional extension guide rails which direct the dropped core downwardly onto the reel 10.

As may be viewed in Figure 3, the reel 10 includes the center shaft 48 which is provided with spiders 124 and 126 at each end with the spiders providing the arms for carrying the rolls. Thus, the spider 126 includes the arms 18, 20 and 22 and the spider 124 is provided with similar arms which are spaced opposite the spider arms 126 for carrying the rolls in horizontal positions to extend across the machine.

As shown in Figure 2, the arm 18 of the reel has another arm 18*a* at the opposite side of the machine. The arm 18 has a rail 50 for supporting the core 28 and the arm 18*a* is provided with a similar rail 50*a*. These rails guide the core into the winding nest 26 when the rider roll 30 moves to the core holding position. When the core drops down from the magazine 100, it is guided to the reels 50 and 50*a*. The core 28 is constructed with an annular groove 28*a* at one end to ride on the rail 50 and hold the core in an axially registered position. The core has a bearing 28*b* at the other end for supporting the core on the rail 50*a*. The groove 28*a* is formed in a rotatable bearing 28*c* so that the core can rotate freely as it is being wound. When the core reaches the position shown in Figures 1 and 2, the rider roll 30 is moved upwardly by action of the cylinder 36 to cage the core in the winding nest.

At the transfer station, a supply strip of web material 132 from a parent roll or the like is fed to the wound on the core 76 which is down in a winding and ejector station 98, the web following the path 132*a* over rolls 52 and 54 and roll 68. When the roll 76 is complete the web is cut at the transfer station 96. A knife blade 134 is mounted on a blade support 136 carried on an arm shown schematically at 138 and pivotally mounted on a shaft 140. The blade 134 is moved to the dotted line position of Figure 1 to cut the web 132 which laps the winding roll 52 and the winding roll 54 in its passage to the winding and ejection station 98. A pinch roll 142 mounted on a pivotal arm 144 and supported on a shaft 146 holds the web material in engagement with the winding roll 52.

After the web material 132 has been cut, the trailing end finishes winding on roll 76. The leading end of the web is started on the new core 32. As soon as it is started, the reel 10 will be indexed to bring the started roll in holding station 14 down into the winding and ejecting station 98. The holding station 12 will be then brought into the transfer station 96.

The rolls of each pair of supporting rolls are equidistant from the center of the reel so that at the winding and ejecting station 98, which is directly below the axis of the reel, the supporting rolls are horizontally opposed and substantially equally share the weight of a heavy roll as it is being wound. The ejecting station is directly below the reel shaft 48 which carries the load of the heavy roll being wound without a torque on the reel.

At the ejecting station 98, as illustrated in Figure 1, an arcuately shaped ejector arm 150 carries an ejector roll 152 upwardly to engage the wound roll 76 and eject it from the reel. The ejector arm is mounted on pivotal support 154, and is operated by an ejector cylinder 156 carrying a piston with a piston rod 158 secured to the ejector arm by a connector 160. The ejector roll will push the wound roll 76 out of the nest 72 up over the winding roll 70 and onto ejector rails 162. The ejector rails are mounted on each of the arms of the reel at the ends of the rolls and have an upper flat surface 164 to smoothly receive and guide the wound core as it rolls out of the winding machine onto an ejecting platform 166. The platform, as illustrated, permits the wound rolls to roll onto a conveyor 168. Each of the holding stations on the reel are provided with similar ejector rails, and the station 12 has ejector rails 170 and the holding station 14 has ejector rails 172.

When the web is cut at transfer station 96, the cut lead end of the web 132 will be caught between the pinch roll 142 and the winding roll 52. The knife holder 136 will move to the dotted line position and carry with it an air jet 148. The air jet carries the lead end of the web material into the gap between the winding rolls 52 and 54 and around the new core. If desired, means may be provided for wetting the core to aid in starting the winding of the lead end of the web.

The strip rides over the winding roll 52 and onto the core, with the core being driven by the rotation of the rolls 52 and 54. The cylinder 64 resiliently holds the rider roll 56 against the core, and permits building up of material thereon. When several turns of the web are made about the core, the spider 126 is again indexed moving the started core in holding station 14 into the winding and ejecting station 98 and the roll continues to build to the desired size. This indexing movement thus brings the core 28 into the position previously occupied by core 30 in the transfer station 96, the oncoming web meanwhile following the path 132*a* of Figure 1.

As will be appreciated by those skilled in the art, the operation of the various elements may be accomplished in timed relationship by a main control mechanism which may operate control devices, such as switches. The control mechanism may operate over a fixed time period or its operation may be initiated by mechanism which is responsive to the size of the roll wound on a core so that when a roll of the desired size is achieved, the reel is automatically indexed. The reel will index automatically and operation of the machine will be continuous with the automatic winding of successive rolls of web material as long as the web material is supplied to the winding machine.

As illustrated particularly in Figures 3 and 4, the reel includes the shaft 48 which is mounted on end columns 174 and 176. At its end, the reel shaft 48 carries an indexing gear 178 driven by an indexing pinion 180 which is mounted on an outward shaft from a speed reduction unit 182 driven by an indexing motor 184 through the motor output shaft 186. The motor is energized intermittently to index the reel, or may be provided with clutch and brake mechanism for the indexing operation.

The winding rolls carried at the holding stations on the reel are driven by an endless belt 188. Sheaves are mounted at the ends of each of the shafts of the winding rolls to drivingly connect the belt to the rolls. This may be illustrated by the winding roll 68 in Figure 3, and only one roll need be shown and described in detail, inasmuch as the construction of the other rolls is substantially identical. The winding roll 68 is mounted on a shaft 68*a* rotatably supported at its ends in bearings 68*c* and 68*d*, which are respectively carried on arms 22*a* and 22 of the reel spiders 124 and 126. The shaft 68*a* has mounted on its end a pulley or sheave 190 over which the drive belt

188 is threaded. The pulley may be connected directly to the shaft or in some instances, a clutch 192 may provide connection, and a brake 194*a* may be provided at the other end of the shaft for control of the shatt. The clutch and brake arrangement would permit stopping of the rolls, such as at the ejection station.

The driving belt 188 forms a loop between each of the rolls for adjusting the tension and for increasing the surface contact between the belt and the sheaves for driving the rolls. Between the rolls 70 and 68, a tightening sheave 194 is provided mounted on a stub shaft 196 which is carried on a plate 198. The plate is provided with slots 200 and 202 through which pass bolts 204 and 206 clamping the plate to the arm 22*a* of the reel. An adjusting bolt 208 extends between a projection 210 on the plate 198 and a boss 212 on the arm for aiding in the adjustment of the take-up pulley 194.

The drive belt 188 also loops between rolls 52 and 54 to pass over a take-up pulley 214 mounted on an adjustable plate 216 which is of a construction similar to the plate 198 and has similar tension adjusting devices.

The drive belt 188 also loops between the rolls 23 and 24 and in this case passes over a drive sheave 218 mounted on one end of a spool 220 rotatably supported on the reel shaft 48. The spool is driven by V-pulleys 222 driven by V-belts 224 which also pass over a drive V-pulley 226 on the drive shaft of a winding motor 228. This motor is operated constantly during operation of the winding mechanism to form a continuous drive source for the rolls.

In brief summary of operation, referring primarily to Figure 1, cores are dropped from the magazine 100 onto the rails 50 and 50*a* and are moved into a winding nest 26 by the rider roll 30. The core is then driven by winding rolls 23 and 24 and then indexed to the transfer station 96. At the transfer station a supply web 132 passes between pinch roll 142 and the winding roll 52 to be wound on the core 30. The roll which has started winding is carried downwardly to the winding and ejecting station 98. When the core is wound, the knife 132 slits the web. The cut lead end of the web is caught between the pinch roll and the next winding roll, and the air jet 148 starts the material on the next core. At the winding and ejecting station 98 the ejector roll 152 is carried upwardly to push the wound roll off of the winding rolls 68 and 70 to roll down rails 162 onto the platform 166. Each time a roll is completed, the reel is automatically indexed to provide for complete automatic operation of the machine.

Thus, it will be seen that we have provided an improved winding machine which meets the objectives and advantages hereinbefore set forth. The winding machine provides improvements over machines of the type heretofore used and obtains smooth transition between the stations, and provides for rapid automatic winding of rolls of web material.

We have, in the drawings and specification, presented a detailed disclosure of the preferred embodiment of our invention, and it is to be understood that we do not intend to limit the invention to the specific form disclosed, but intend to cover all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by our invention.

We claim as our invention:

1. A winding machine for automatically winding a supply web such as wrapping paper into successive heavy rolls comprising a rotatable reel having a plurality of radially disposed circumferentially spaced inwardly facing holding stations thereon, pairs of supporting rolls defining said holding stations therebetween and mounted on fixed axes at each of the holding stations with each supporting roll of a pair substantially equidistant from the reel axis for supporting and rotating rolls of material, means for driving each of said supporting rolls, a single rider roll at each of said stations for caging the rolls of material and holding them outwardly against the supporting rolls and movable radially inwardly to accommodate the build-up of material against the fixed supporting rolls, a core delivering station for delivering cores to be wound into rolls of material, a transfer station for starting the end of web material on a fresh core, a winding and ejecting station at a location where said supporting rolls are horizontally opposed and positioned directly below the reel axis so that the weight of a roll of material is fully supported and substantially equally shared by said supporting rolls, said reel being rotatable to move the supporting rolls successively to said delivering, transfer, and winding and ejecting stations, and means for ejecting rolls of material at said ejecting station by forcing the rolls of material out of the holding station over one of the supporting rolls.

2. A winding machine for automatically winding a supply web such as wrapping paper into successive heavy rolls comprising a rotatable reel having a plurality of radially disposed circumferentially spaced inwardly facing holding stations thereon, pairs of supporting rolls defining said holding stations therebetween and mounted on fixed axes at each of the holding stations with each supporting roll of a pair substantially equidistant from the reel axis for supporting and rotating rolls of material, an endless belt drivingly coupled to each of the supporting rolls on the reel for simultaneously driving all of the rolls at substantially the same speed, a single rider roll at each of said stations for caging the rolls of material and holding them outwardly against the supporting rolls and movable radially inwardly to accommodate the build-up of material against the fixed supporting rolls, a core delivering station for delivering cores to be wound into rolls of material, a transfer station for starting the end of web material on a fresh core, a winding and ejecting station at a location where said supporting rolls are horizontally opposed and positioned directly below the reel axis so that the weight of a roll of material is fully supported and substantially equally shared by said supporting rolls, said reel being rotatable to move the supporting rolls successively to said delivering, transfer, and winding and ejecting stations, and means for ejecting rolls of material at said ejecting station by forcing the rolls of material out of the holding station over one of the supporting rolls.

3. A winding machine for automatically winding a supply web such as wrapping paper into successive heavy rolls comprising a rotatable reel having a plurality of radially disposed circumferentially spaced inwardly facing holding stations thereon, pairs of supporting rolls defining said holding stations therebetween and mounted on fixed axes at each of the holding stations with each supporting roll of a pair substantially equidistant from the reel axis for supporting and rotating rolls of material, means for driving each of said supporting rolls, a single rider roll at each of said stations for caging the rolls of material and holding them outwardly against the supporting rolls and movable radially inwardly to accommodate the build-up of material against the fixed supporting rolls, a core delivering station for delivering cores to be wound into rolls of materials, a transfer station for starting the end of web material on a fresh core, a winding and ejecting station at a location where said supporting rolls are horizontally opposed and positioned directly below the reel axis so that the weight of a roll of material is fully supported and substantially equally shared by said supporting rolls, said reel being rotatable to move the supporting rolls successively to said delivering, transfer, and winding and ejecting stations, an ejector member laterally engageable with a roll of material in said ejecting station for forcing a wound roll laterally over one of the supporting rolls, and means for moving said ejector member laterally into the ejecting station.

4. A winding machine for automatically winding a supply web such as wrapping paper into successive heavy rolls comprising a rotatable reel having a plurality of

radially disposed circumferentially spaced inwardly facing holding stations thereon, pairs of supporting rolls defining said holding stations therebetween and mounted on fixed axes at each of the holding stations with each supporting roll of a pair substantially equidistant from the reel axis for supporting and rotating rolls of material, means for driving each of said supporting rolls, a single rider roll at each of said stations for caging the rolls of material and holding them outwardly against the supporting rolls and movable radially inwardly to accommodate the build-up of material against the fixed supporting rolls, a core delivering station for delivering cores to be wound into rolls of material, a transfer station for starting the end of web material on a fresh core, a winding and ejecting station at a location where said supporting rolls are horizontally opposed and positioned directly below the reel axis so that the weight of a roll of material is fully supported and substantially equally shared by said supporting rolls, said reel being rotatable to move the supporting rolls successively to said delivering, transfer, and winding and ejecting stations, an arcuately shaped ejector arm at said ejecting station, means pivotally supporting the ejector arm, a freely rotatable ejector roll carried on the free end of said ejector arm and movable in a path with pivotal movement of the ejector arm laterally into the holding station on the reel, and means for pivoting said ejector arm to force a wound roll of material out over one of the supporting rolls.

5. A winding machine for automatically winding a supply web such as wrapping paper into successive heavy rolls comprising a rotatable reel having a plurality of radially disposed circumferentially spaced inwardly facing holding stations thereon, pairs of supporting rolls defining said holding stations therebetween and mounted on fixed axes at each of the holding stations with each supporting roll of a pair substantially equidistant from the reel axis for supporting and rotating rolls of material, means for driving each of said supporting rolls in rotation including an endless driving member threaded over the ends of each of said supporting rolls, a rotatable driving member having the endless driving member threaded thereover and mounted for rotation coaxial with the reel, means for driving said rotatable driving member so that the supporting rolls can continue to rotate independently of rotation of the reel, said endless driving member extending outwardly between the supporting rolls at one of said holding stations, rotatable take-up members mounted inwardly of the holding stations at each of the other holding stations and having the endless driving member threaded thereover, means for adjusting the radial position of said take-up members to tension the endless driving member, a single rider roll at each of said stations for caging the rolls of material and holding them outwardly against the supporting rolls and movable radially inwardly to accommodate the build-up of material against the fixed supporting rolls, a core delivering station for delivering cores to be wound into rolls of material, a transfer station for starting the end of web material on a fresh core, a winding and ejecting station at a location where said supporting rolls are horizontally opposed and positioned directly below the reel axis so that the weight of a roll of material is fully supported and substantially equally shared by said supporting rolls, said reel being rotatable to move the supporting rolls successively to said delivering, transfer, and winding and ejecting stations, and means for ejecting rolls of material at said ejecting station by forcing the rolls of material out of the holding station over one of the supporting rolls.

6. A winding machine for automatically winding a supply web such as wrapping paper into successive heavy rolls comprising a rotatable reel having a plurality of radially disposed circumferentially spaced inwardly facing holding stations thereon, pairs of supporting rolls defining said holding stations therebetween and mounted on fixed axes at each of the holding stations with each supporting roll of a pair substantially equidistant from the reel axis for supporting and rotating rolls of material, drive sheaves mounted coaxially at the end of each of said supporting rolls, clutch means between each of said sheaves and said supporting rolls, an endless drive belt threaded over said drive sheaves, brake means for each of said supporting rolls, a single rider roll at each of said stations for caging the rolls of material and holding them outwardly against the supporting rolls and movable radially inwardly to accommodate the build-up of material against the fixed supporting rolls, a core delivering station for delivering cores to be wound into rolls of material, a transfer station for starting the end of web material on a fresh core, a winding and ejecting station at a location where said supporting rolls are horizontally opposed and positioned directly below the reel axis so that the weight of a roll of material is fully supported and substantially equally shared by said supporting rolls, said reel being rotatable to move the supporting rolls successively to said delivering, transfer, and winding and ejecting stations, and means for ejecting rolls of material at said ejecting station by forcing the rolls of material out of the holding station over one of the supporting rolls.

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