Jan. 1, 1952 C. A. DICKHAUT 2,581,242

FRICTION DRUM WINDING MACHINE

Filed Aug. 25, 1947 4 Sheets-Sheet 1

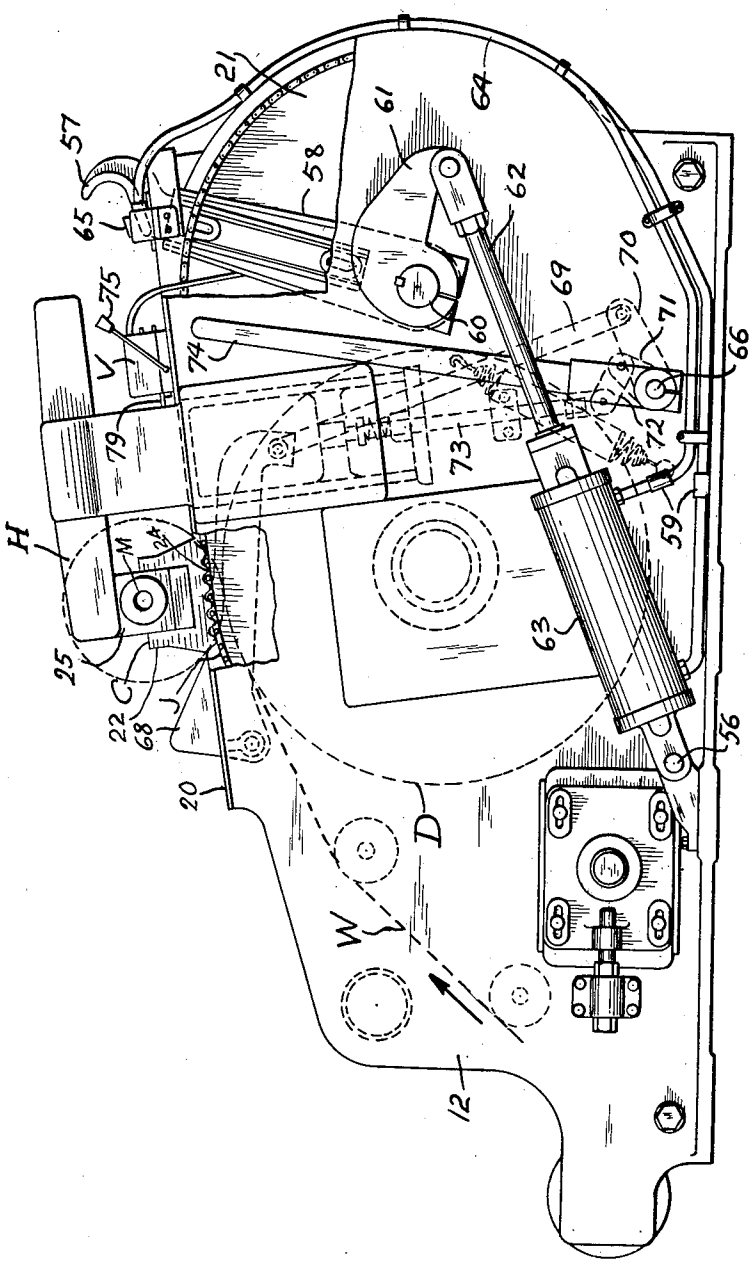


FIG. I.

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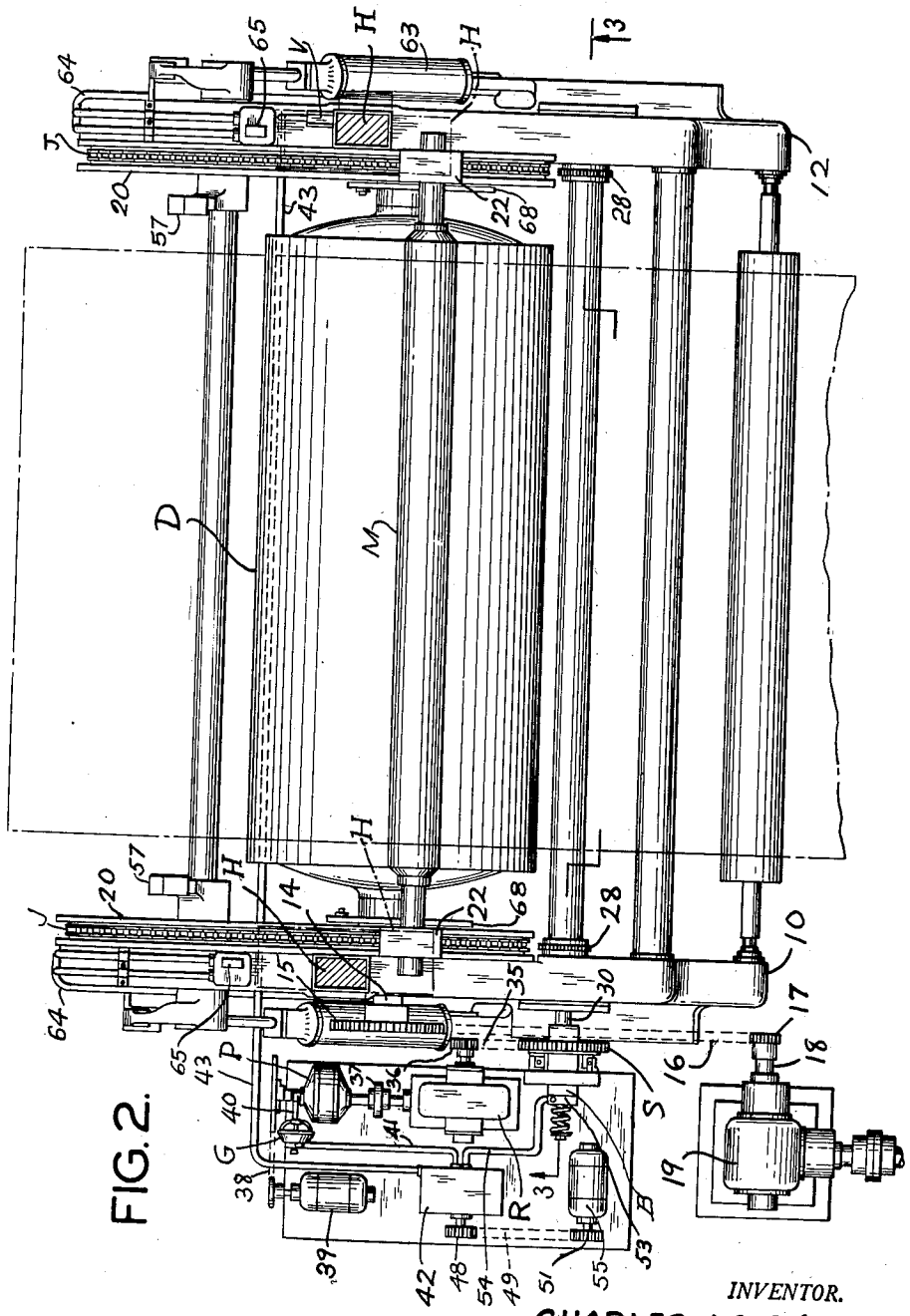


FIG. 2.

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FRICTION DRUM WINDING MACHINE

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FIG.6.

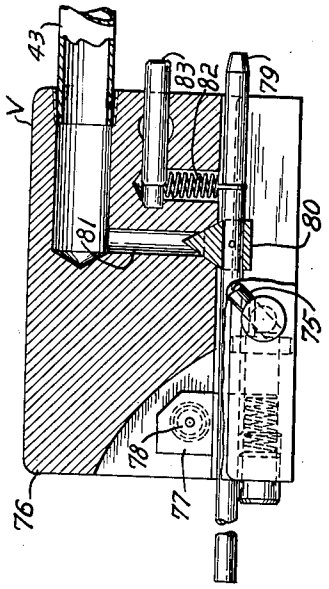



FIG.5.

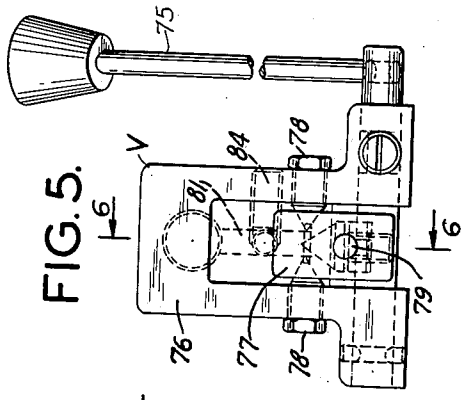



FIG.4.

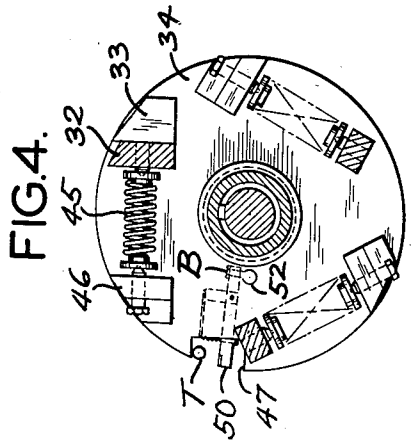
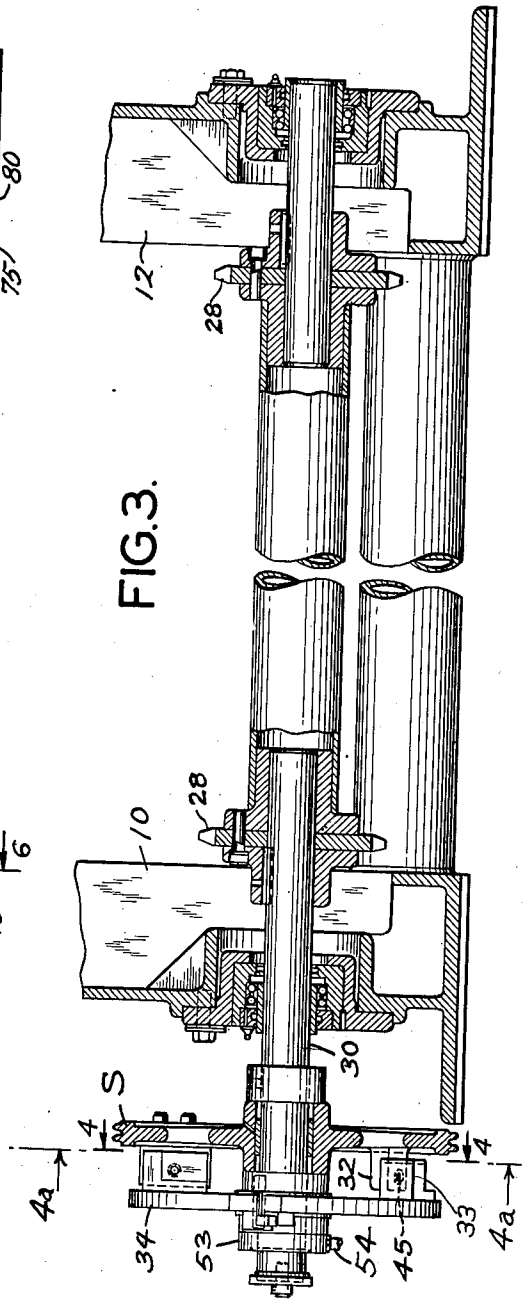



FIG.3.

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FRICTION DRUM WINDING MACHINE

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FIG. 7

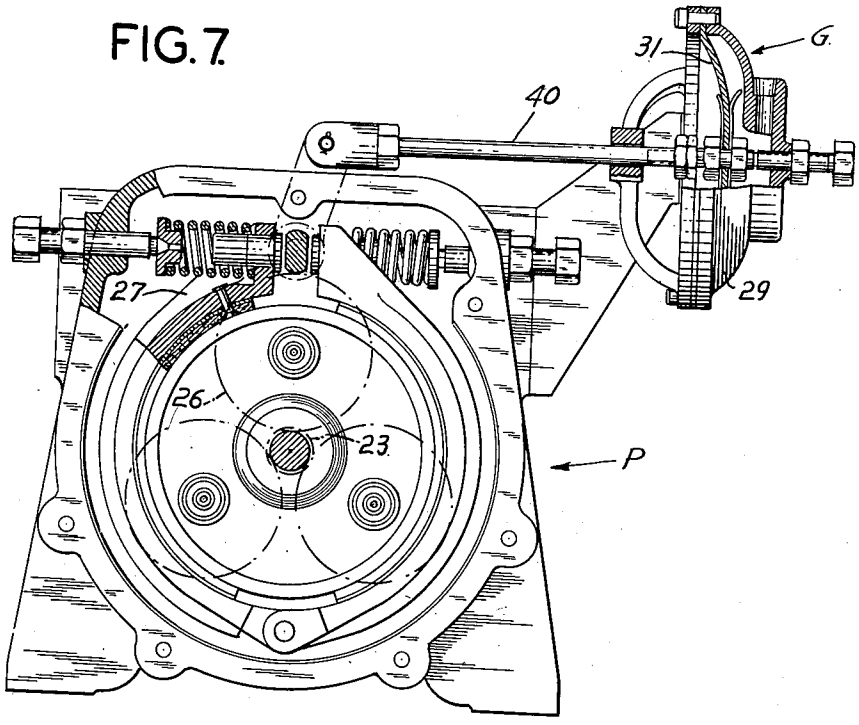



FIG. 4a.

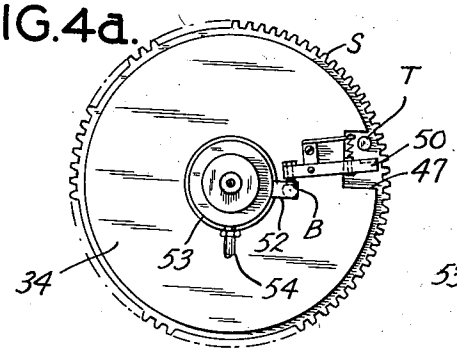



FIG. 4b.

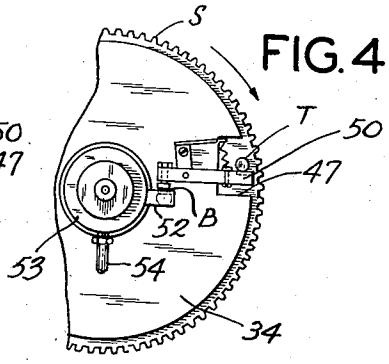
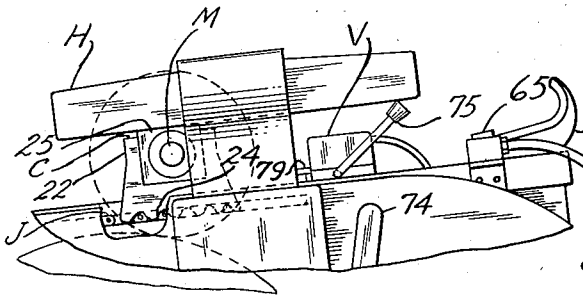



FIG. 1a.

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Patented Jan. 1, 1952

2,581,242

# UNITED STATES PATENT OFFICE

2,581,242

## FRICTION DRUM WINDING MACHINE

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Application August 25, 1947, Serial No. 770,380

15 Claims. (Cl. 242—65)

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This invention relates to web delivery, and more particularly to apparatus for rolling up or rewinding a web being delivered from a continuous treating operation such as a coating process.

Heretofore it has been customary in winding a web into a bundle on a core, to pass the web over a driven winding drum onto the core, which rests of its own weight on the drum, and is rotated by peripheral contact therewith. At the beginning of the winding operation, when only a few layers have been wound onto the core, the bundle is relatively small in diameter and light in weight, so that the winding pressure is low and in consequence the web is relatively loosely wound. As the winding proceeds, and more layers are added, the bundle increases in diameter and weight, and as the entire weight of the bundle is carried by the winding drum, the increase in pressure causes the web to be more tightly wound. Thus the more tightly wound outer layers constrict the more loosely wound inner layers, and this condition increases as the winding proceeds, until the inner layers are crinkled or crushed, resulting in waste of the inner layers.

Objects of the present invention are to eliminate this difficulty, to provide a uniform winding pressure, to support the weight of the bundle independently of or separately from the winding drum, to move the axis of the core away from the winding drum in response to increase in diameter of the roll being wound, to provide an initial pressure in addition to the weight of the bundle at the beginning of the winding operation, to take the increased weight of the roll off the winding drum as the roll increases in diameter, and to otherwise improve the apparatus for winding webs.

According to the invention the web winding machine comprises a winding drum over which the web passes and a core on which the web is wound by peripheral contact with said winding drum, movably mounted bearings in which said core is journaled, means separate from said bearings and cooperating therewith for supporting the weight of the bundle thereon, and means for moving said bearings along said separate weight supporting means away from said winding drum and comprising a shaft, a motor for driving said shaft, and means responsive to increase in diameter of said bundle for transmitting power from said shaft to move said bearings.

Other objects and features of novelty will be apparent as the following description proceeds, with reference to the accompanying drawings, in which:

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Figure 1 is a side elevation of a winding machine according to the preferred embodiment of the present invention;

Figure 1*a* is a partial view of the same, showing the parts in a different position;

Figure 2 is a plan view of the same, with parts broken away to show structure therebelow;

Figure 3 is a vertical section taken along the line 3—3 of Figure 2;

Figure 4 is a vertical section taken along the line 4—4 of Figure 3;

Figure 4*a* is a similar section looking in the opposite direction;

Figure 4*b* is a partial view of Fig. 4*a*, showing parts in a different position;

Figure 5 is an enlarged elevation of the pneumatic valve shown in Figs. 1 and 2;

Figure 6 is a vertical section taken along the line 6—6 of Figure 5; and

Figure 7 is a detail of the diaphragm and planetary gearing shown in Fig. 2.

As shown in Figures 1 and 2, the web W, continuously delivered from the treating process, passes in peripheral contact with a rewind drum D, which is continuously driven at uniform speed. The web W is wound up into a delivery bundle on a core M, the ends of which are journaled in carriages C. A rider H bears on the journals of the core and presses the core against the web on the winding drum D to provide the nip for the winding operation thus providing an initial pressure in addition to the weight of the bundle at the beginning of the winding operation.

As the bundle on the core M increases in diameter, it raises the journals of the core M, which in turn raise the rider H. This upward movement of the rider H relieves the initial pressure above referred to, and is utilized to start driving a chain J, which moves the carriage C away from the drum D, thus providing greater space between the core and the drum to accommodate the increase in diameter of the bundle of web, and taking the consequent increase in weight off the winding drum D to prevent increase in the winding pressure.

Thus upward movement of the rider H opens a valve V, which breaks vacuum in a diaphragm G (Fig. 2), which in turn applies brakes to the ring gear of planetary gearing P, the drive pinion of which is continuously driven at constant speed. Through a gear reducer R the planetary gearing P drives a sprocket S which in turn drives the drive shaft for the chains J.

After the chain J has moved the carriage C and the journals of the core M away from the

winding drum D a sufficient distance to relieve the drum D of the increment of pressure due to the bundle build-up and permit the rider H to descend, the descent closes the valve V. This restores vacuum to the system which actuates the diaphragm G to unbrake the planetary ring gear, which idles until another increment in diameter of the bundle starts to repeat the operation in intermittent fashion, inching the core away from the drum D, until the carriage C gets beyond the rider H.

After the carriage C passes out from under the rider H, the force of increasing diameter tends to push the bundle away from the drum D, because the axis of the core is now to one side instead of vertically above, the axis of the winding drum. This causes a pull on the chain J which causes an overrunning condition of the sprocket S, and permits a pin T (Fig. 4) on the sprocket S to trip another valve B. The valve B breaks vacuum in the diaphragm G, and causes driving of the chain J as before. When the chain J has moved the distance required by the bundle diameter increment, the valve B closes, which restores the drive to idling again.

Referring more particularly to the drawing, the winding machine frame comprises a pair of end plates or castings **10** and **12**, in which the shaft **14** of the rewind drum D is journaled. One end of this shaft has keyed thereto a sprocket **15** driven by a chain **16** from a sprocket **17** on a shaft **18** of a transmission gear box **19**, driven with other machinery not shown, such as a tensioning device, from a large main drive motor.

On top of each of the end plates **10** and **12** is mounted a straight slotted track **20** which is inclined a few degrees upwardly in the direction of movement of the web. The carriages C are slidable along the tracks **20**, and comprise a pair of chain blocks **22** provided with rack sprocket teeth **24** depending through the slots to engage the upper runs of chains J which move along inside the slots. The chain blocks **22** have upright guides which slidably receive bearings **25** in which the ends of the mandrel core M are journaled.

The chains J are driven by sprockets **28** keyed on a shaft **30** journaled in the end plates **10** and **12**. The sprocket S is freely rotatable on this shaft **30**. As shown in Figure 4 the sprocket S is provided with lugs **32** which are adapted to engage corresponding lugs **33** on a disk **34** keyed on the shaft **30** for driving the same.

The sprocket S is driven by a chain **35** from a sprocket **36** on the gear reducer R. The gear reducer R is driven through a coupling **37** from the planetary gearing P. The drive pinion **23** of the planetary gearing P is continuously driven by a sprocket chain **38** at constant speed from a small motor **39**. The drive pinion **23** meshes with planet wheels **26** journaled in known manner in a carrier, not shown, which is joined to the coupling **37**. The planet wheels **26** engage an internally toothed ring gear, not shown, the external periphery of which is adapted to be engaged by spring loaded brake shoes **27**.

The brake for the ring gear of the planetary gearing P is actuated through a lever **40** by the diaphragm G, which comprises a vacuum-tight casing **29** closed by a flexible diaphragm **31**. The lever **40** is connected to the center of the diaphragm **31**. The left hand side of the diaphragm, with reference to Figure 7, is in communication with the atmosphere, while the interior of the casing **29** on the other side of the diaphragm is connected by a conduit **41** to a vacuum pump **42** connected by a conduit **43** to the valve V. The



vacuum pump **42** has a sprocket **48** driven by a chain **49** from a sprocket **51** driven by a small motor **55**.

Valve V comprises a body **76** in which a cradle **77** is pivoted on screws **78**. Cradle **77** carries a rod **79** upon which there is mounted a conical valve member **80** which is adapted to engage a conical seating at the end of a bore **81** communicating with the conduit **43**. Valve member **80** is normally held in vacuum-tight relationship with its seating **81** by means of a coil spring **82** connected at one end to the rod **79** and at its other end to a rod **83** held in the body **76** by a set screw **84**. The left hand extremity of the rod **79**, with reference to Figure 6, engages a recess, not shown, in rider H.

Referring again to Figure 4, the lugs **32** are urged toward the lugs **33** by springs **45** bearing against abutments **46** rigidly mounted on the disk **34**. This forms a lost motion driving connection between the disk **34** and the sprocket S when the latter is rotated in a direction to separate the lugs **32** and **33**. The disk **34** is notched at **47** to receive the pin T projecting thereinto from the sprocket S. A trip lever **50** is pivoted on the disk **34** and extends into the path of the pin T. The other end of the lever **50** carries the valve B which opens a passage **52** in communication with a gland ring **53**, from which a conduit **54** leads to the vacuum pump **42**. The vacuum in the diaphragm G is controlled by the valve B.

In the open position of the valve B the passage **52** places the gland ring **53** in communication with the atmosphere while in the closed position of the valve the gland ring is sealed from the atmosphere.

The manner of operation of the parts of the machine so far described is as follows:

The main driving motor and the motors **39** and **55** are started up with the result that the drum D, the drive pinion **23** and the vacuum pump **42** are all driven. Valves V and B are closed (Figs. 1*a* and 4*a*) so that vacuum pump **42** and the brake shoes **27** are held off the ring gear of the planetary gear P. The planet wheels **26** rotate in their carrier, the latter remaining stationary.

The web W, Figure 1, continuously delivered from a treating process in the direction of the arrow, passes between the drum D and the mandrel core M and is wound into a roll or bundle on the latter by rotation of the drum D. The riders H bearing on the slidable bearings **25** of the mandrel core provide the necessary nip on the web for this winding operation by providing an initial pressure in addition to the weight of the bundle at the beginning of the winding operation.

As the roll or bundle on the core M increases in diameter, as soon as its weight exceeds that needed for web winding pressure, it raises the bearings **25** in the chain blocks **22** and bearings **25** in turn raise the riders H thus relieving the initial pressure above referred to. Upward movement of the riders H tilts the rod **79** in valve V about the pivot screws **78** with the result that valve member **80** is removed from its seating and the vacuum in casing **29** is released. The rod **79** may be tilted also manually by means of handle **75**.

Release of the vacuum in casing **29** causes the brake shoes **27** to be applied to the ring gear of planetary gear P, with the result that the planet wheel carrier rotates coupling **37** which in turn rotates sprocket **36** through reduction gear R. The sprocket **36** drives chain **35** which drives

sprocket S, and the lugs 32 bearing on the lugs 33 of the disk 34 rotate the latter together with shaft 30 and sprockets 28. Rotation of sprockets 28 drives the chains J in the direction to move the carriages C and the core M from left to right in Fig. 1. This movement of the carriages C away from the drum D increases the space between the core M and the drum to accommodate the increase in diameter of the bundle.

As the chains J move the carriages C and the bearings 25 away from the drum D, the bearings 25 descend in the chain blocks 22 under the influence of the riders H with the result that the latter descend to allow valve member 80 of valve V to return to its seating (Fig. 1*a*). The vacuum pump 42 now restores vacuum to casing 29 and diaphragm 31 moves to release the brake shoes 27 from the planetary ring gear. The planet wheel carrier ceases to rotate and the chains J are no longer driven. The carriages C and core M come to rest and remain in their new position until the roll diameter increases again sufficiently for rider H to be raised to open valve V again to repeat the above operation. The core M is thus inched intermittently from the drum D until the carriages C pass beyond the riders H.

When the carriages C reach a point in the tracks 20 where the right hand end of the riders H no longer bear on the bearings 25, the force on the core M due to increase in diameter of the roll tends to push the roll farther to the right along the tracks 20, with reference to Figure 1, as the axis of the core is by this time well to the right, instead of vertically above, the axis of the winding drum. This creates a pull in the chains J which causes rotation of sprocket S to take up the lost motion between itself and the disk 34. Lugs 32 and 33 separate against the action of springs 45, the loading of which maintains web winding pressure. When the web winding pressure is exceeded, the springs 45 are compressed sufficiently to permit the pin T on the sprocket S to trip lever 50 (Fig. 4*b*). Tripping of lever 50 opens valve B to place the vacuum pump in communication with the atmosphere through conduit 54, gland ring 53 and passage 52. The vacuum in casing 29 is again released and driving of the chains J is brought about as described above. When the chains J have moved the core M sufficiently to relieve the pull in the chains valve B closes, and chains J and the core M are again arrested.

When the roll or bundle is nearly completed, the carriages C approach the end of the tracks 20 at a point where the chains J move from the straight to the circular part of their path around the idler sprockets 21 with the result that the depending teeth 24 disengage from the chains, the last tooth to unmesh pushing the carriage C off the end of track 20. This causes the carriage C to tip, and to release the bearings 25 from the guides on the chain blocks 22. At this time the core mandrel M engages hooks 57 on the outer ends of a pair of cradle arms 58 keyed on a shaft 60 journaled in the frame members 10 and 12. Also keyed on the shaft 60 are two rocker arms 61, one at each end of the shaft 60, each of which is pivoted to the piston rod 62 of a hydraulic cylinder 63. Each of the hydraulic cylinders 63 is pivotally mounted as at 56 to one of the end plates 10, 12. The ends of the cylinders 63 are connected by a conduit 64 in which is mounted a valve 65. Valve 65 normally closes the conduit 64 so that the piston rods 62 are held in the position shown in Figure 1 where the hooks 57 are



in position to receive the mandrel core M. The valve 65 may be operated manually, but in the form shown the valve is in the path of the mandrel core M, to be automatically tripped thereby when the bundle is completed, to automatically lower the bundle with its core cradled in the hooks 57. Tripping of valve 65 places the ends of each cylinder 65 in communication with each other to free the piston rods 62, with the result that the weight of the bundle cradled in hooks 57 causes the arms 58 to rotate in a clockwise direction to lower the roll from the machine. The conduits 64 are provided with a flexible portion 59 to allow slight pivoting movement of the hydraulic cylinders 63 during this lowering motion of the completed roll.

The lowering of the bundle releases the carriages C, which are manually removed by the operator from the wound mandrel, then returned to the other end of the tracks 20 to receive an empty core. To facilitate this operation a pair of carriage supporting members 68 each have one end pivoted on the frames 10 and 12 and the other end connected by a link 69 to a bell crank 70, pivotally mounted on shaft 66. Arm 71 of bell crank 70 is connected by a link 72 to a push rod 73 connected to the rider H. A hand lever 74 is provided on shaft 66 by means of which the shaft and bell cranks 70 may be rotated to raise the riders H and the carriage supporting members 68 to permit insertion of the carriages C under the riders H and on top of the supporting members 68 into loading position. The carriage supporting members 68 being elevated prevent the depending teeth 24 from engaging the chain J while the fresh mandrel is being loaded into the carriage C, and also prevent the fresh mandrel from prematurely contacting the winding drum D. The carriage supporting member 68 and the riders H are then lowered manually by lever 74. This lowers the fresh mandrel into contact with the web on the winding drum D to start the winding of another roll, also lowers the teeth 24 into meshing engagement with the chains J, and lowers the riders H into operative position for applying an initial pressure in addition to the weight of the bundle at the beginning of the winding operation and for later automatic operation of the related mechanism in response to increase in diameter of the roll.

What is claimed is:

1. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises movably mounted bearings in which said core is journaled, means separate from said bearings and cooperating therewith for supporting the weight of the bundle of web thereon, and means for moving said bearings along said separate weight supporting means away from said winding drum comprising a shaft, a motor for driving said shaft, and means responsive to increase in diameter of said bundle for transmitting power from said shaft to move said bearings.

2. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum, the improvement which comprises movably mounted bearings in which said core is journaled, means along which said bearings are slidable for supporting the weight of the roll of web thereon, and means for moving said bearings along said

slidably supporting means away from said winding drum to maintain uniform pressure of said core on the web comprising a shaft, a motor for driving said shaft, power transmission means between said shaft and said bearings, and fluid pressure means responsive to increase in diameter of said bundle for actuating said power transmission means.

3. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises guide tracks substantially tangential to said drum, carriages slidably mounted on said guide tracks, core mandrel bearings slidable upwardly in said carriages in response to increase in diameter of the bundle being wound on said core, a rider slidable upwardly with respect to said guide tracks in response to engagement of said rider by said mandrel bearings, and means responsive to upward movement of said rider for moving said carriages along said tracks, comprising a shaft, a motor for driving said shaft, and driving connections between said shaft and said bearings.

4. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises guide tracks substantially tangential to said drum, carriages mounted on said guide tracks, core mandrel bearings slidable upwardly in said carriages in response to increases in diameter of said bundle; chains for moving said carriages along said guide tracks, a rider slidable upwardly with respect to said guide tracks in response to engagement by said mandrel bearings, and means responsive to upward movement of said rider for inching said chains along said guide tracks, comprising a shaft, a motor for driving said shaft, and driving connections between said shaft and said chains.

5. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises movably mounted bearings in which said core is journaled for supporting the weight of the bundle of web thereon, and means for moving said bearings away from said winding drum comprising a shaft driven at constant speed, driving connections between said shaft and said bearings, and means responsive to increase in diameter of said bundle for transmitting power from said shaft to move said bearings.

6. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises movably mounted bearings in which said core is journaled for supporting the weight of the bundle of web thereon, power transmission means for moving said bearing away from said winding drum, driving connections between said power transmission means and said bearings, and fluid pressure means responsive to increase in diameter of said bundle for actuating said power transmission means.

7. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises movably mounted bearings in which said core is journaled for supporting the weight of the bundle of web thereon, and means for moving said bearings away from said winding drum comprising planetary gearing having a pinion driven at constant speed, driving connections between said planetary gearing and said bearings, and means responsive to increase in diameter of said bundle for braking the ring gear of said planetary gearing.

8. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises movably mounted bearings in which said core is journaled for supporting the weight of the bundle of web thereon, means for moving said bearings away from said winding drum comprising planetary gearing having a pinion driven at constant speed, a diaphragm for braking the ring gear of said planetary gearing, driving connections between said planetary gearing and said bearings, and means responsive to increase in diameter of said roll for varying the pressure on said diaphragm.

9. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises movably mounted bearings in which said core is journaled for supporting the weight of the bundle of web thereon, and means for moving said bearings away from said winding drum comprising a lost motion driving connection, means responsive to increase in diameter of said bundle for driving said connection in a forward direction, power transmission means between said lost motion driving connection and said bearings, and means responsive to further increase in diameter of said bundle for causing overrunning of said lost motion driving connection.

10. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises guide tracks substantially tangential to said drum, carriages slidably mounted on said guide tracks, core mandrel bearings slidable upwardly in said carriages in response to increase in diameter of the bundle being wound on said core, a rider slidable upwardly with respect to said guide tracks in response to engagement of said rider by said mandrel bearings, a shaft, a motor for driving said shaft, transmission means for driving said carriages from said shaft, means responsive to upward movement of said rider for connecting said transmission means to said shaft, moving said carriages along said tracks, and means for lifting said rider to facilitate the insertion of carriages for an empty core.

11. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises movably mounted bearings in which said core is journaled, means separate from said bearings and cooperating therewith for supporting the weight of the bundle of web thereon, means for moving said bearings along said separate weight supporting means away from said winding drum, comprising a shaft, a motor for driving said shaft, means responsive to increase in diameter of said bundle for transmitting power from said shaft to move said bearings, and cradle means for receiving the

core from said bearings when the bundle is completed.

12. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises movably mounted bearings in which said core is journaled, means along which said bearings are slidable for supporting the weight of the bundle of web thereon, means for moving said bearings along said slidably supporting means away from said winding drum comprising a shaft, a motor for driving said shaft means responsive to increase in diameter of said bundle for transmitting power from said shaft to move said bearings, cradle means for receiving the said core from said bearings when the bundle is completed, and means actuated by engagement with a part moving with said core for lowering said cradle means.

13. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises movably mounted bearings in which said core is journaled, means for providing an initial pressure on said bearings in addition to the weight of the core and initially-wound web thereon during the initial winding operation to provide the necessary nip between the periphery of the winding drum and the periphery of the initially-wound web during said initial winding operation, weight-supporting means separate from said bearings and cooperating therewith for supporting the weight of the core and the web wound thereon, means for removing said initial pressure from said bearings and for transferring the weight of the core and initially-wound web from said winding drum to said weight supporting means after completion of initial winding operation, and means for moving said bearings along said weight-supporting means away from said winding drum comprising a shaft, a motor for driving said shaft, and means responsive to increase in diameter of said bundle for transmitting power from said shaft to move said bearings.

14. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises guide tracks substantially tangential to said drum, carriages slidably mounted on said guide tracks, core mandrel bearings slidable upwardly in said carriages in response to increase in diameter of the bundle being wound on said core, a weighted rider overlying said core mandrel bearings and supported thereon during the initial winding operation for providing an initial pressure on said bearings in addition to the weight of the core and initially-wound web thereon during the initial winding operation to provide the necessary nip between the periphery of the winding drum and the periphery of the initially-wound web during said initial winding operation, said rider being slidable upwardly with respect to said guide tracks in response to engagement of said rider by said mandrel bearings, means for removing said initial pressure from said bearings and for transferring the weight of said core and said initially-wound web from said winding drum to said carriages after completion of said initial winding operation, and means responsive to upward movement of said rider for moving said carriages along said tracks comprising a shaft, a motor for driving said shaft, and driving connections between said shaft and said bearings.



15. In a web winding machine having a winding drum over which the web passes and a core on which the web is wound into a bundle by peripheral contact with said winding drum; the improvement which comprises movably mounted bearings in which said core is journaled for supporting the weight of the bundle of web thereon, means for providing an initial pressure on said bearings in addition to the weight of the core and initially-wound web thereon during the initial winding operation to provide the necessary nip between the periphery of the winding drum and the periphery of the initially-wound web during said initial winding operation, means for removing said initial pressure from said bearings after completion of said initial winding operation, and means for moving said bearings away from said winding drum after completion of said initial winding operation comprising a shaft driven at constant speed, driving connections between said shaft and said bearings, and means responsive to increase in diameter of said bundle for transmitting power from said shafts to move said bearings.

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