Dec. 18, 1962 L. F. SHABRAM 3,069,106

ROLL-CHANGING MECHANISM

Filed Oct. 10, 1960

4 Sheets-Sheet 1

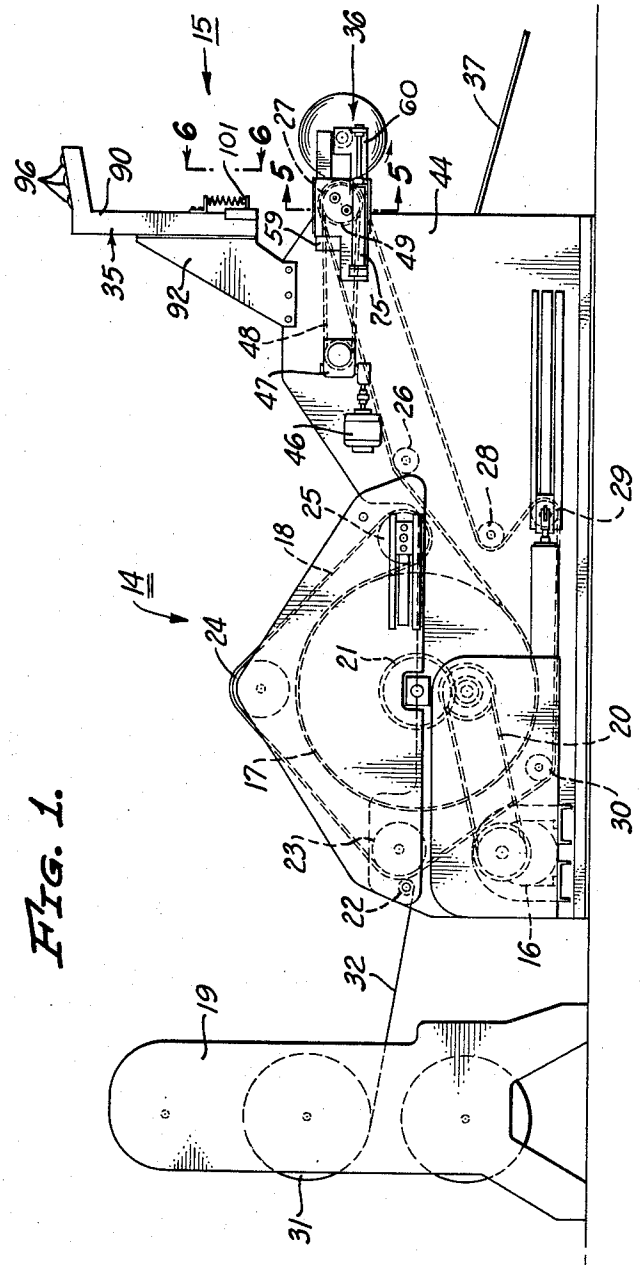


FIG. 1.

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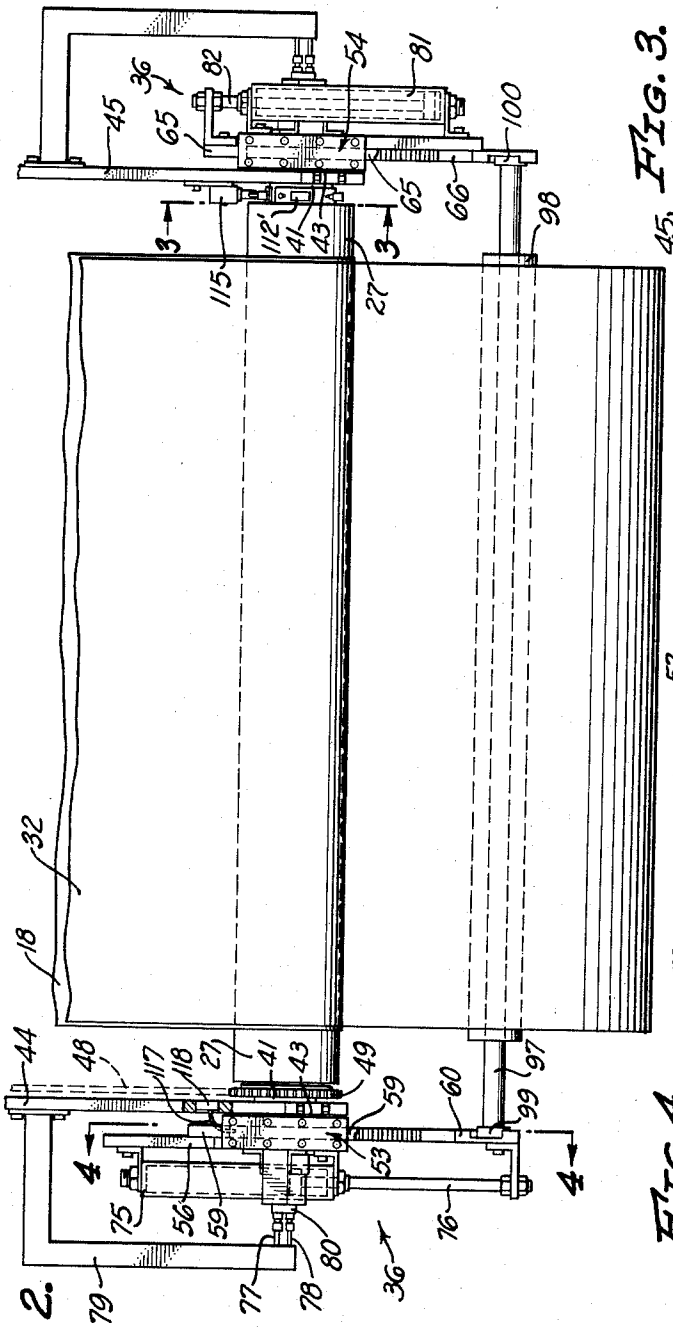


FIG. 2.

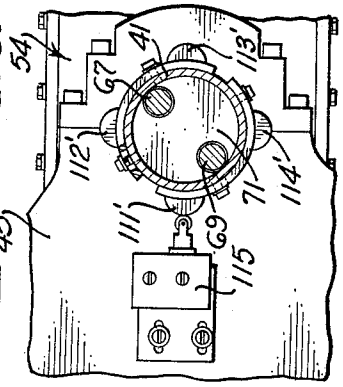


FIG. 3.

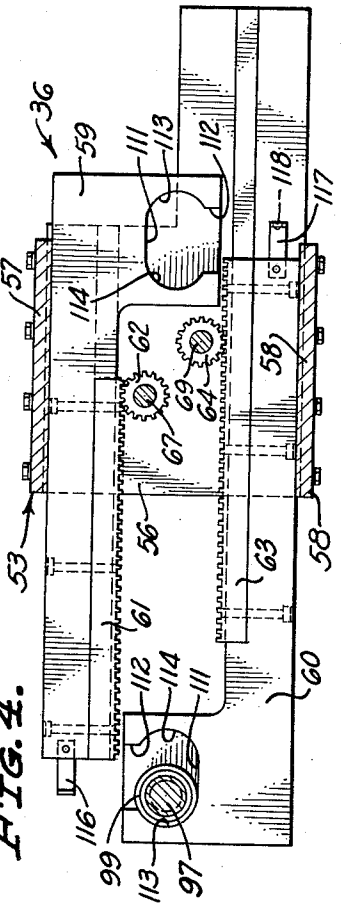


FIG. 4.

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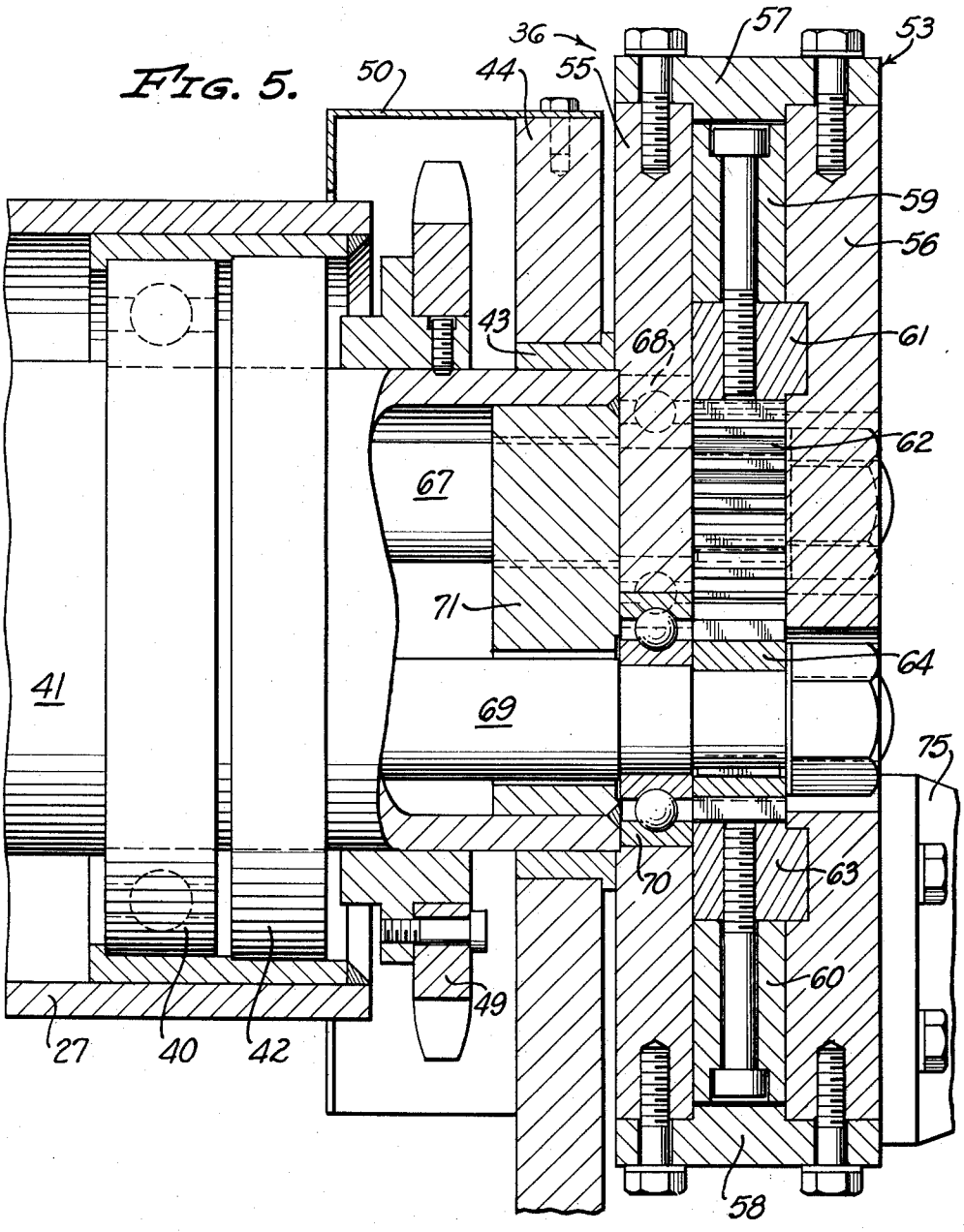
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ROLL-CHANGING MECHANISM

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FIG. 5.

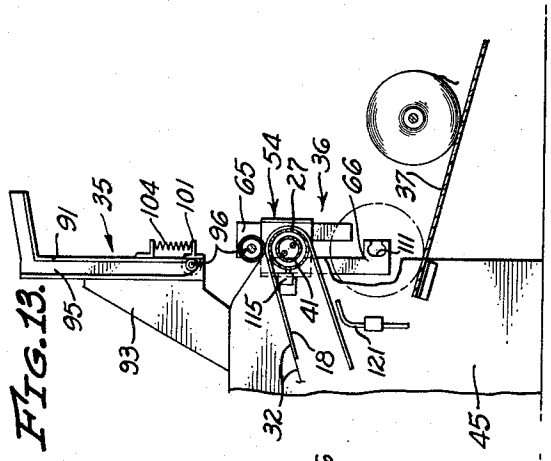


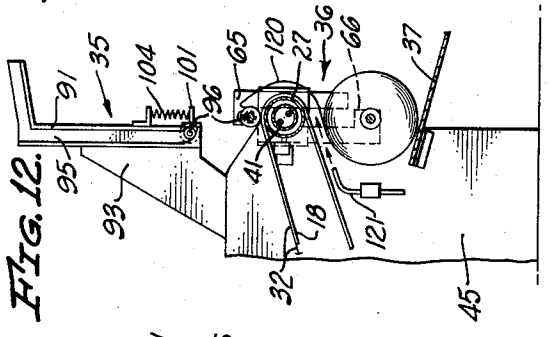
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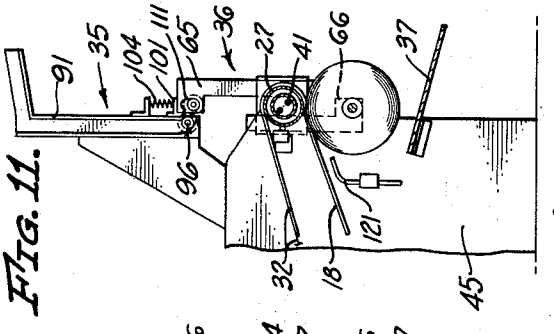
Dec. 18, 1962 L. F. SHABRAM 3,069,106

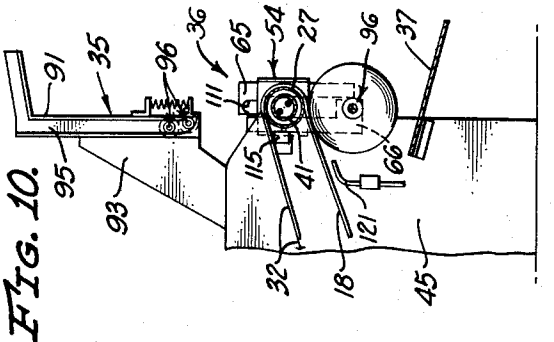
ROLL-CHANGING MECHANISM

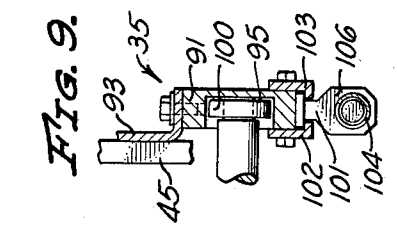
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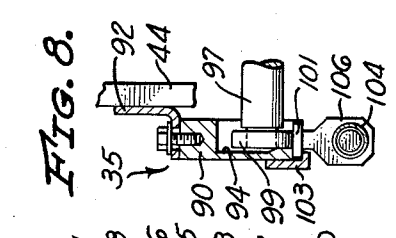


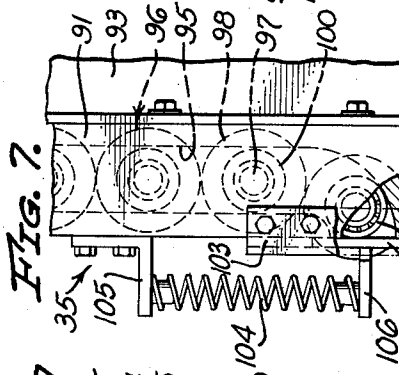


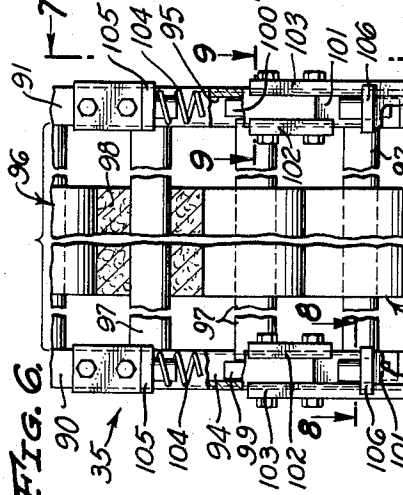












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United States Patent Office 3,069,106 Patented Dec. 18, 1962

3,069,106

ROLL-CHANGING MECHANISM

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Filed Oct. 10, 1960, Ser. No. 61,720
15 Claims. (Cl. 242—65)

This invention relates to roll changing and, in particular, to apparatus for changing take-up rolls in continuously running machines without stopping or slowing the machine. The invention is described and shown herein in conjunction with a plastic bag machine in which bags are formed from thin films of polyethylene or the like, usually by heat-sealing techniques. Such machines may operate at lineal speeds in the range of 500 to 800 feet per minute and higher creating a difficult material-handling problem at the output side of the machine. A typical machine is shown in my copending application entitled Apparatus for Forming Articles From a Web, Serial No. 70,481, filed Nov. 21, 1960, and assigned to the same assignee as the present application.

The bag-making machine or similar device produces an output in the form of a continuous strip of material which is to be wound on rolls for storage, shipping, use or further processing. It is an object of the present invention to provide an apparatus for changing rolls at the output of a bag machine or the like in which an empty roll is substituted for a full roll without interrupting operation of the bag machine. A further object is to provide such apparatus which can be operated automatically to change rolls without supervision.

It is an object of the invention to provide a roll-changing apparatus including means for bringing the empty roll into engagement with the moving strip of material and means for moving the full roll away from the moving strip to permit formation of a loop of material between the rolls for wrapping around the empty roll. Tension in the loop between the two rolls causes the material to tear, disengaging the full roll from the strip and continuing the rolling process on the empty roll. A further object is to provide means for removing the full roll from the apparatus. Another object is to provide means for supplying empty rolls to the apparatus as needed.

It is an object of the invention to provide an apparatus for changing take-up rolls on a continuously running machine including first support means for supporting a roll, second support means for supporting a roll, mounting means carrying the first and second support means for rotation about an axis, means for moving a strip of material toward the axis for winding on a roll, means for moving the first support means toward the axis when a roll thereon is empty, means for moving the second support means away from the axis when a roll thereon is full, and means for wrapping a portion of the strip of material adjacent the full roll around the empty roll. A further object of the invention is to provide means for simultaneously rotating the first and second support means about the axis when the full roll is unloaded from the second support means and continuously urging the first support means toward the axis during the rotation to maintain tension winding on the apparatus at all times. Another object of the invention is to provide an air stream directed against the strip of material between the full and empty rolls to aid in forming the loop of material and engaging the loop with the empty roll.

It is an object of the invention to provide apparatus for roll changing on a continuous-running machine including a frame, means for feeding a continuous strip of material past a pivot axis, first and second roll supports, mounting means for mounting the roll supports on the frame for

rotation about the pivot axis, first means for reciprocating the first roll support between extended and retracted positions, second means for reciprocating the second roll support between extended and retracted positions, and a feed unit for storing empty rolls with the feed unit having a roll discharge opening and with each of the roll supports positionable at the discharge opening when in the extended position. A further object is to provide such an apparatus including means for extending one roll support to the roll discharge opening to pick up an empty roll and retracting the roll support to engage the empty roll with the strip of material, means for extending the other roll support to move the full roll away from the strip of material for severing the strip and disposing of the full roll, and means for rotating both roll supports while maintaining the empty roll in engagement with the strip.

It is an object of the invention to provide a roll-changing apparatus including a frame, a belt roller mounted in the frame for rotation about an axis, a belt moving over the roller for carrying a strip of material therewith, first and second roll supports, mounting means for mounting the roll supports on the frame for rotation about the axis, a first piston carried on the mounting means for reciprocating the first roll support, and a second piston carried on the mounting means for reciprocating the second roll support, with the pistons being operable to extend and retract the roll supports in sequence and with the roll supports being simultaneously rotatable about the axis.

The invention also comprises novel details of construction and novel combinations and arrangements of parts together with other objects, advantages, features and results, which will more fully appear in the course of the following description. The drawings merely show and the description merely describes a preferred embodiment of the present invention which is given by way of illustration or example.

In the drawings:

FIG. 1 is a side elevation of a preferred form of the roll-changing apparatus mounted on a plastic bag machine;

FIG. 2 is an enlarged plan view of the apparatus of FIG. 1;

FIG. 3 is an enlarged partial sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is an enlarged partial sectional view taken along the line 4—4 of FIG. 2;

FIG. 5 is an enlarged partial sectional view taken along the line 5—5 of FIG. 1;

FIG. 6 is an enlarged partial view taken along the line 6—6 of FIG. 1;

FIG. 7 is a side elevation of the apparatus shown in FIG. 6;

FIG. 8 is a partial sectional view taken along the line 8—8 of FIG. 6;

FIG. 9 is a partial sectional view taken along the line 9—9 of FIG. 6; and

FIGS. 10–13 are side elevation views showing steps in the operating cycle of the roll-changing apparatus.

In FIG. 1, a bag-making machine **14** carries a roll-changing apparatus **15** at the output end thereof. The bag-making machine **14** includes a drive motor **16**, heat-sealing drum **17**, an endless belt **18**, and a roll stand **19**, and is described in detail in my aforesaid copending application. The motor **16** drives the drum **17** through a belt **20** and gear **21**. The drum, in turn, drives the endless belt **18** which passes between rolls **22**, **23**, over rolls **24**, **25**, around the drum **17**, over rolls **26**, **27**, **28** and over rolls **29**, **30** of a belt-tensioning device.

In the operation of the bag-making machine, a roll **31** of material such as polyethylene film is mounted in the

roll stand 19 and a strip 32 of the material, which is ordinarily folded double, is fed from the roll 31 into engagement with the endless belt 18 between the rollers 22, 23. The drum 17 carries appropriate heat-sealing electrodes which form the strip of material into the desired articles. Typically, the product of the machine will be rectangular bags having a folded edge at the bottom and heat-seald edges at each side. The machine will be operated so that the heat-sealing electrodes do not completely separate the bags from each other such that a continuous strip of material leaves the drum.

The roll-changing apparatus 15 includes a roll feed unit 35, a roll support mechanism 36, and a roll discharge ramp 37. Empty rolls are stored in the roll feed unit and are automatically fed to the roll support mechanism as required. Full rolls are placed onto the discharge ramp by the roll support mechanism during the roll-changing operation. While it is preferred to feed empty rolls and remove full rolls automatically, it should be noted that empty rolls can be inserted manually and full rolls can be removed manually if desired.

The roller 27 over which the belt 18 passes rotates freely on a bearing 40 at each end thereof, the bearing being carried on a torque tube 41 (FIGS. 2 and 5). A shaft seal 42 is also positioned between the roll 27 and the tube 41 outside each of the bearings 40. The torque tube 41 rotates in a sleeve bearing 43 at each end, the sleeve bearings being carried in frame members 44, 45 of the machine 14. The torque tube 41 is driven by a motor 46 mounted on the frame member 44, through a gear reduction unit 47, a chain 48, and a gear 49 mounted on the tube. A protective housing 50 encloses the gear 49.

The roll support mechanism 36 includes two roll support units 53, 54 carried at the respective ends of the torque tube 41, the unit 53 being shown in detail in FIG. 5. Vertical plates 55, 56 are maintained in fixed, spaced relation by lateral plates 57, 58, the vertical plate 55 being fixed to the torque tube 41 by suitable means such as welding or the like. Roll support arms 59, 60 are slidably positioned between the plates 55, 56. The roll support arm 59 carries a gear rack 61 for engaging a pinion 62. The roll support arm 60 carries a similar gear rack 63 for engagement with a pinion 64. Similar roll support arms 65, 66 are carried in the roll support unit 54 at the opposite end of the torque tube 41. The pinions 62 for the roll support arms 59, 65 are carried on a countershaft 67 journalled in bearings 68 in the vertical plates 55. Similarly, the pinions 64 for the roll support arms 60, 66 are carried by a countershaft 69 journalled in bearings 70 in the vertical plates 55. The countershafts pass through clearance openings in reinforcing plates 71 positioned at each end of the torque tube.

A hydraulic cylinder 75 is mounted on the vertical plate 56 of the roll support unit 53. A piston 76 is slidably positioned in the cylinder 75, with the free end of the piston fixed to the roll support arm 60. Hydraulic lines 77, 78 for actuating the cylinder 75 are carried from the frame member 44 through a conduit 79 to a rotating coupling 80 mounted on the plate 56. A similar hydraulic cylinder 81 is mounted on the corresponding vertical plate of the roll support unit 54 with a piston 82 fixed to the roll support arm 65. Hydraulic fluid for operating the cylinder 81 is supplied in the same manner as for the cylinder 75.

The hydraulic cylinder 75 provides for extension and retraction of the roll support arms 60, 66 and the cylinder 81 provides for extension and retraction of the arms 59, 65. Of course, compressed air or other suitable means may be used for moving the roll support arms.

The details of the roll feed unit 35 are shown in FIGS. 6–9. Track members 90, 91 are supported on brackets 92, 93 projecting upward from the frame members 44, 45, respectively. Grooves 94, 95 in the track members 90, 91, respectively, provide for passage of rolls therealong, the grooves terminating in roll discharge openings at their lower ends. Typically, a roll 96 consists of a shaft 97 carrying a centrally disposed wooden cylinder 98, with roller bearings 99, 100 mounted at the respective ends of the shaft. The discharge opening of each track member is closed by a gate member 101 which slides vertically in a groove formed by angle brackets 102, 103 and the track member. A compression coil spring 104 may be positioned between a bracket 105 fixed to the track member and another bracket 106 fixed to the gate member to urge the gate member to the downward position. A stop plate 107 at the bottom of the track member defines the downward position of the gate member.

Each of the roll support arms 59, 60, 65, 66 includes means for receiving and supporting an end of a roll. A preferred form of roll-receiving opening is shown in FIG. 4, the opening 111 comprising a slot 112 which communicates with spaced opposing semicircles 113, 114. The semicircles 113, 114 are of a radius to receive the roller bearings 99, 100 carried at the end of a roll and preferably have a radius a fraction of an inch greater than the radius of the roller bearing.

Means may be provided for indicating the rotational position of the torque tube 41 and the roll support units 53, 54 carried therewith. A preferred form of such structure is shown in FIGS. 2 and 3 and includes four cams 111', 112', 113', 114' mounted on and equally spaced about the torque tube 41 between the roller 27 and the frame member 45. An electrical switch 115 is mounted on the frame member 45 for actuation by the cams as the torque tube rotates.

Means may be provided for indicating when a roll is full and a roll-changing cycle should be initiated. One form of such structure is shown in FIGS. 2 and 4. A flexible finger 116 may be provided on the roll support arm 59 and a similar finger 117 may be provided on the roll support arm 60. An electrical switch 118 is mounted on the frame member 44 for actuation by the finger on the roll support arm carrying the roll on which material is being wound when a predetermined thickness is achieved.

The operation of the roll-changing apparatus will be described in conjunction with FIGS. 1, 10, 11, 12 and 13. Normally, the roll support mechanism 36 is disposed horizontally, as shown in FIG. 1. A roll is resting in the roll support arms 60, 66 and the strip of material from the bag machine is being wound onto the roll. The cylinder 75 is energized to urge the roll toward the belt with the belt providing the driving torque for the roll. This arrangement maintains tension on the strip of material and produces a tightly wound roll of material. When the roll is full, the change cycle is initiated. This may be accomplished by engagement of the finger 117 with the switch 118, or by other suitable means such as a light and photocell, or by visual observations of the apparatus. The motor 46 is energized to rotate the torque tube 90° to the position of FIG. 10. Then the cylinder 81 is actuated to extend the arms 59, 65 upwardly to the roll discharge opening of the feed unit 35. The extending roll support arms engage the brackets 106 of the gate members 101, moving the gate members upward against the action of the springs 104. Upward movement of the gate members permits a roll to move outward through the discharge opening of the feed unit into the roll-receiving openings 111 of the roll support arms as shown in FIG. 11.

The cylinder 81 is now energized to retract the arms 59, 65 bringing the empty roll into engagement with the strip of material 32 carried by the belt 18. When the empty roll engages the strip, the cylinder 75 is energized to extend the arms 60, 66 and move the full roll out of engagement with the belt as seen in FIG. 12. A slack loop 120 of the material forms between the rolls permitting the material to start winding on the empty roll. A source of air such as a pipeline 121 may be directed along

the belt between the rolls to aid in forming the slack loop and winding of the material onto the empty roll. This air source may be actuated only during the changing cycle or may operate continuously, as it does not affect the operation except when the full roll is moved away from the belt.

When the material starts to wind on the empty roll, the loop **120** is placed in tension and tears to free the full roll from the strip. As the arms **60**, **66** continue to move downward, engagement of the full roll with the discharge ramp **37** raises the roll relative to the arms, permitting the roll to move out of the roll-retaining openings in the arms. The full roll will then move down the ramp **37** for subsequent use as seen in FIG. 13. Ordinarily, the last step of the change cycle is rotation of the torque tube another 90° to the position of FIG. 1, bringing the apparatus to the normal position for winding.

In the embodiment illustrated, the complete change cycle occurs in about ten seconds and does not require any manual manipulation or handling of the strip of material or roll. As indicated previously, empty rolls can be inserted manually at the start of the cycle and full rolls can be removed manually at the end of the cycle if desired. It is sometimes desirable to provide a coating of adhesive, such as a strip of double-faced pressure-sensitive tape, on the empty rolls to aid engagement with the initial layer of the material being wound thereon. While not mandatory, the particular shape of the roll-receiving openings **111** in the roll support arms in preferred as it permits receiving, handling and discharge of the rolls automatically without risk of loss of rolls or misalignment or the like. It should be noted that the winding operation does not have to be conducted with the roll support mechanism oriented as shown in FIG. 1. The winding could be carried out while the mechanism is in the position of FIG. 10 or FIG. 13, if preferred.

Although an exemplary embodiment of the invention has been disclosed and discussed, it will be understood that other applications of the invention are possible and that the embodiments disclosed may be subjected to various changes, modifications and substitutions without necessarily departing from the spirit of the invention.

I claim as my invention:

1. In an apparatus for changing take-up rolls on a continuously running machine, the combination of: a frame; means for feeding a continuous strip of material past a pivot axis; first and second roll supports; mounting means for mounting said roll supports on said frame for rotation about said pivot axis; first means for reciprocating said first roll support along a path at right angles to said axis between extended and retracted positions; second means for reciprocating said second roll support along a path at right angles to said axis between extended and retracted positions; and a feed unit for storing empty rolls, said feed unit having a roll discharge opening, with each of said roll supports positionable at said discharge opening when in the extended position.

2. In an apparatus for changing take-up rolls on a continuously running machine, the combination of: a frame; means for feeding a continuous strip of material past a pivot axis; first and second roll supports; mounting means for mounting said roll supports on said frame; first means for reciprocating said first roll support along a path at right angles to said axis between extended and retracted positions; second means for reciprocating said second roll support along a path at right angles to said axis between extended and retracted positions; and a feed unit for storing empty rolls, said feed unit having a roll discharge opening, with each of said roll supports positionable at said discharge opening when in the extended position, said mounting means providing for rotation of said roll supports about said axis to move one roll support away from said feed unit and the other support toward said feed unit simultaneously.

3. In an apparatus for changing take-up rolls on a continuously running machine, the combination of: a frame; means for feeding a continuous strip of material past a pivot axis; first and second roll supports; mounting means for mounting said roll supports on said frame; first means for reciprocating said first roll support along a path at right angles to said axis between extended and retracted positions; second means for reciprocating said second roll support along a path at right angles to said axis between extended and retracted positions; a feed unit for storing empty rolls, said feed unit having a roll discharge opening; and discharge means defining a discharge path for loaded rolls, with each of said roll supports positionable at said discharge means when in the extended position to deposit a roll thereon, said mounting means providing for rotation of said roll supports about said axis to move one roll support away from said feed unit toward said discharge means and the other roll support toward said feed unit simultaneously.

4. In an apparatus for changing take-up rolls on a continuously running machine, the combination of: a frame; first and second roll supports; mounting means for mounting said roll supports on said frame for rotation about a pivot axis; a belt for travelling around said axis and carrying a continuous strip of material therewith; first means carried on said mounting means for reciprocating said first roll support along a path at right angles to said axis between extended and retracted positions; second means carried on said mounting means for reciprocating said second roll support along a path at right angles to said axis between extended and retracted positions; and a feed unit for storing empty rolls, said feed unit having a roll discharge opening, with each of said roll supports positionable at said discharge opening when in the extended position.

5. In an apparatus for changing take-up rolls on a continuously running machine, the combination of: a frame; a belt roller mounted in said frame for rotation about an axis; a belt moving over said roller for carrying a strip of material therewith; first and second roll supports; mounting means for mounting said roll supports on said frame for rotation about said axis; first means carried on said mounting means for reciprocating said first roll support toward and away from said axis between retracted and extended positions; second means carried on said mounting means for reciprocating said second roll support toward and away from said axis between retracted and extended positions; and a feed unit having a roll discharge opening for feeding empty rolls, with a roll support positionable at said discharge opening when in the extended position to receive an empty roll and positionable adjacent said axis when in the retracted position to engage the roll with the strip of material on the belt.

6. In an apparatus for changing take-up rolls on a continuously running machine, the combination of: a frame; a belt roller mounted in said frame for rotation about an axis; a belt moving over said roller for carrying a strip of material therewith; first and second roll supports; mounting means for mounting said roll supports on said frame for rotation about said axis; first means carried on said mounting means for reciprocating said first roll support toward and away from said axis between retracted and extended positions; second means carried on said mounting means for reciprocating said second roll support toward and away from said axis between retracted and extended positions, with said first and second means normally urging the respective roll supports to the retracted positions; a feed unit positioned above said axis and having a roll discharge opening for feeding empty rolls; and a roll discharge unit positioned below said axis for receiving a full roll from a roll support, with a roll support positionable at said discharge opening when in the extended position to receive an empty roll and positionable adjacent said axis when in the retracted position to engage the roll with the strip of material on the belt and, following rotation of said mount-

ing means, positionable at said discharge unit when in the extended position to discharge a full roll into said discharge unit.

7. In an apparatus for changing take-up rolls on a continuously running machine, the combination of: a frame; a belt roller mounted in said frame for rotation about an axis; a belt moving over said roller for carrying a strip of material therewith; first and second roll supports; mounting means for mounting said roll supports on said frame for rotation about said axis; first means carried on said mounting means for reciprocating said first roll support toward and away from said axis between retracted and extended positions; second means carried on said mounting means for reciprocating said second roll support toward and away from said axis between retracted and extended positions, with said first and second means normally urging the respective roll supports to the retracted positions; a feed unit positioned above said axis and having a roll discharge opening for feeding empty rolls; a roll discharge unit positioned below said axis for receiving a full roll from a roll support, with a roll support positionable at said discharge opening when in the extended position to receive an empty roll and positionable adjacent said axis when in the retracted position to engage the roll with the strip of material on the belt and, following rotation of said mounting means, positionable at said discharge unit when in the extended position to discharge a full roll into said discharge unit; and means for directing a stream of air along said belt toward said axis between said belt and a roll support extended toward said discharge unit.

8. In an apparatus for changing take-up rolls on a continuously running machine, the combination of: a frame; a belt roller mounted in said frame for rotation about an axis; a belt moving over said roller for carrying a strip of material therewith; first and second roll supports; mounting means for mounting said roll supports on said frame for rotation about said axis; a first piston carried on said mounting means for reciprocating said first roll support toward and away from said axis between retracted and extended positions; a second piston carried on said mounting means for reciprocating said second roll support toward and away from said axis between retracted and extended positions; a feed unit having a roll discharge opening for feeding empty rolls; means for rotating said mounting means to a first position with said first roll support above said axis and said second roll support below said axis; means for actuating said first piston to extend said first roll support to said discharge opening for receiving a roll and retract said first roll support to engage said roll with the strip of material carried bp said belt; and means for actuating said second piston to extend said second roll support to move the roll of material thereon out of engagement with said belt permitting a loop of material to form and wind on the empty roll engaging said belt.

9. In an apparatus for changing take-up rolls on a continuously running machine, the combination of: a frame; a belt roller mounted in said frame for rotation about an axis; a belt moving over said roller for carrying a strip of material therewith; first and second roll supports; mounting means for mounting said roll supports on said frame for rotation about said axis; a first piston carried on said mounting means for reciprocating said first roll support toward and away from said axis between retracted and extended positions; a second piston carried on said mounting means for reciprocating said second roll support toward and away from said axis between retracted and extended positions; a feed unit having a roll discharge opening for feeding empty rolls; means for rotating said mounting means to a first position with said first roll support above said axis and said second roll support below said axis; means for actuating said first piston to extend said first roll support to said discharge opening for receiving a roll and retract said first roll support to engage said roll with the strip of material carried by said belt; means for actuating said second piston to extend said second roll support to move the roll of material thereon out of engagement with said belt; and means for directing a stream of air between said belt and said roll of material to force said material into engagement with the empty roll.

10. In an apparatus for changing take-up rolls on a continuously running machine, the combination of: first support means for supporting a roll; second support means for supporting a roll; mounting means carrying said first and second support means for rotation about an axis; means for moving a strip of material toward said axis for winding on a roll; means for moving said first support means toward said axis when a roll thereon is empty; means for moving said second support means away from said axis when a roll thereon is full; means for wrapping a portion of the strip of material adjacent the full roll around the empty roll; and means for simultaneously rotating said first and second support means about said axis when said second support means is unloaded and continuously urging said first support means toward said axis during said rotation.

11. In an apparatus for changing take-up rolls on a continuously running machine, the combination of: a frame; a belt roller mounted in said frame for rotation about an axis; a belt moving over said roller for carrying a strip of material therewith; first and second roll supports; mounting means for mounting said roll supports on said frame for rotation about said axis; a first piston carried on said mounting means for reciprocating said first roll support toward and away from said axis between retracted and extended positions; a second piston carried on said mounting means for reciprocating said second roll support toward and away from said axis between retracted and extended positions; a feed unit having a roll discharge opening for feeding empty rolls; a roll discharge unit having a zone for receiving full rolls; means for rotating said mounting means to a first position with said first roll support above said axis and said second roll support below said axis; means for actuating said first piston to extend said first roll support to said discharge opening for receiving a roll and retract said first roll support to engage said roll with the strip of material carried by said belt; means for actuating said second piston to extend said second roll support to move the roll of material thereon out of engagement with said belt to said roll discharge zone; and means for directing a stream of air between said belt and said roll of material to force said material into engagement with the empty roll.

12. An apparatus as defined in claim 11 in which said feed unit includes: an inwardly directed roll storage zone terminating at its lower end in said roll discharge opening; an upwardly slidable gate closing said opening; and means carried on said gate for engaging a roll support when moving away from said axis toward the extended position to displace said gate from said discharge opening.

13. An apparatus as defined in claim 11 in which each of said roll supports includes parallel spaced arms having roll-receiving openings therein, each of said openings comprising a slot communicating with a pair of spaced opposing semicircles intermediate the semicircles.

14. An apparatus as defined in claim 11 including an empty roll in said feed unit, said empty roll having an adhesive on the surface thereof.

15. In an apparatus for changing take-up rolls on a continuously running machine, the combination of: a frame; a belt roller mounted in said frame for rotation about an axis; a belt moving over said roller for carrying a strip of material therewith; first and second roll supports; mounting means for mounting said roll supports on said frame for rotation about said axis; a first piston

carried on said mounting means for reciprocating said first roll support toward and away from said axis between retracted and extended positions; a second piston carried on said mounting means for reciprocating said second roll support toward and away from said axis between retracted and extended positions; means for rotating said mounting means to a first position with said first roll support above said axis and said second roll support below said axis; means for actuating said first piston to extend said first roll support for receiving a roll and retract said first roll support to engage said roll with the strip of material carried by said belt; and means

for actuating said second piston to extend said second roll support to move the roll of material thereon out of engagement with said belt permitting a loop of material to form and wind on the empty roll engaging said belt.

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