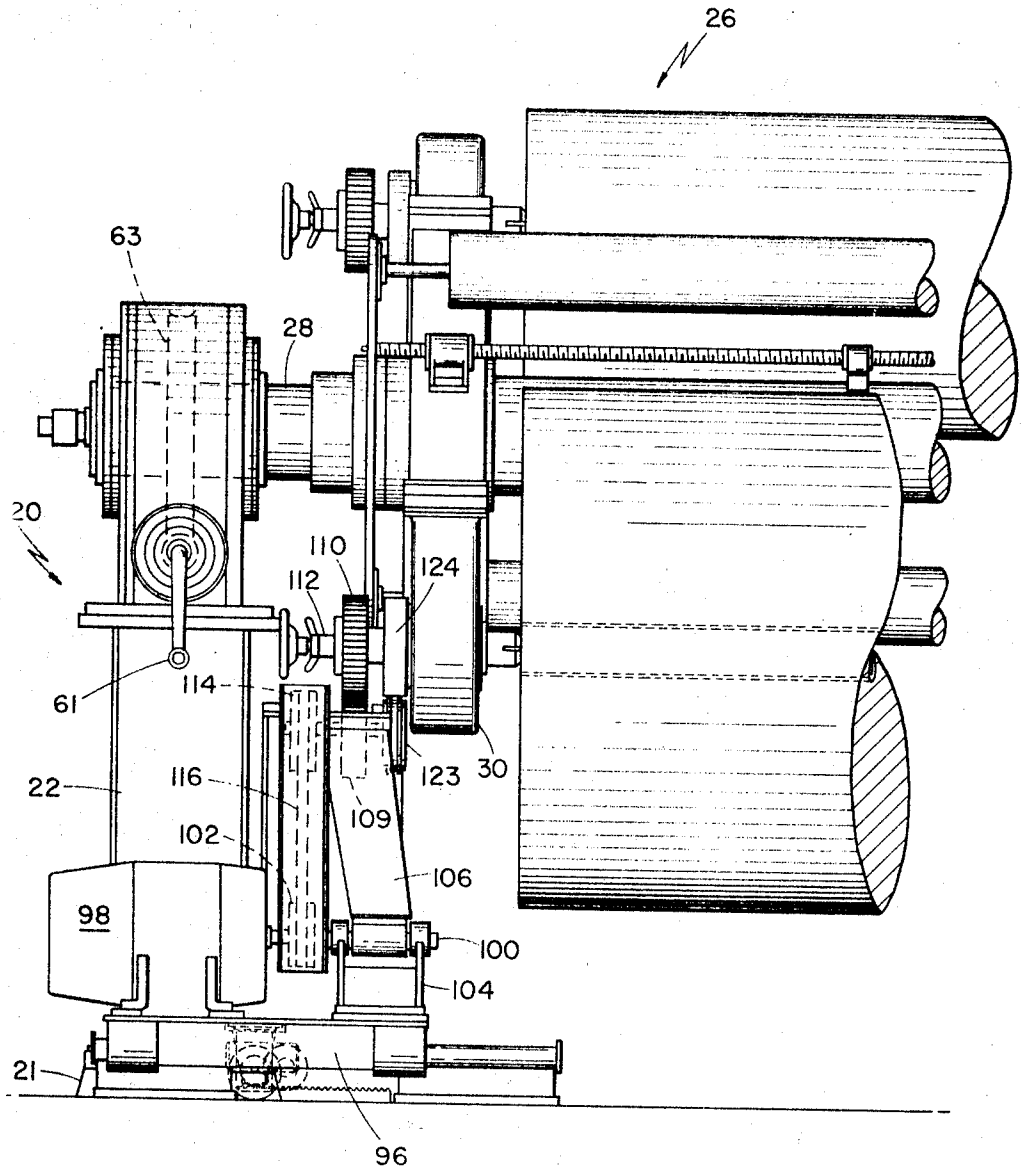
Aug. 12, 1969 F. P. FORD ETAL 3,460,775

TURRET UNWINDER

Filed March 13, 1967 4 Sheets-Sheet 1

FIG 1



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TURRET UNWINDER

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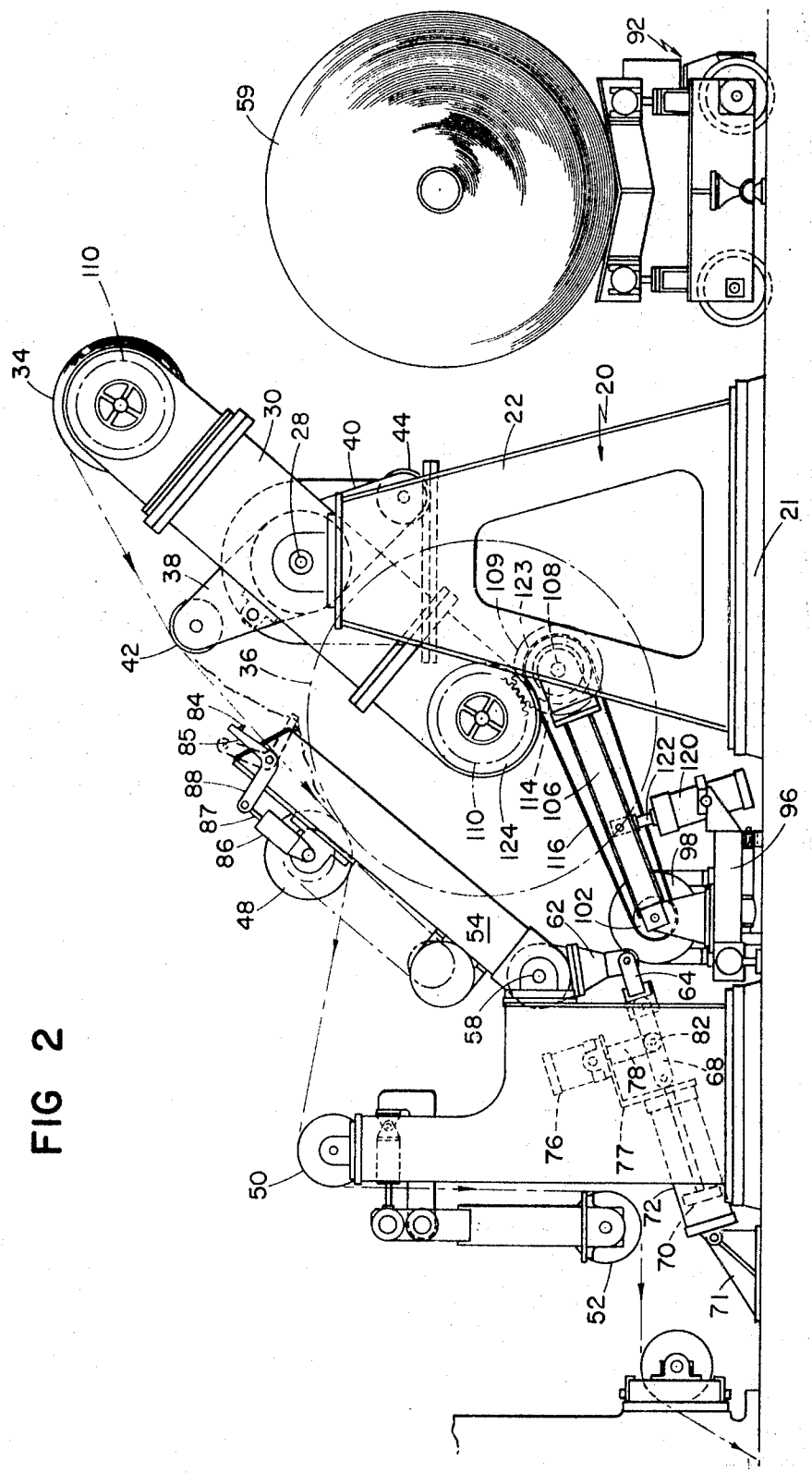

FIG 2

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TURRET UNWINDER

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FIG 3

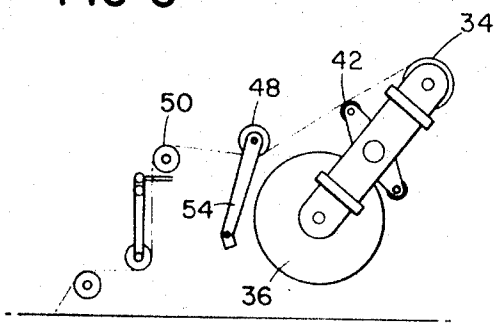

FIG 4

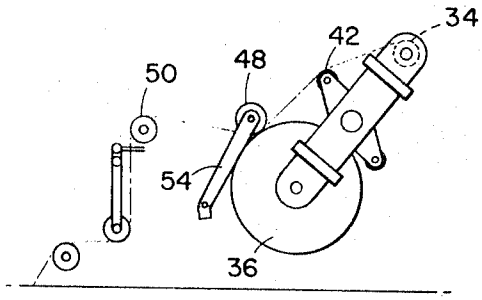

FIG 5

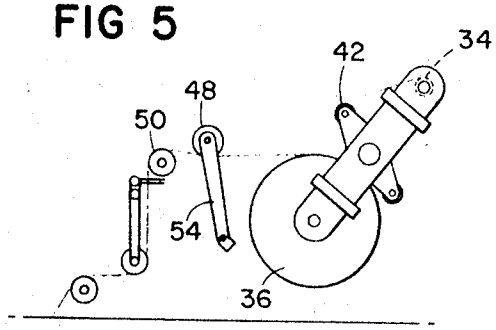

FIG 6

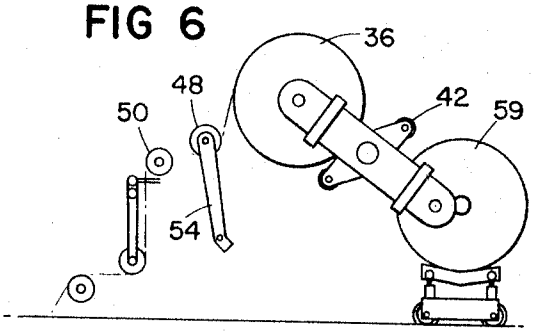

FIG 7

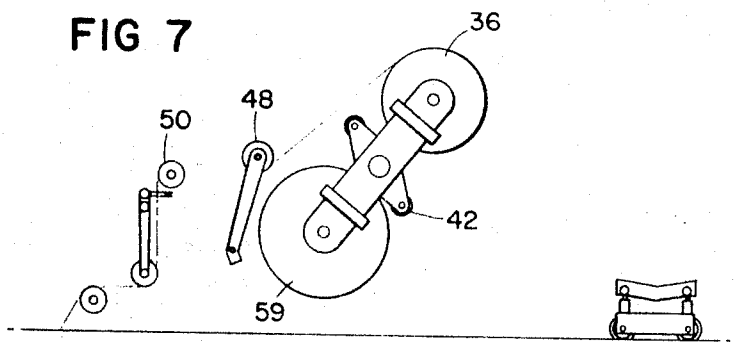

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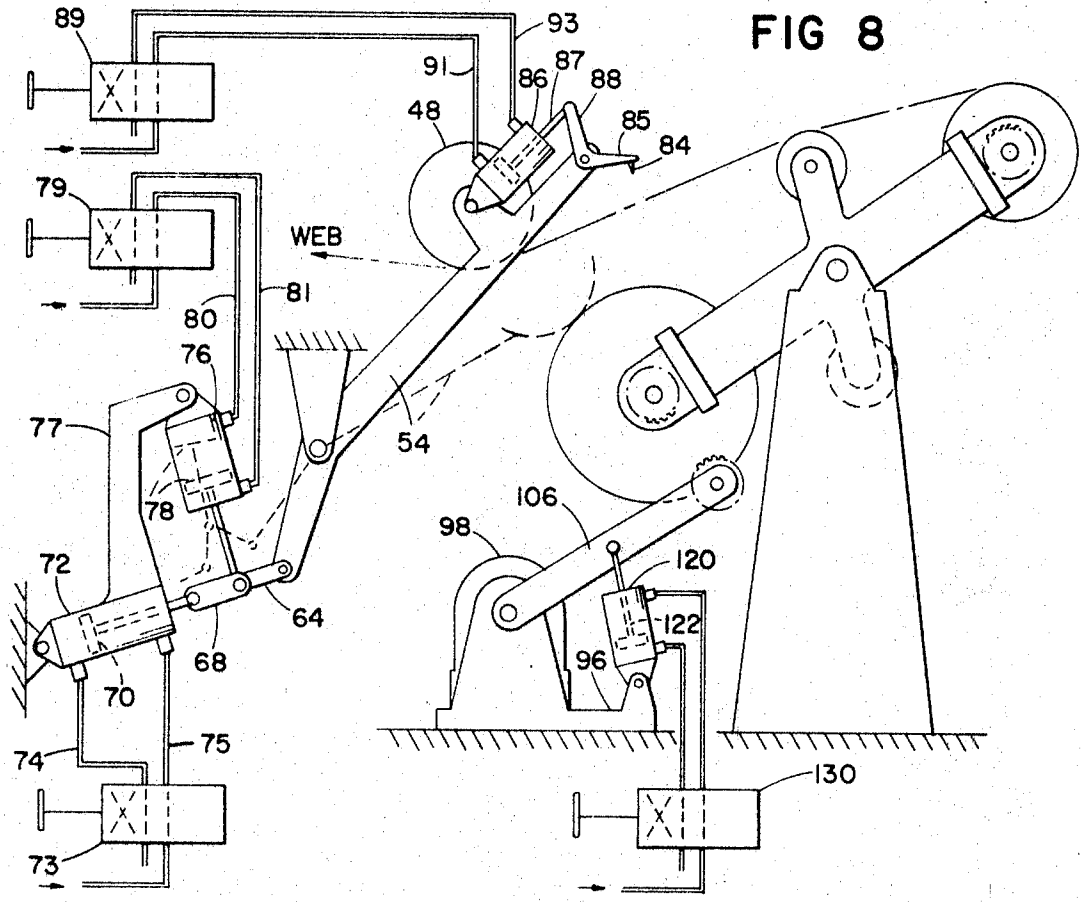
FIG 8



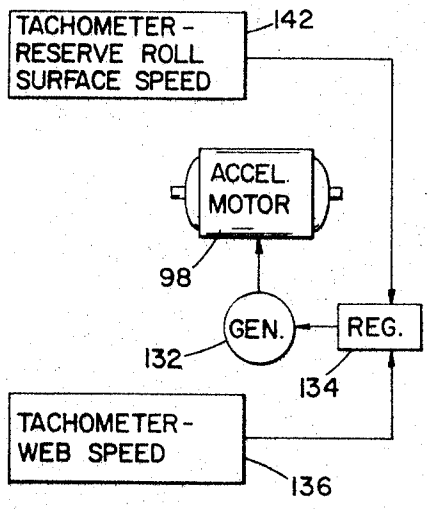


FIG 9

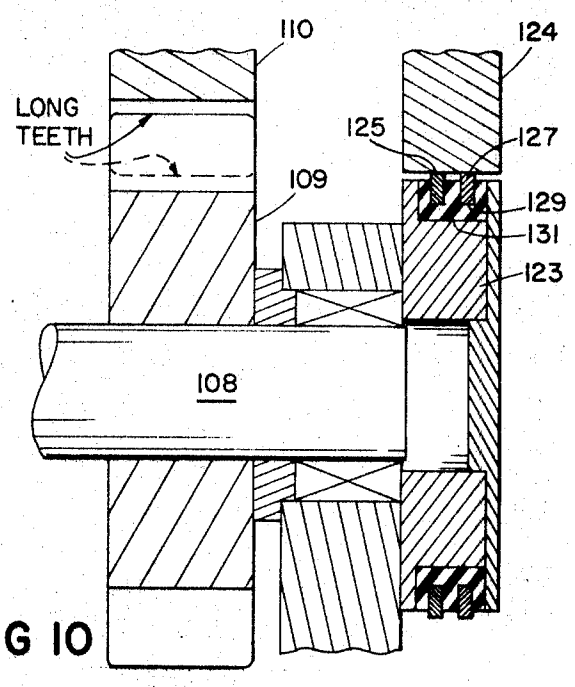


FIG 10

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TURRET UNWINDER

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U.S. Cl. 242—58.3 6 Claims

ABSTRACT OF THE DISCLOSURE

A turret unwinder having: a reel rotatable about an axis providing support for two rolls in unwinding and reserve locations, means for drawing a web from the roll at the unwinding location past the roll at the reserve location, means rotating the reel in a direction opposite to the roll draw-off direction for moving a roll from the reserve location to the unwind location and thence to an intermediate roll replenishing location, a paste roll normally located in an operative position adjacent the reserve roll location and movable to engage the travelling web against the reserve roll for pasting, and to an alternative inoperative position beyond the orbital path of the web rolls, and means operable prior to exhaustion of a web roll at the roll unwind location for moving the paste roll and engaged traveling web against the reserve web roll, thereafter for retracting said paste roll to the alternate inoperative position for movement of the reel to the intermediate replenishing location, and thereafter to the operative position adjacent the reserve roll location.

The present invention relates to an improved apparatus for splicing a web of sheet material in roll form to a moving web, and more particularly to an improved reel unwinder in which mechanism is provided for splicing a new reel to a nearly depleted roll without interrupting the high speed operation of the web feed.

A principal object of the invention is to provide a novel and improved web splicing device of this general description which will operate dependably at high web feed rates indicated which may approximate 2000 or even 3000 linear feet per minute.

More specifically it is an object of the invention to provide a novel web splicing device having a reel movable between web feed roll positions to bring successively loaded rolls of material into operating position and to intermediate web roll loading positions, and a pasting device for attaching the new roll to the end of a previously depleted roll, which includes a paste roll adapted to be moved between a normal running position, and to a withdrawn inoperative position during movement of the reel to the loading position, and to a fully advanced operative position for the pasting of a replacement roll to the remnant of a depleted roll.

It is a further object of the invention to provide an improved construction and arrangement of the mechanism for accelerating the newly substituted roll in the reel to a peripheral speed which is approximately equal to the linear rate of movement of the depleted roll so that the pasting operation may be carried out without risk of failure.

With the above and other objects in view as may hereinafter appear, the several features of the invention and advantages gained thereby will be readily apparent to one skilled in the art from the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a partial view in side elevation of a turret unwinder adapted for splicing a substitute web roll to the web remnant of a depleted web roll in the turret unwinder;

FIG. 2 is an end view of the turret unwinder shown in FIG. 1 illustrating particularly the reel, a dolly, and a substitute web roll mounted thereon, the paste mechanism for connecting the leading end of a substitute web roll to a last portion of the web feeding from a substantially depleted web roll, and an accelerating drive for bringing the substitute roll up to speed prior to the pasting operation; and

FIGS. 3 to 7 inclusive are a series of somewhat diagrammatic views showing successive positions of the reel and paste mechanism, of which;

FIG. 3 illustrates the turret unwinder in the normal running position including a partially depleted feeding web roll, and with the paste roll in a normal running position;

FIG. 4 illustrates a first step of the pasting operation in which the paste roll has been moved to engage the remnant of the web from the substantially depleted web roll with the replacement web roll;

FIG. 5 illustrates a next step in which the web remnant from the depleted web roll has been severed, and the paste roll has been moved to its inoperative position;

FIG. 6 illustrates a next step in which the reel has been rotated clockwise to the loading position;

FIG. 7 illustrates a final step in which the reel has been rotated through the full 180° to the alternate running position and in which the paste roll has been returned from its inoperative to its normal running position;

FIG. 8 is a somewhat diagrammatic view showing one arrangement of the operating controls for the turret unwinder;

FIG. 9 is a diagram of the electrical operating connections for the accelerating motor; and

FIG. 10 is a fragmentary view of the accelerating drive pinions and circular cams.

Referring more particularly to the drawings a reel unwinder is shown which comprises a frame **20**, comprising a base **21** and a pair of uprights **22** (only one of which is shown) which provide bearing support for a reel **26**, consisting of a central shaft **28** rotatably mounted on the uprights **22** and having secured thereto a pair of cross arms **30** (only one of which is shown), which provide support for two web rolls **34** and **36**. The web reel assembly further includes two pairs of shorter cross arms **38** and **40** disposed from the shaft **28** at nearly right angles to and at opposite sides of the plane of the cross arms **30**. The two pairs of shorter cross arms **38** and **40** are secured in fixed relation to the central shaft **28**, and provide support for fly rolls **42** and **44** which are thus disposed at opposite sides of the cross arms **30** between the locations of the two web rolls carried on said cross arms **30**. The fabric web being unwound from the active roll mounted on the upwardly extending portions of web roll support arms **30**, for example, passes over the adjacent fly roll **42** past the paste roll **48**, and thence, away from the turret unwinder around two idler rolls **50** and **52**.

The paste roll **48**, mounted on parallel arms, of which one arm **54** is illustrated to turn on parallel pivots **58** at opposite sides of the travelling web, is shown in FIG. 2 in the normal running position, lightly engaged with a portion of the feeding web between the fly roll **42** and idler roll **50**. As the amount of web material on the upwardly disposed web roll **34** approaches depletion the paste arms **54** and paste roll **48** are dipped to engage the trailing end portion of the web on the depleted roll **34** with the leading end of the web **58** on the replacement roll **36**, FIG. 4. After the pasting operation is completed including the severing of the web feeding from the depleted roll **34**, the paste roll **48** is swung on its supporting arms **54** backwardly to the inoperative position of FIG. 5 as the reel is rotated clockwise to the loading position of FIG. 6. The paste roll **48** is thereafter returned to the running position of FIG. 7 in which the web roll **36** is being unwound and

the replacement web roll 59 is brought to the replacement position of FIG. 7. The reel 26 can be rotated clockwise from the running position of FIG. 3 to the loading position of FIG. 6, and thereafter to the alternate running position of FIG. 7 by any convenient means which may, for example, comprise a hand crank 61, a worm, and a worm wheel 63 secured to one end of the central shaft 28 of the reel 26.

The construction and arrangement of the web splicing apparatus so far described has the specific advantage that the lead of the web around the paste roll 48 is reduced to a minimum. The web is not subjected to severe reverse bends immediately following the area in which the paste or splice is made. This insures that the splice is made under optimum conditions and that the spliced joint is subjected to minimum tensile and centrifugal stresses immediately after pasting. Further, the movement of the paste roll 48 away from the newly activated web roll immediately after the paste is made as shown in FIG. 5 permits the turret to be rotated immediately to the reload position of FIG. 6, thus providing more time for unloading the depleted roll 34 and the loading of a replacement roll 59, a matter of considerable importance in high speed unwinders.

The construction, arrangement and operation of the paste connection forming and web remnant severing mechanism of the machine will now be described somewhat more in detail as follows:

The two paste lever arms 54 are secured to a paste roll shaft 58 which extends across the width of the apparatus. A downwardly extending paste roll actuating lever 62 secured to the shaft 58 is connected by a link 64 forming one arm of a toggle and a link 68 forming the other arm of the toggle to a piston rod and piston 70 of an air operated cylinder 72 secured at its rear end to a floor bracket 71. Movement of piston 70 from the retracted position shown to an extended position with relation to the cylinder 72 causes the paste roll 48 to be moved to the retracted position, FIGS. 5 and 6 in which a replacement web roll, for example, web roll 36 is moved from the reserve position, FIG. 5, to the intermediate position, FIG. 6, in which a replacement web roll 59 is loaded in place of depleted roll 34, and finally, to the running position, FIG. 7. This movement may be effected, for example, by means of a manually operated four-way valve 73 which channels a pressure fluid alternatively through a conduit 74 to the leading face of the piston 70 as shown in FIG. 8, or alternatively to the rear face of the piston 70 through a conduit 75 to retract the piston as above outlined.

The paste roll 48 and paste roll actuating lever 62 are further advanced to the paste position of FIG. 4 by the action of pressure cylinder 76 pivotally mounted on a bracket 77. The piston 78 associated with the pressure cylinder 76 is connected to an intermediate portion of the toggle link 68, and acts when retracted to break the toggle connection 64, 68, so that the paste roll 48 and paste roll actuating lever 62 are advanced to the extreme paste forming and web severing position of FIG. 4. The above noted operation of the piston 78 of pressure cylinder 76 is effected, for example, by means of a manually operated four-way valve 79. A fluid pressure is directed to the upper end of the piston 78 through conduit 80 to maintain the toggle links 64, 68 in their straightened position. When the valve 79 is moved to its reverse position pressure fluid is directed through conduit 81 to the lower end of cylinder 76 and piston 78 so that the toggle joint 64, 68 is broken, and the paste roll 48 and paste roll actuating lever 62 are moved to the extreme paste forming position of FIG. 4.

In accordance with the usual practice the illustrated apparatus is provided with a cutter which is operative to sever the remnant of material which may be left on the depleted web roll, for example, roll 34. The cutter comprises a blade 84 carried on a cross rod 85 extending the width of the machine and rotatably supported at the ends thereof on the paste lever arms 54. At the completion of the paste operation, and before the paste roll is moved away from the reel to the inoperative position of FIGS. 5 and 6, the cross rod 85 and knife blade 84 are rotated an approximate 90° clockwise from the solid to the dotted line position of FIG. 8, thereby severing the web being fed from the depleted web roll 34. The operation of the cross rod 85 and knife blade 84 is controlled by means of a pressure cylinder 86, FIG. 8, mounted on one of the paste lever arms 54. A piston and piston rod 87 provided therewith is connected with an actuating lever arm 88 secured to the cross rod 85. Fluid pressure is supplied to the pressure cylinder 86 by means of a manually operated four-way valve 89. For the position shown, FIG. 8, pressure fluid is supplied through conduit 91 to the head end of the cylinder 86 causing the knife blade 84 to be advanced and to move across the plane of the web severing same. When the position of the valve 89 is reversed, pressure fluid is supplied through conduit 93 and the piston and piston rod 87 are retracted.

Following the operations of pasting a new web to the old, and of severing the old web, the reel 26 is rotated clockwise to the roll replenishing position of FIG. 6 in which the depleted roll 34 is removed and a new web roll 59 supported on a dolly 92 is mounted in place of the depleted roll 34 on the cross arms 30.

A feature of the invention consists in the provision of an improved accelerating mechanism for driving the replacement web roll 36 in such a manner that it is accelerated to approximately the same surface speed as the travelling web being unwound from the active web roll 34 prior to the paste operation.

The accelerating drive mechanism referred to comprises a base element 96 having mounted thereon a D.C. accelerating motor 98. A belt pulley is mounted on the output shaft of motor 98. Separated from, but in axial alignment with, the output shaft of motor 98, a shaft 100 is supported in a bifurcated bracket 104, and serves as a pivot for an accelerating arm 106. A cross shaft 108, FIG. 2, mounted on the outer end of the accelerating arm 106 carries a pinion 109, FIG. 10, which is arranged to be meshed with a pinion 110 secured to a chuck 112, FIG. 1, provided in the reel arm 30 at one side of the machine to drive the web roll supported thereby. A pulley 114 also mounted on shaft 108 is connected by a belt 116 with the pulley 102, FIG. 2. The accelerating arm 106 is moved upwardly to engage the pinions 109 and 110 so that the accelerating motor 98 will be connected to accelerate the replacement web roll by means of a pressure cylinder 120 pivotally mounted on the base element 96 having a piston 122 connected at its outer end to the accelerating arm 106.

In the engaged position of pinions 109, 110, a circular cam 123 mounted coaxially with pinion 109 on the accelerating arm 106, engages a circular cam 124 mounted coaxially with the pinion 110 and chuck 112 to ensure the correct engagement of these pinions. As particularly brought out in the fragmentary disclosure of FIG. 10, the pinions 109 and 110 are formed with long tapered teeth to cause these pinions to be brought certainly, accurately into mesh when the accelerating driving arm 106 is raised to engage the pinion 110. Cams 123 and 124 prevent the long teeth of pinion 109 and 110 from engaging too deeply and perhaps jamming or injuring the teeth. Cam 123 has a pair of annular brass contact rings 125, 127 supported by annnular rubber mounting 129 in an annular channel 131. Rings 125, 127 project a slight distance above the surface of rubber mounting 129 such that, when cams 123, 124 are in contact, an electrical path is established from ring 125 through cam 124 to ring 127. Rings 125, 127 are connected to an appropriate control circuit which permits operation of the accelerating motor 98 only when cams 123, 124 are in contact thus insuring proper mesh of pinions 109, 110.

The operation of the turret unwinder to position and secure a replacement web roll on the arms 30, and, thereafter, to effect a paste operation which will substitute the web from the replacement roll for the remnant feeding

from the depleted roll, will be briefly described as follows:

It will be assumed that a replacement web roll **36** has been mounted on the arms **30** and that the turret has been moved to its normal operating position as shown in FIG. 3. The paste roll **48** is now brought to its operative position by a withdrawal movement of the piston **70** into its associated cylinder **72**. This is the position of FIGS. 3 and 7. When the web roll **34** becomes substantially depleted accelerating arm **106** is moved upwardly from the normally inoperative depressed position, so that pinion **109** is meshed with pinion **110** connecting the replacement roll **36** to be driven by the accelerating motor **98**. This operation may be carried out with the assistance of a manually-operated four-way valve **130**, FIG. 8, having alternative on and off positions for supplying fluid pressure to and for discharging fluid from the accelerating arm actuating cylinder **120**.

The operating circuit for the accelerating motor **98**, FIG. 9, includes generator **132**, regulator **134**, tachometer **136** which provides a voltage signal representative of the speed of the web, and tachometer **142** which provides a voltage signal representative of the surface speed of the reserve roll. When the circuit of FIG. 9 is activated, tachometer **136** is providing an input to regulator **134** representative of the speed of the web, while tachometer **142** is providing a signal representative of the surface speed of the reserve roll which is substantially lower than the web. The regulator provides signal which is a function of the difference of these signals to generator **132** which provides relatively more power to accelerator motor **98** when the reserve roll surface speed is less than web speed, relatively less power when the reserve roll surface speed is more than web speed, and leaves the power input to motor **98** unchanged when the two speeds are the same

The pressure cylinder **76** is now actuated, moving piston **78** to break the toggle arms **64** and **68** causing the paste roll **48** to be moved inwardly or downwardly to effect the pasting operation. The knife **84** is actuated to sever the remnant of the web feeding from the depleted web roll **34**. The piston **78** of pressure cylinder **76** is now returned to its initial position straightening the toggle links **64**, **68**, and piston **70** of cylinder **72** is moved to its extended position so that the paste roll **48** is moved to its fully retracted out of the way position, FIG. 5. The reel is next rotated clockwise to the position of FIG. 6 and a new web roll **59** is installed between arms **30**. Finally, the reel is further rotated to the position of FIG. 7, and the paste roll is returned to its advanced position by a withdrawal movement of piston **70** into its cylinder **72**, this being the position shown in FIGS. 2 and 7.

It will be understood that, while the several operations are herein described as effected by means of manually operated devices including the hand crank **61** for turning the reel to successive operating and loading positions, and the several pressure cylinders referred to which control the operation of the paste arms **54**, the web cutter **84**, and the D.C. accelerating motor **98**, these operations may be carried out by other means, and, if so desired, may be performed automatically in the desired sequence by any suitable programming means, not here shown.

A preferred embodiment of the invention in a turret unwinder having been described what is claimed is:

1. A turret unwinder having: a reel rotatable about an axis providing support for two rolls in unwinding and reserve locations, respectively, means for drawing web from the roll at said unwinding location past the roll at said reserve location, means rotating said reel in a direction opposite to said roll draw-off direction for moving a roll from the reserve location to the unwind location and thence to an intermediate roll replenishing location, a paste roll normally located in an operative position adjacent said reserve roll location and movable to engage the traveling web against the reserve roll for pasting, and to an alternative inoperative position beyond the orbital path of said web rolls, and mechanism for moving said paste roll which comprises a pair of pivoted paste roll arms, a pressure cylinder and connections to move said paste roll arms between an operative position and a retracted position beyond the orbital path of said web rolls, a toggle joint in said connections, and a pressure cylinder for controlling said toggle joint to move said paste roll between said operative and paste positions.

2. A turret unwinder having a reel rotatable about an axis providing support for two rolls including an unwinding roll in an unwinding location in an upper quadrant of the reel and a reserve roll in a reserve and splicing location in an opposite low quadrant of said reel, means for drawing-off web from said unwinding roll along a line passing over the reserve roll, means rotating said reel in a direction opposite to said roll draw-off direction to move an exhausted roll orbitally to a roll replenishing location intermediate the unwinding location and the reserve and splicing location, and simultaneously to move the reserve roll orbitally to said unwind location, a paste roll disposed normally over and in a position to impose a bend on the web passing over the reserve roll, means moving the paste roll to engage the unwinding web in pasting engagement with the reserve roll, and means for moving the paste roll substantially along said web draw-off line beyond the orbital path of the reserve roll to the unwinding location, and thereafter for returning said paste roll to the normally disposed position.

3. The combination of claim **2** further comprising an idler roll for receiving said web after it passes from said unwinding roll over said reserve roll and partially around said paste roll, said rolls including said idler roll, paste roll, reserve roll and unwinding roll being arranged to position the path of said web between said idler roll and said paste roll at an obtuse angle to the path of said web between said paste roll and unwinding roll for minimizing stress and bending of said web.

4. In a turret unwinder having a reel rotating about an axis with two rolls located in unwinding and reserve locations, respectively, and means for drawing web from the roll at said unwinding location past said reserve roll, the combination of apparatus for splicing a web from the roll at said reserve location to the web unwinding from the roll at said unwinding location, which comprises an accelerating drive mechanism for accelerating the roll at the reserve location to a peripheral speed approximating that of the unwinding web, which includes a pinion on said reel coaxial with and connected to turn with the roll at the reserve location, a driving pinion, a swinging arm on which said driving pinion is mounted movable to engage and disengage said driving pinion from the first mentioned pinion, an accelerating motor, and means between said motor and driving pinion for driving the first mentioned pinion, and means for moving said swinging arm to engage and to disengage said pinions.

5. The combination of claim **4** in which the pinions are formed with long tapered teeth to facilitate the proper engagement of the pinions with one another.

6. The combination of claim **4** in which a pair of cams are provided, one co-axially mounted with each of said pinions, for engagement with one another to ensure the correct engaging position of said pinions.

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