

Dec. 25, 1956

A. W. POMPER
WEB ROLL REPLENISHER

2,775,409

Filed Feb. 10, 1953

3 Sheets-Sheet 1

FIG. 1.

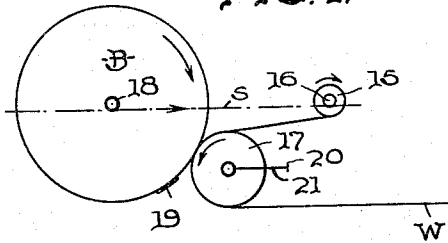


FIG. 2.

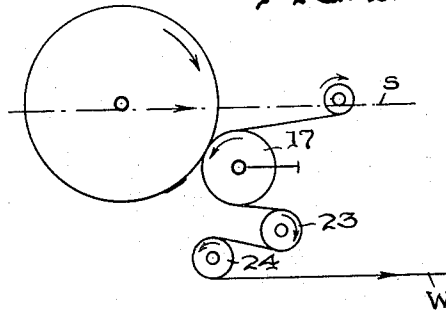


FIG. 3.

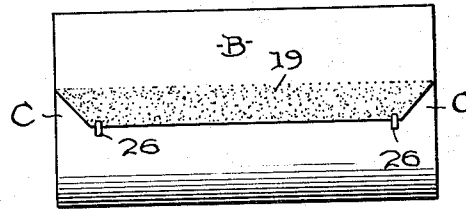
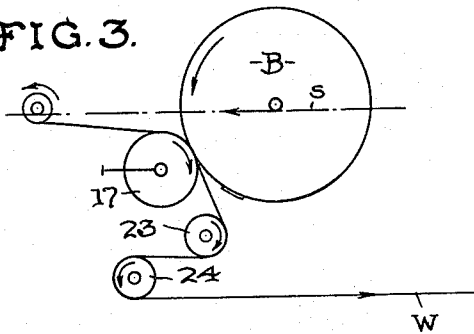


FIG. 4.

FIG. 5.

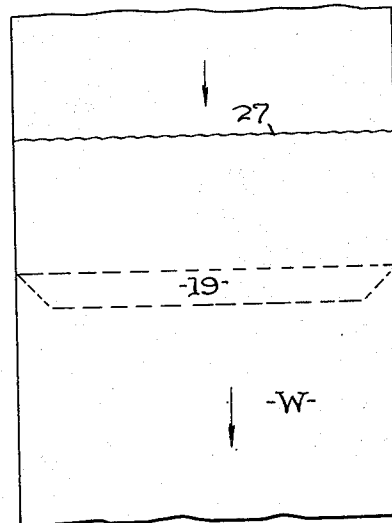
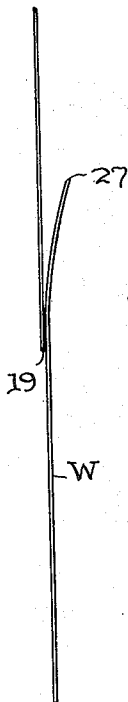


FIG. 6.



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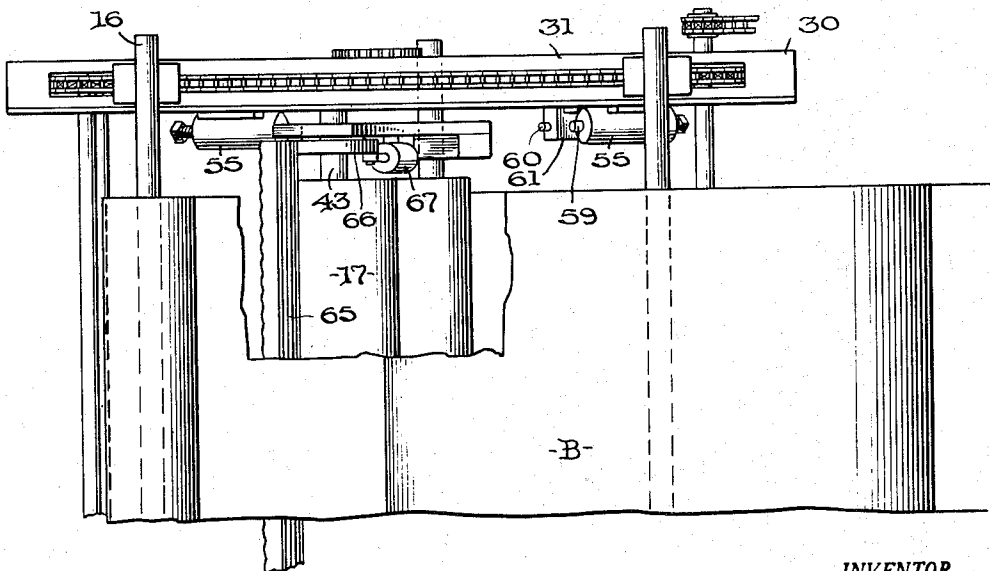
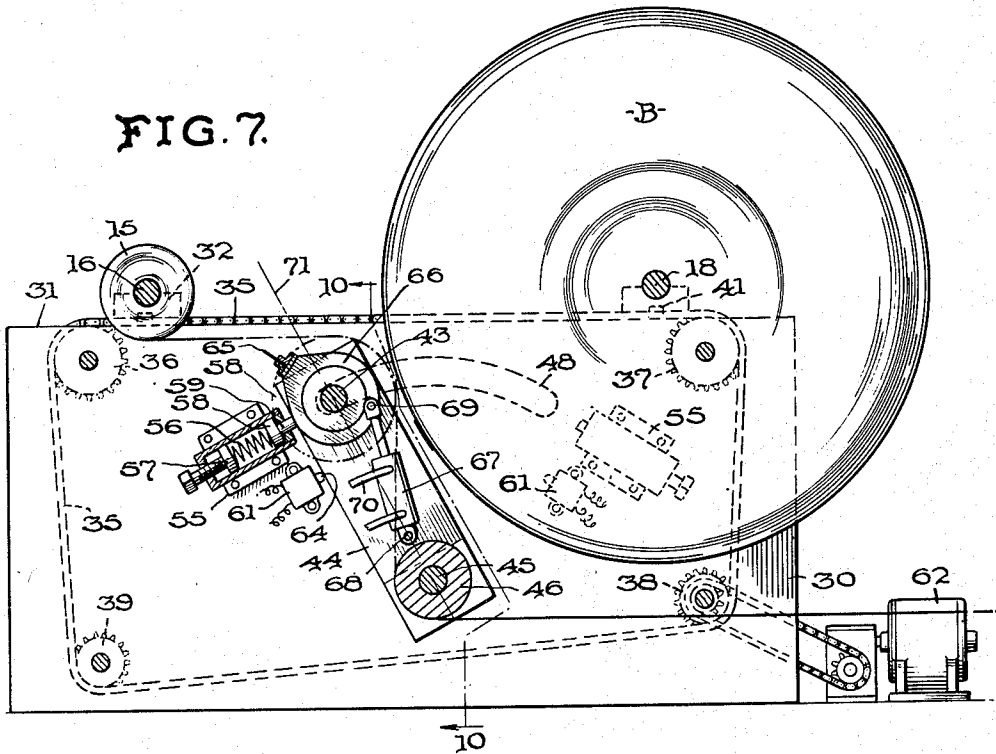


FIG. 8.

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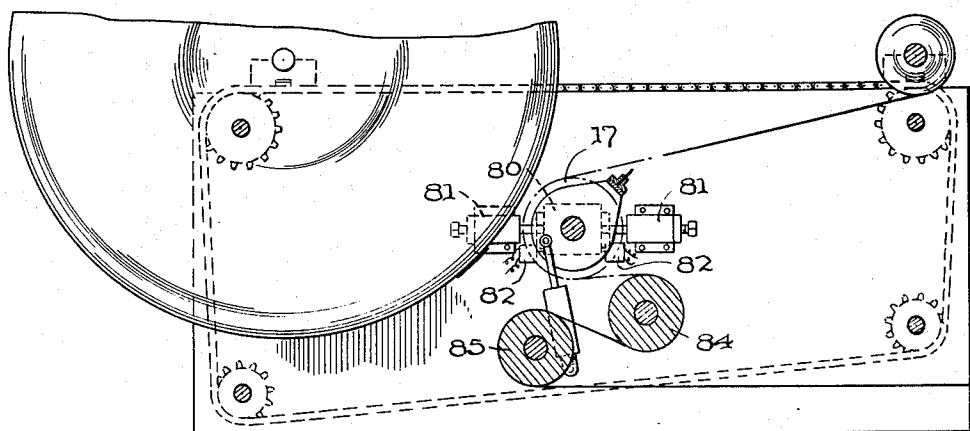
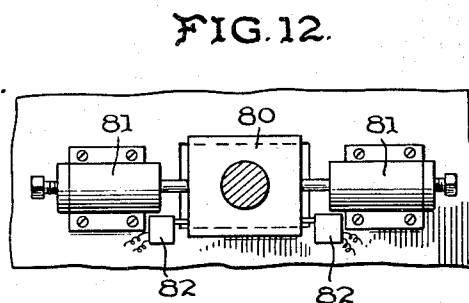
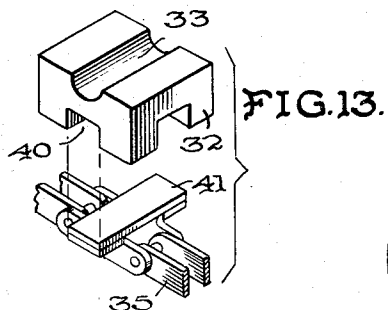
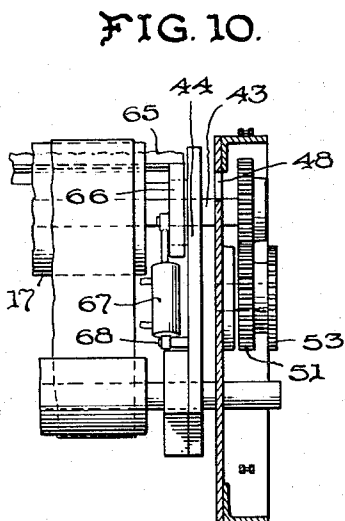
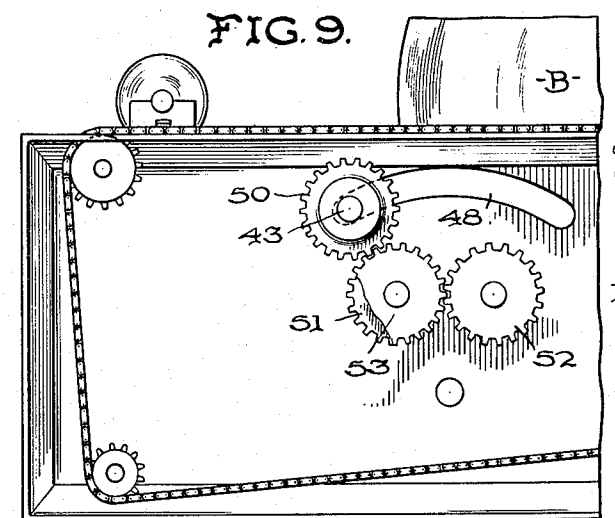
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3 Sheets-Sheet 3



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WEB ROLL REPLENISHER

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Application February 10, 1953, Serial No. 336,035

17 Claims. (Cl. 242—58)

The invention relates to web roll replenishing apparatus and methods and more particularly to apparatus and methods for effecting more simply what is sometimes known as "flying pasting," whereby the leading end of a replenishing bundle or roll of web material is pasted to the web traveling to converting machinery from an expiring roll without stopping its movement.

It is a general object of the present invention to provide novel and improved methods and apparatus for web roll replenishing.

More particularly it is an object of the present invention to provide methods and apparatus for web roll replenishing wherein the new roll is brought up to web speed in one revolution of the roll by direct contact with the web alone.

It is an important object of the invention to provide a web roll replenisher and method whereby splices may be effected with the web unwinding either with the outside or the inside up.

Another important object of the invention comprises the method and means for effecting a flying splice whereby the new bundle is motor advanced into contact with the web where it passes over a splice roll forcing the latter to move a short distance against preloaded springs for effecting suitable contact pressure for speeding the new bundle, together with means actuated by movement of the splice roll to stop the motor.

Essential and significant features of the invention include:

Use of continuous strips of adhesive throughout the width of the web.

Use of preloaded springs to obtain suitable contact pressure to accelerate the new bundle in one revolution.

Provision of higher coefficient of friction between traveling web and driven splice roll than between web and new bundle.

Use of same cut-off knife on two sides of splice roll. Automatic reversal of direction of drive of splice roll when opposite unwind is effected.

Other and further objects and features of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawings and following specification wherein are disclosed several exemplary embodiments of the invention with the understanding that such modifications may be made therein as fall within the scope of the appended claims without departing from the spirit of the invention.

In said drawings:

Fig. 1 is a schematic and diagrammatic showing of the fundamental elements for a machine constructed to carry out the present invention;

Fig. 2 is similar to Fig. 1 but showing a two way or either side up type of machine set for unwinding "outside up";

Fig. 3 is the machine of Fig. 2 set for unwinding "inside up";

Fig. 4 shows a side elevation of a new roll or bundle prepared for splicing;

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Fig. 5 shows in plan a section of web containing a completed splice;

Fig. 6 is an edge view of the splice;

Fig. 7 is a longitudinal vertical section of a preferred embodiment of a machine constructed in accordance with the present invention taken just inside one of the side frames and looking toward the other;

Fig. 8 is a plan view of one side of the machine, shown like Fig. 7, set for unwinding "inside up";

Fig. 9 is a fragmentary side elevation of the machine of Fig. 7 showing the splicing roll driving and direction reversing mechanism;

Fig. 10 is a transverse section taken through broken line 10—10 of Fig. 7 of one side of the machine;

Fig. 11 is a view similar to Fig. 7 but showing a simplified embodiment of the machine;

Fig. 12 is a view on an enlarged scale of the splicing roll bearing block mounting and restraining devices; and

Fig. 13 is an exploded perspective detail of a bundle bearing block and cooperating drive chain lug.

Web material such as paper, plastic, fabric and the like, is usually delivered from a large roll or "bundle" to converting apparatus such as printing machinery, coating devices, embossing or laminating equipment and the like, in a continuous manner. The threading of the web through the conversion machinery is often intricate and time consuming, and it is highly desirable that the web be fed continuously without requiring either the stopping of the machine or machines or their rethreading when a new bundle is to replace an expiring one.

Various forms of apparatus have been proposed for attaching the leading edge of the web from a new bundle to the traveling web from the expiring roll and then cutting the expiring web so that only a short section of overlapped material passes through the machinery. Particularly with high speed apparatus this operation is fraught with some difficulties, primary among which may be mentioned the need for accelerating the new bundle or roll up to the peripheral speed of the web traveling to the conversion machinery. This has required complex apparatus including variable speed mechanism, governors and roll driving devices. In many cases this includes tapes or belts surrounding the new bundle, or friction rollers engaging its surface at several spots throughout its length.

The bundles are heavy, in many cases weighing up to a ton or more, and care must be exercised in bringing them up to a speed to prevent tearing or breaking of the material, which is often quite fragile. The actual attachment of the leading edge of the traveling web is commonly effected by a coating of adhesive, usually of pressure sensitive type, applied to the outer surface of the leading edge of the new bundle for attachment when the two are brought into contact. The various driving means requiring contact with the surface of the new bundle for bringing it up to speed necessitate gaps in the adhesive where they operate, thus making the application of the material difficult and time consuming and providing a discontinuous attachment of the two webs.

In the various known forms of bundle accelerating devices a number of bundle revolutions are required to achieve the necessary peripheral speed and therefore some synchronizing or timing means must be provided to bring the new bundle into contact with the traveling web in the proper phase in respect to the adhesive thereon.

In accordance with the present invention roll driving means of any type whatsoever are completely eliminated, as are governors, synchronizers and the like, and the peripheral speed of the new bundle is brought up to that of the web by direct contact therewith and in less than one full rotation of the new bundle. This is achieved by having the web pass over a "splicing" roll, which is preferably rubber covered and mechanically driven at

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the same speed as the web. The surface of the driven roll is always such that the coefficient of friction between the web and this driven or splicing roll is greater than the coefficient of friction between the web and the surface of the new bundle pressed against it. This prevents slippage between the web and the driven roll, eliminating strain in the unsupported web following the driven roll so that no breakage results. The bundle has the outer face adjacent its leading edge continuously coated with a strip of adhesive and secured down by several narrow readily breakable tapes. Contact is made between the new bundle and the splicing roll closely adjacent to the strip of adhesive and the new bundle is brought up to speed in just less than one rotation, obviating the need for synchronizing means. As soon as the adhesive engages the web on the splicing roll the new web is connected to the old and in the usual manner a cutting knife severs the old web.

Referring now to the drawings, and particularly to Fig. 1, for a diagrammatic illustration of apparatus capable of carrying out the new method, there is disclosed at 15 the expiring roll of web material mounted on a spindle 16 supported in bearings slidable on surface S, from which it is drawn by the driven splicing roll 17 rotating in the direction indicated. The web passes about this roll to the extent of approximately 180° of its circumference and is fed off to the right as shown at W to converting machinery driven at the same web speed as the roll 17.

The new bundle of web material B is shown supported on a spindle 18 whose bearings are slidable on surface S, and having a coating 19 of pressure sensitive adhesive material along the outer face adjacent its end. When the operator sees that the expiring roll 15 is substantially finished, he moves the bearings supporting the spindle 18 of the bundle B to the right until the bundle is brought tightly into engagement with the splicing roll 17 as shown, first ascertaining that the adhesive 19 is just below the line of contact. The bundle B is rapidly accelerated because of the high pressure between the two surfaces and by the time the adhesive 19 has made substantially 360° of rotation the bundle peripheral speed is equal to that of the web and contact is effected between the adhesive and traveling web whereby the new web is drawn off adherent to the old one. The serrated knife 20 operating on arms 21 pivoted to the spindle of the splicing roll is now rotated counterclockwise to sever the old web. The bundle B may be backed off slightly so that the unwinding results solely from the tension of the web, if desired, and the old bundle 15 and its spindle removed. As soon as the new bundle is sufficiently reduced in diameter it is advanced to the right over the top of the splicing roll to the position shown for the expiring bundle and a new bundle properly prepared is positioned for splicing.

The device shown in Fig. 1 delivers the web with its outer surface, as wound on the bundle, upward, but it is desired that the machine be capable of delivering either "outside up" or "inside up" since various webs are wound differently and the desired side must be properly presented to the conversion machine. In accordance with Figs. 2 and 3 the addition of a pair of idler rollers 23 and 24 permits the same machine to be used to deliver either side up. In Fig. 2 the parts all correspond in their disposition and arrangement to that shown in Fig. 1 but instead of delivering the web directly from the driven splicing roll it passes first around the idler roll 23 to rotate the same clockwise and then to idler 24 to rotate the same counterclockwise, the web being delivered outside up as in Fig. 1.

In Fig. 3 the expiring roll is arranged to the left of the new bundle B, the paper passing over the top of the splicing roll 17, now rotating clockwise rather than counterclockwise as in Figs. 1 and 2. From there it passes over idler roll 23 and then idler roll 24, rotating them in the same direction as in connection with Fig. 2 but delivering the web inside up. The new bundle must be ad-

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vanced toward the left to achieve the splicing and means must be provided to rotate the splicing roll in the opposite direction and to actuate the cutting knife from the left instead of from the right as in Fig. 2. All this can be achieved with simple mechanism such as will be defined in the embodiments of the apparatus about to be described.

Fig. 4 shows the simple arrangement of adhesive on the outer face of the web adjacent the leading edge of the new bundle B. Preferably the end has its corners chamfered as at C and a wide band of adhesive 19 applied adjacent the edge. Two narrow tapes of readily breakable material are shown at 26 adherent to the end and the body of the bundle to hold down the end until the adhesive engages the traveling web. It then sticks sufficiently hard to break the tapes 26. It will be noted that the direction of rotation is such that the effort applied to bring the bundle up to speed does not stress these tapes.

Fig. 5 shows the expiring web W with the attached end and its adhesive 19 from the new web. This attachment is beneath the web W, as indicated by the dotted lines and by the serrated trailing end 27 of the old web, where it has been cut. In edge view these parts are seen in Fig. 6 where the numbering is the same as in Fig. 5.

Figs. 7, 8, 9, 10 and 13 illustrate a practical embodiment of apparatus for carrying out the process described in connection with the diagrammatic showings. As shown in Figs. 7 and 8 the machine is contained between two side frames which are like but reversed. They may each be formed of any suitable casting or the like, or as shown by a metal plate welded to one flange of a surrounding angle bar. The frame is provided with the necessary bearings, not shown in detail, for supporting the several shafts and spindles. The top surface 31 of each of the side frames forms a wide horizontal track on which are supported the half bearings 32 each notched in its upper surface as at 33 for receiving the ends of spindles 16 and 18 of the expiring and new bundles respectively (see Fig. 13). These blocks are adapted to be traversed along this surface 31, when desired, by means of chains 35 operating over sprockets 36, 37, 38 and 39 roughly near the four corners of each frame. Each bearing block, as seen in Fig. 13, has a transverse notch 40 in its under surface adapted to cooperate with a driving lug 41; a number of which are spaced at appropriate intervals along each chain, as seen in Figs. 7 and 13. The chains rest on tracks 31 and pass to sprockets 36 and 37 through slots in the tracks, as seen in Fig. 8, some distance inwardly from the ends thereof so that as the chains advance and pass down through the slots a set of the blocks is left resting on the tracks beyond the sprocket slots so that the expiring bundle will not fall. It may be held against moving under the pull of the unwinding web by having latches (not shown) to engage the blocks 32.

The splicing roll 17 is secured to a shaft 43 journaled in a pair of links or frames 44 which are pivoted on shaft 45 supported near the lower edges of the side frames and carrying the single idler roll 46. The desired amount of throw-over of the splicing roll by the tilting of the links 44 is accommodated by the arcuate slots 48 in the side frames through which the roller shaft 43 passes, as seen in Fig. 10.

The primary purpose of link mounting the splicing roll is to shorten the overall machine length. If a machine is to be used for either "inside up" or "outside up" delivery a fixed splicing roll would have to be at the center of the length of the frames and enough length provided beyond this center in each direction to accommodate a new bundle of maximum diameter, whereas with the movable splicing roll positioned toward the lesser diameter expiring web bundle there is provided additional space for a large new bundle on a frame of less length than required for the fixed splicing roll. The drawings clearly illustrate this.

It will be remembered from the description of Figs. 2

and 3 that there was a requirement for reversing the direction of rotation of the splicing roll, and this, in the present embodiment is automatically effected by the displacement of the position of the latter. As viewed in Fig. 9, at least one of the ends of shaft 43 carrying the splicing roll which pass out through the slots 48 is equipped with gear 50 adapted to engage one or the other of drive gears 51 or 52 dependent on the position of the splicing roll. As seen in Fig. 10 one of the gears mounts a second gear 53 whereby it is driven from machinery, not illustrated. The gears 51 and 52 mesh with each other and hence run in opposite directions so that when gear 50 meshes with gear 51 it drives the splicing roller in the desired direction and reverses this when gear 50 meshes with gear 52. The splicing roll is easily shifted by hand from one to the other of its two positions to change the operation of the machine.

In the operation of bringing the new roll or bundle up to speed, it must be pressed against the surface of the web traveling over the splicing roll with adequate pressure to prevent any substantial slippage. This pressure is predetermined by means of preloaded stop spring assemblies 55, one near either end of each of the arcuate slots 48. Each comprises a housing providing a cylindrical chamber for helical spring 56 having a threaded adjustable follower 57 forcing the spring against disc 58 having button 59 on the end thereof projecting through an opening in the front end closure for the chamber. This button is positioned to be engaged by the appropriate side of the link 44. The springs can be preloaded by their adjusting means since the outer ends are fixed by the engagement of disc 58 with the closure. Under these conditions desired preloading of the springs can be effected. Also adjacent to and adapted to be engaged by the corresponding edge of the link member is the operator 64 of limit switch 61. This operator is not pressed to open the switch circuit until the desired movement of spring loaded button 59 is effected.

The control of the machine is achieved from a panel, not shown, by an operator. With the apparatus positioned as shown in Fig. 7 the operator waits until the expiring roll 15 is substantially used up and then closes the circuit for starting the motor 62, which through the gears and sprockets shown advances the chains 35 in a counterclockwise direction for "inside up" delivery. As the bundle B advances to the left its periphery engages the web on the splicing roll and presses the latter toward the left against the opposition of its springs 56. When, in accordance with the preloading of the springs, appropriate pressure exists between the two rolls, movement is sufficient to operate the switch button 64 to open the motor circuit stopping the chain drive. At about this time the bundle B is up to speed and the splice is automatically made as previously explained. The operator then immediately presses the operating button (not shown) which actuates the cutoff knife and the splicing is finished. At the time that the bundle B is reduced sufficiently in size to pass over the splicing roll the chain motor is started again to move the now expiring roll to the position shown at 15. This movement does not drop the half bearings for the previously expired roll off the tracks, but merely deposits them near the ends thereof while the chains and lugs pass down the slots. These bearings are now carried around to the opposite end of the machine and positioned where they can each be engaged by one of the lugs on a chain. A new bundle is then hoisted into position with its shaft in the half bearing notches and readied to be spliced.

The cutoff knife 65 is supported between a pair of shear blades, the ends of which are secured to the discs 66, one journaled on each end of the splice roll shaft 43 between the roll and the link 44, as best seen in Fig. 10. At each end of the machine an air cylinder 67 has its lower end pivoted at 68 to link 44 just above the idler roll and has its piston rod pivoted at 69 to the knife disc.

When the piston rods of the air cylinders are retracted by admitting air through the tubes 70 the knife is oscillated at least to the position indicated by dotted line 71 so that the paper is cut. When air is released from the cylinder the knife drops back to the position shown in Fig. 7 by gravity.

When the splicing roller assembly and its links is thrown over to the position opposite that shown in Fig. 7, the knife moves with it, retaining the initial position shown in Fig. 7, but a push on the air control button brings the knife to the dotted line position 71, so that on release of air pressure in the operating cylinders it drops over to the right and is ready for cutting when the web is unrolled in the opposite direction.

A simpler embodiment of the invention is shown in Figs. 11 and 12. Here the essentials are somewhat like those already described but since the splicing roll 17 is not displaceable except through the slight amount necessary to actuate the limit switches, it must be at the center of the length of the frames, which then must be longer than in the preferred embodiment in order to be able to accommodate a full sized new bundle at either side of the splicing roll. The bundle drive chains and other parts are similar to that just described, but the bearings 80 for the splicing roll are mounted for horizontal sliding in slots in the frames and the preloaded spring assemblies 81 are mounted where their buttons are contactable by these bearing members when engagement occurs between the advancing new bundle and the splicing roll. Similarly the limit switches 82 are appropriately placed. The arrangement is shown in greater detail in Fig. 12, where the arrangement of the parts will be readily recognized. This machine has all of the advantages and effects the same satisfactory splice as the preferred form but is somewhat greater in length. Also the preferred form provides a better component of effort to move the splicing roll against its preloaded springs because of the downward direction of movement of the roll by virtue of its link mounting.

The construction disclosed in Fig. 11 may be modified and simplified by mounting the bearings for the splicing roll to slide vertically downwardly when contacted by the new bundle, thereby reducing the required number of sets of preloaded springs and the number of limit switches.

The embodiment of Fig. 11 shows two idler rolls 84 and 85 over which the web passes for delivery. In this embodiment as in the preferred it may be found under certain conditions of supply roll location that the arc of contact of the web with the driven splicing roll is insufficient for proper web drive, in which case the roll or rolls referred to as idlers may be driven at proper speed to maintain the desired tension on the web for unwinding the bundle, etc.

I claim:

1. The method of accelerating a new roll of web material for attachment to a web traveling from an expiring roll comprising passing the traveling web over a rigid splicing roll, driving the splicing roll at a peripheral speed equivalent to the web speed, mounting the new roll for initial free rotation, advancing the mounted new roll rectilinearly into tangential contact with the portion of the travelling web supported on said splicing roll, rapidly increasing the contact pressure sufficiently to accelerate the new roll from zero to a peripheral speed equivalent to the web speed in slightly less than one revolution of the new roll, and moving the remainder of the new roll when nearly depleted in the same rectilinear path over the splicing roll to the expiring roll position.

2. The method set forth in claim 1 in which the coefficient of friction between the traveling web and the splicing roll is maintained higher than that between the traveling web and the surface of said new roll whereby slippage between the traveling web and the splicing roll is prevented.

3. Apparatus for web roll replenishing comprising in

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combination, means to rotatably support a roll delivering web for use at a predetermined speed, a rigid splicing roll having partial peripheral contact with said web, means to drive the splicing roll at web speed, means to initially freely rotatably support a replenishing roll of web having the outer surface of its end coated with adhesive, power means to rapidly advance the last mentioned roll rectilinearly at zero rotational speed to tangentially contact the traveling web where supported on the splicing roll with sufficient pressure to accelerate the replenishing roll from zero to web speed in less than one revolution thereof, means to stop the power means causing advance of the replenishing roll, and means responsive to a predetermined contact pressure between the replenishing roll and splicing rolls to actuate the stop means.

4. The apparatus of claim 3 in which means is provided to advance the new roll above the splicing roll along a continuous rectilinear path to the position of the previously expiring roll, said means acting to simultaneously displace the expiring roll.

5. In a web splicing apparatus in combination, a pair of spaced side frames, means carried by said frames journalling a splicing roll, means to drive said splicing roll at a predetermined speed, means to rotatably support a web delivering bundle from said frames positioned adjacent to but out of contact with said splicing roll, means drawing said web from said bundle over and in contact with said splicing roll with substantially no slippage, means to initially freely rotatably support a new bundle of web in a position nearly contacting the web on said splicing roll, means to rapidly advance the new bundle along a rectilinear path into tangential contact with said web where supported by the splicing roll with sufficient pressure to accelerate the new bundle from zero speed at contact until its peripheral speed equals that of the traveling web and in less than one revolution of the new bundle, and mechanism associated with said new bundle advancing means to simultaneously move the expiring bundle farther from the splicing roll along said rectilinear path.

6. The apparatus of claim 5 wherein said splicing roll is displaceable under said new bundle contact, and including preloaded spring means resisting said movement and means responsive to a predetermined amount of splicing roll displacement to terminate said bearing block drive.

7. The apparatus of claim 5 in which said frames have continuous track surfaces thereon and wherein the surface of the splicing roll is below the track surfaces whereby the new bundle when partially expired may be advanced on said track to the position of the first mentioned web delivering bundle, and including means to reverse the direction of rotation of said splicing roll and the bundle advancing means whereby web may be delivered either "inside up" or "outside up."

8. In a web splicing apparatus in combination, a pair of spaced side frames each having a horizontal track surface at the top thereof, bearing blocks slidable on said tracks and adapted to rotatably support an expiring web bundle adjacent one end of the tracks for web delivery to a machine withdrawing it at a predetermined rate and a new web bundle at the other, a splicing roll rotatably supported intermediate said bundles and having its surface entirely below the level of said tracks, means to drive said roll at delivered web speed, an idler roll to deliver said web from said splicing roll always toward the same end of the frames, means to reverse the direction of rotation of the splicing roll whereby the web may be delivered "inside up" with the expiring bundle at one end of the tracks or "outside up" with the bundle at the other end of the tracks, and motor driven means to advance said blocks whereby a new bundle at the track end opposite the expiring bundle may be forced into contact with the web on the splicing roll for acceleration thereby and splicing thereto and may later be moved above the splicing roll to the opposite end of the tracks.

9. The apparatus of claim 8 in which movable bearings

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are provided for said splicing roll, and including resilient means opposing movement of said bearings and a switch actuable on predetermined movement of the splicing roll, said switch being arranged to stop said motor driven means, whereby when the new bundle moves the splicing roll sufficiently for acceleration of the former in one revolution advancement of the new bundle is terminated.

10. The apparatus of claim 8 in which the coefficient of friction between the traveling web and the splicing roll is greater than that between the web and the surface of the new bundle, whereby breakage of the web is prevented.

11. The apparatus of claim 8 in which movable bearings are provided for said splicing roll, and including a pair of links having their lower ends pivoted respectively to the side frames and each carrying at its upper end one of said bearings, stop means for each link to determine its normal limit of movement on each side of vertical, the means to drive said splicing roll comprising a gear secured thereto, a pair of meshing gears positioned so as to be alternatively meshed with the roll gear when the roll links are in one or the other of the normal limit positions, and means to drive one of said meshing gears.

12. The apparatus of claim 11 in which the distance between the surface of the splicing roll and the ends of the frames most distant therefrom in either of its "stopped" positions is just slightly greater than the radius of a new bundle.

13. The apparatus of claim 11 in which a secondary drive roll is arranged on a fixed axis adjacent the axis of the said links, is driven at web speed and receives the web passing from the expiring roll over the splicing roll and under the secondary drive roll.

14. The apparatus of claim 11 in which a knife is provided to sever the expiring web after the "splice," and including discs journaled coaxial with the splicing roll mounting said knife, an air cylinder and piston connected between each disc and link and means to actuate the pistons in unison to raise the knife to an active position substantially in alignment with the longitudinal axis of the links.

15. The apparatus of claim 14 wherein the connections to the discs are diametrically opposite to the knife whereby it may be caused to assume by gravity an inoperative position toward the low sides of the links whatever their setting.

16. Apparatus for supporting a new and an expiring bundle of web for delivery in a replenishing splicing operation comprising a pair of side frames having horizontal track tops, bearing blocks slidable on said tracks and adapted to rotatably support said bundles, a continuous chain adapted to travel along the top surface of each track between slots adjacent the track ends, sprockets guiding said chains through said slots and beneath said tracks adjacent said slots, means to drive said chains, spaced transverse lugs on said chains, a longitudinal slot in each block to straddle the chain, a transverse slot in each block to receive a chain lug and be driven thereby, each track extending outwardly beyond each track slot therein a sufficient distance to support a block disengaged from said chain.

17. Apparatus for web roll replenishing comprising in combination, means to rotatably support a roll delivering web for use at a predetermined speed, a rigid splicing roll having partial peripheral contact with said web, means to drive the splicing roll at web speed, means to initially freely rotatably support a replenishing roll of web having the outer surface of its end coated with adhesive, power means to rapidly advance the last mentioned roll rectilinearly at zero rotational speed to tangentially contact the traveling web where supported on the splicing roll with sufficient pressure to accelerate the replenishing roll from zero to web speed in less than one revolution thereof, a cutting device pivoted on the axis of the splicing roll for movement from an inoperative position to a position be-

tween the splicing roll and the expiring roll to sever the expiring web, and means to reverse the inoperative position of the cutting device for use when the web approaches the splicing roll from the opposite direction.

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