United States Patent [19]

Bassett et al.

[11] **3,859,883**

[45] **Jan. 14, 1975**

[54] **WEB SUPPLY APPARATUS**

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[73] Assignee: **Butler Automatic, Inc.**, Canton, Mass.

[22] Filed: **May 14, 1973**

[21] Appl. No.: **359,636**

Related U.S. Application Data

[62] Division of Ser. No. 11,654, Feb. 16, 1970, Pat. No. 3,753,833.

[52] **U.S. Cl.** **83/545**, 83/588, 83/639

[51] **Int. Cl.** **B26d 5/12**, B26d 7/22

[58] **Field of Search** 83/545, 588, 590, 639, 83/144, 145, 375; 30/180, 286

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Primary Examiner—J. M. Meister
Attorney, Agent, or Firm—Cesari and McKenna

[57] **ABSTRACT**

A web supply apparatus of the type wherein web is unwound alternately from each of two similar mobile roll stands each movable in the direction of its web roll axis between an unwind position usually in line with a web consuming machine and a loading position laterally offset from the path of the web. The two roll stands generally move on floor supported tracks between their loading and unwind positions and each is equipped with a portion of a web splicing device so constructed that, in the loading position a ready web roll having been picked up from the floor has its leading end so prepared and mounted that when the ready roll stand is moved to the unwind position, the ready web may be spliced automatically to the trailing end of the running web by the co-action of the two splicer halves mounted on the unwinding and ready roll stands. A compact knife assembly is provided wherein the knife is secured directly to a fluid powered actuator and is positioned to sever the web at the same point in space regardless of variables in the operation of the splicer.

1 Claim, 11 Drawing Figures

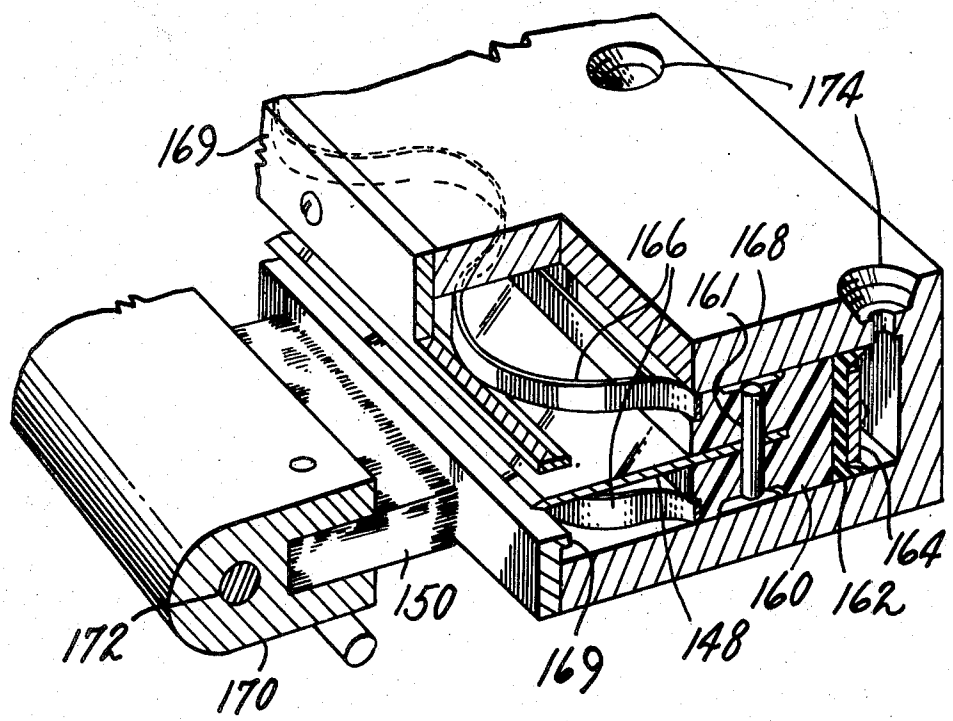


Fig. 1

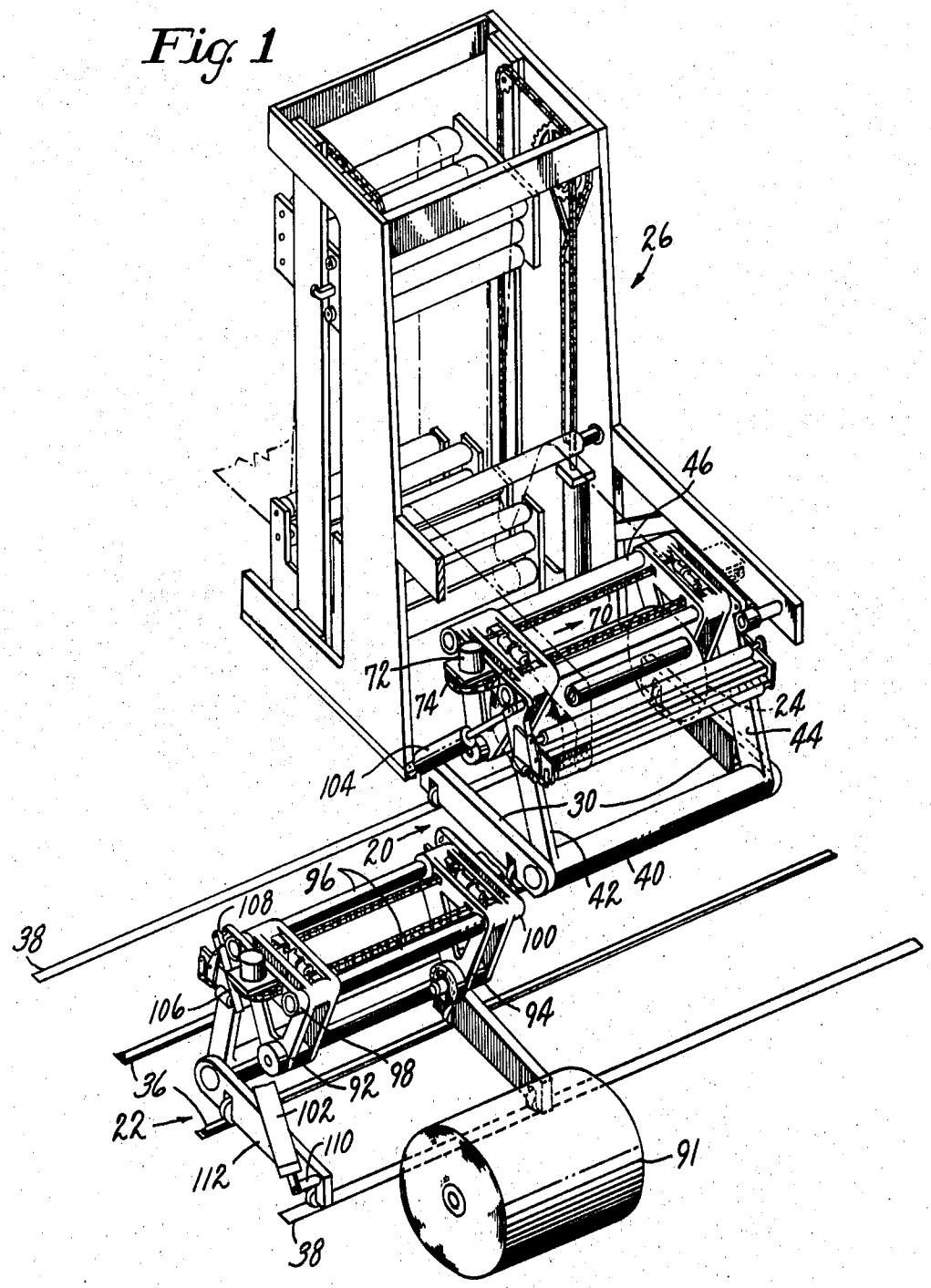

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Fig. 2

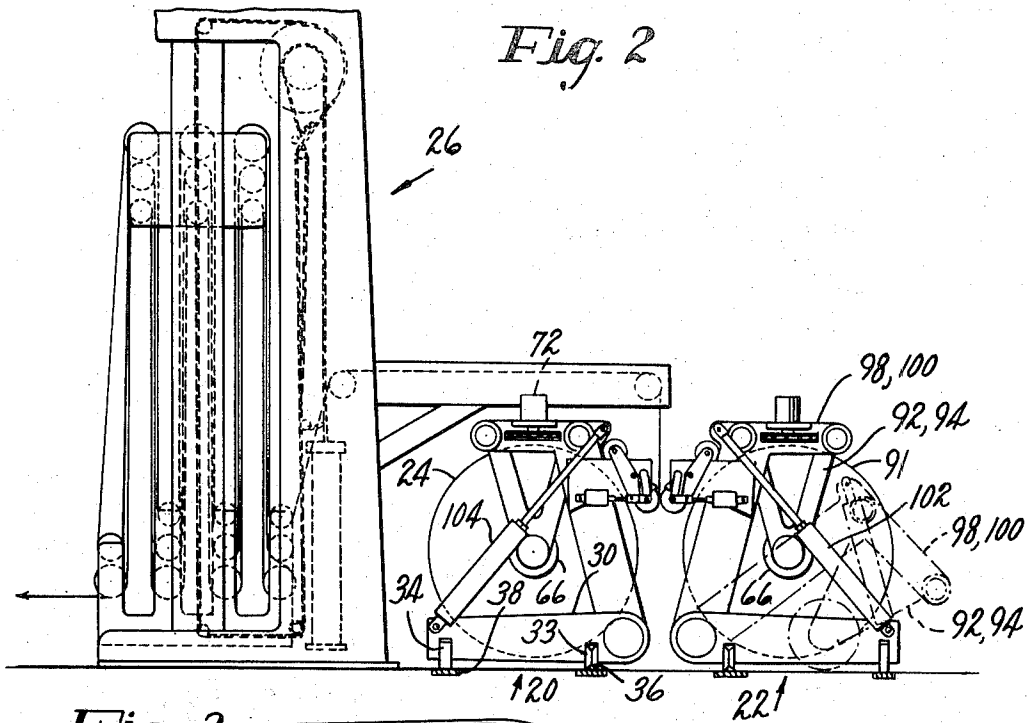

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Fig. 3

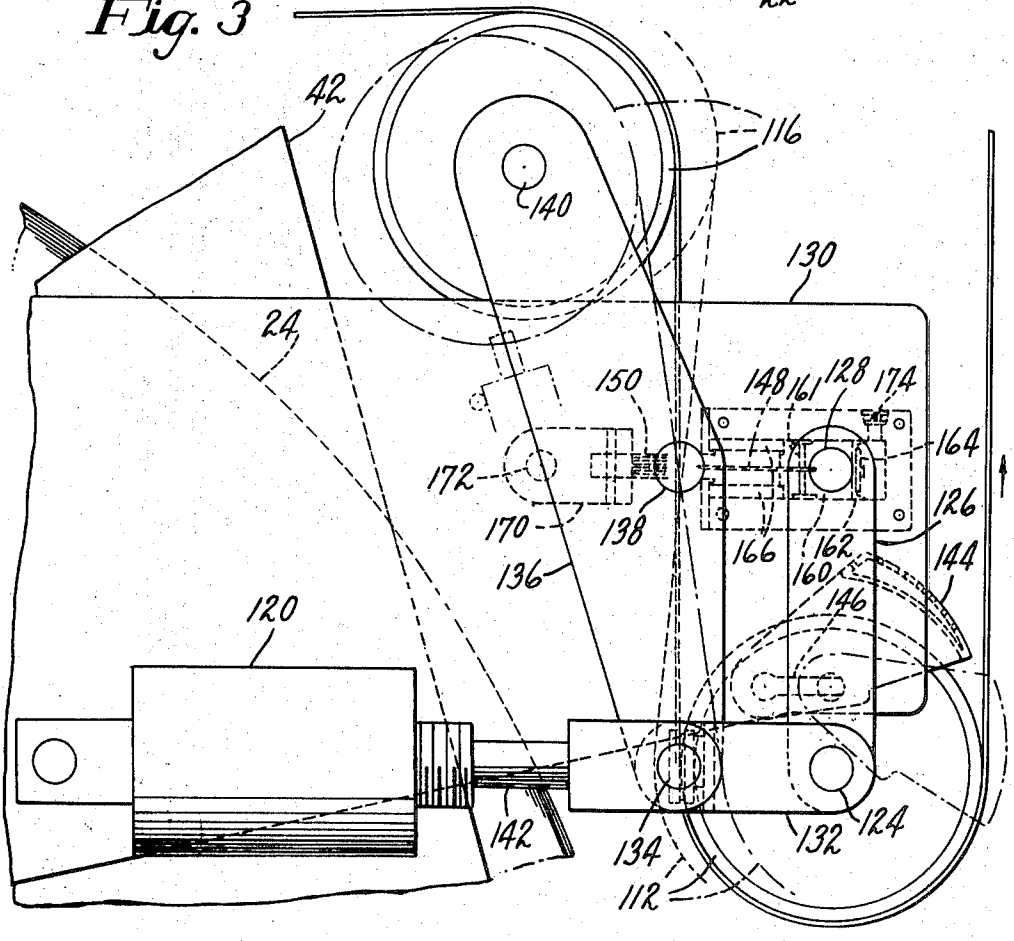

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Fig. 4

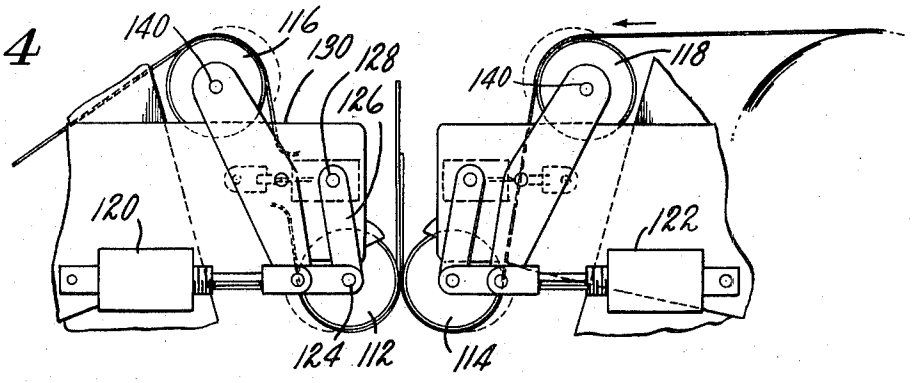

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Fig. 5

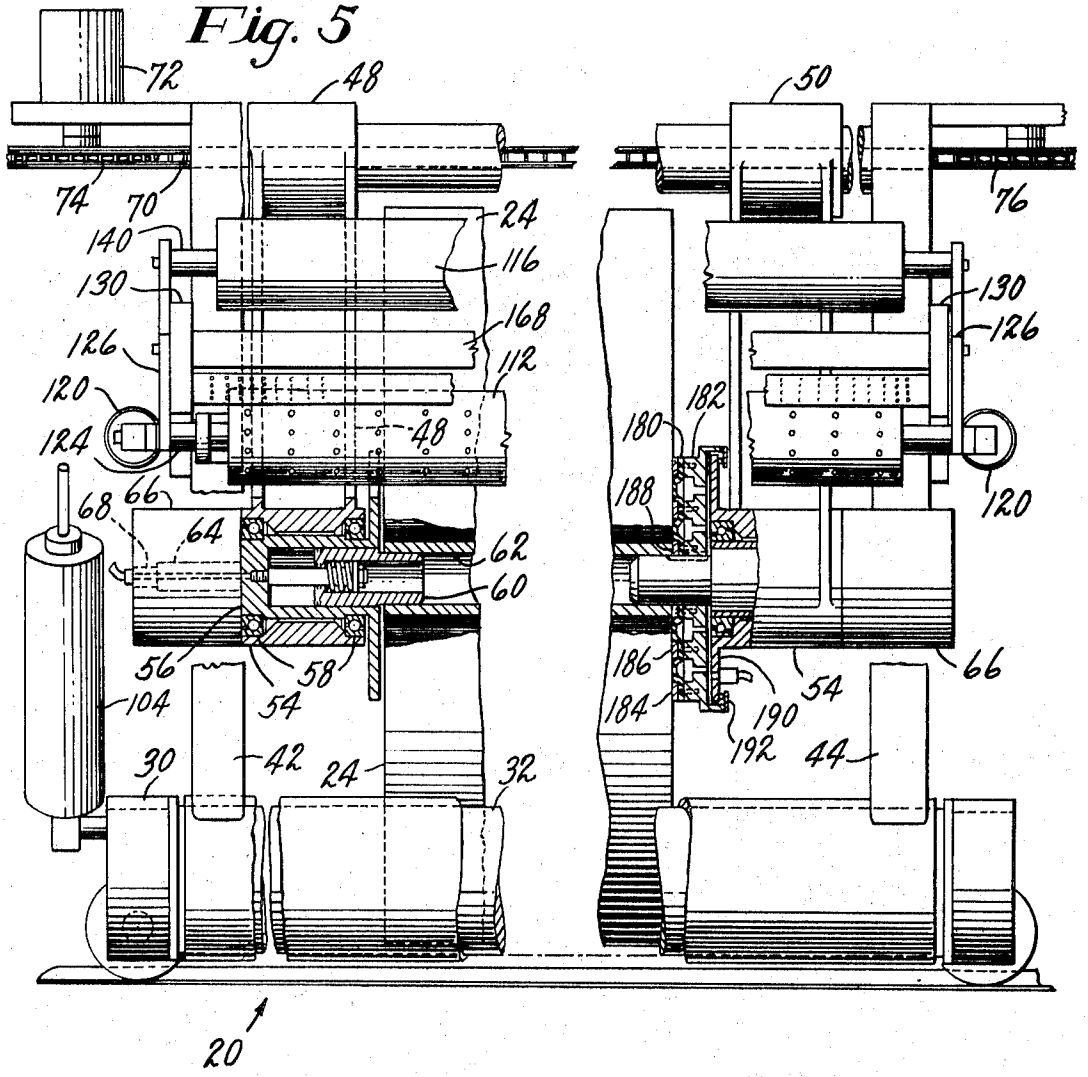

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Fig. 6

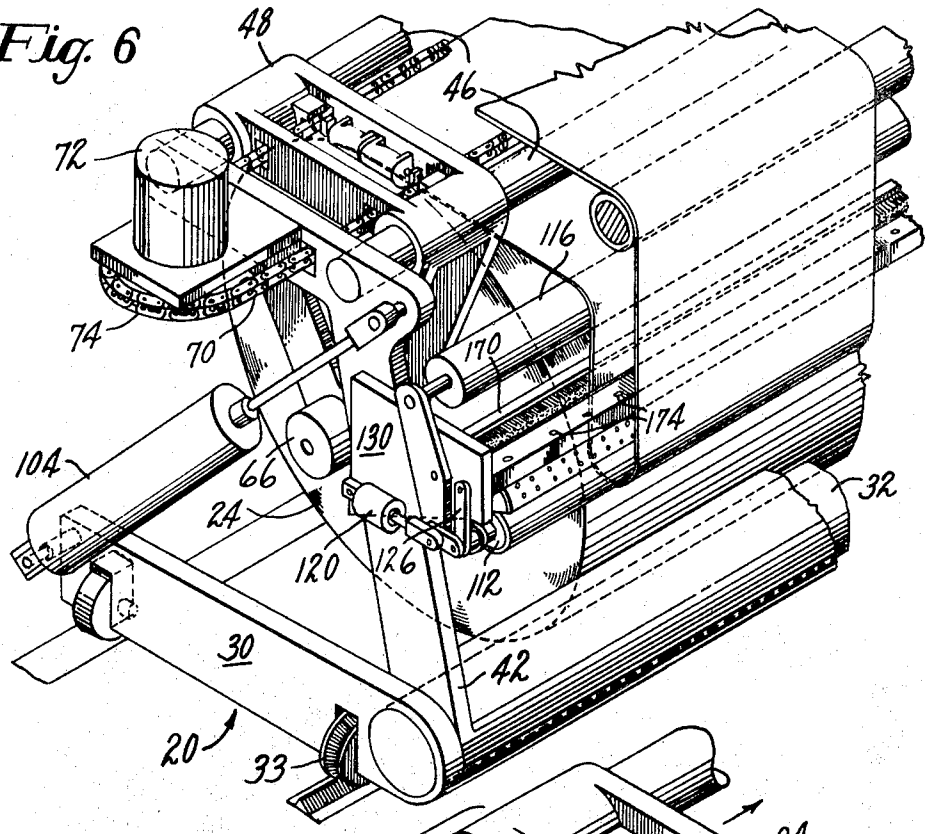

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Fig. 7

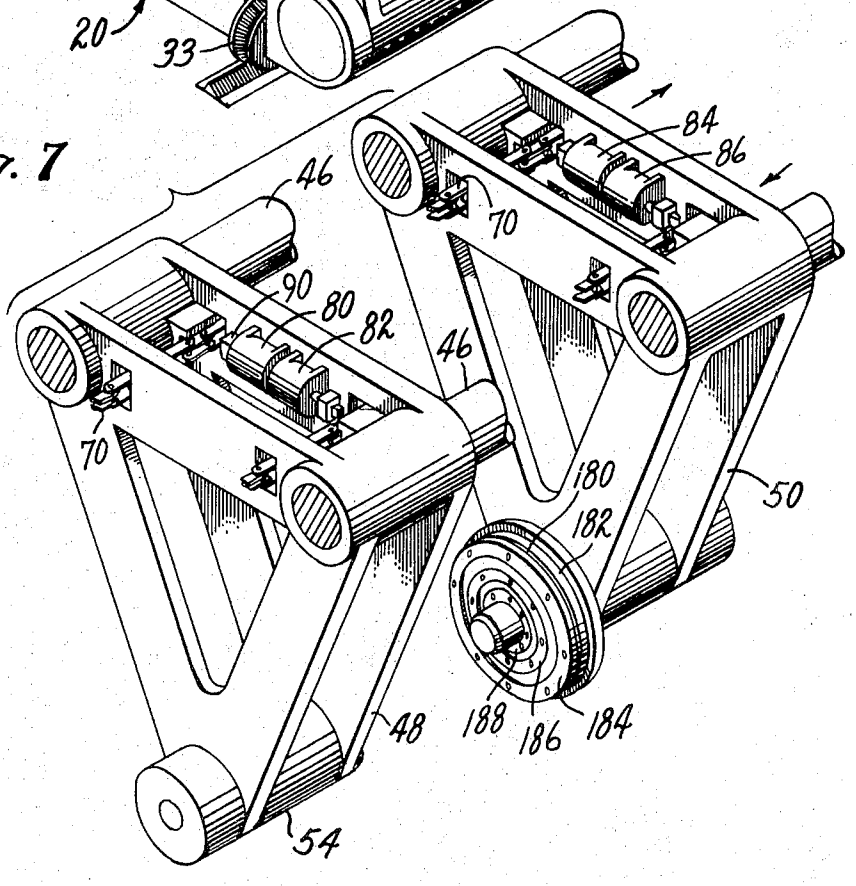

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Fig. 8

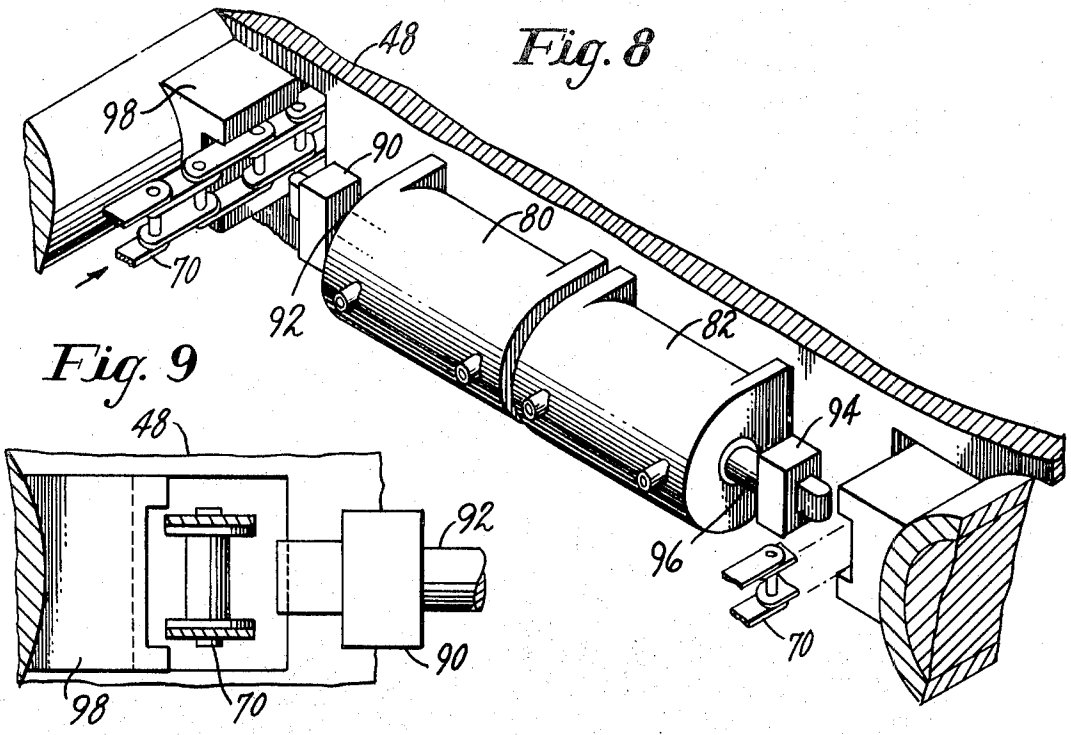


Fig. 9

Fig. 10

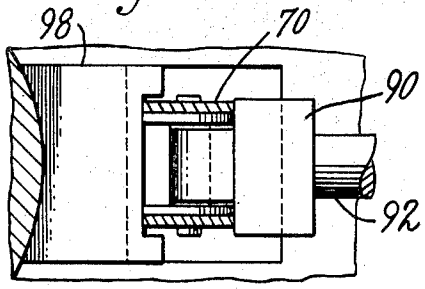
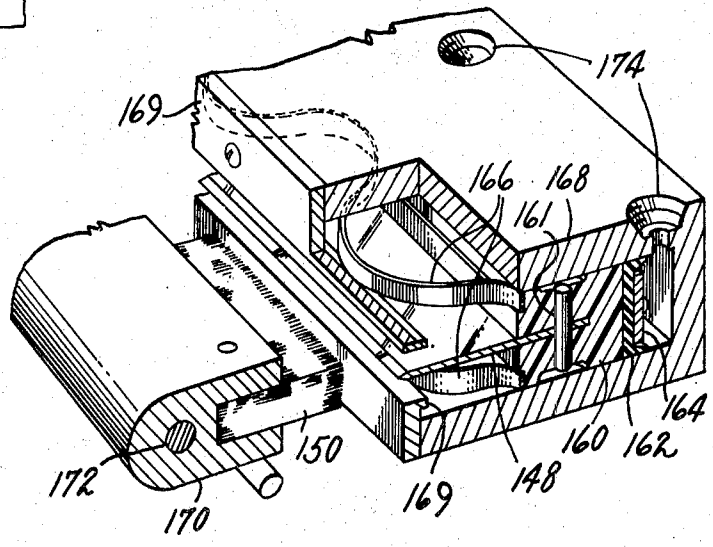


Fig. 11



WEB SUPPLY APPARATUS

This application is a division of application Ser. No. 11,654, filed Feb. 16, 1970, entitled WEB SUPPLY APPARATUS, now Pat. No. 3,753,833.

The present invention relates generally to web supply apparatus and more particularly to such apparatus of the type which includes a pair of alternately employed mobile unwind or roll stands from which web is delivered to a web consuming machine. More particularly in at least one aspect, the invention relates to a splicing device for automatically joining the leading end of the web supply roll mounted on one roll stand to the trailing end of the depleted or nearly depleted roll mounted on the other roll stand so as to assure an uninterrupted supply of web to the consuming machine.

In the processing of web such as paper, there is currently in use a multiplicity of unwind or roll stands which are mounted on wheels and are used in pairs. These roll stands have the advantage that they offer great convenience in picking up and readying one web roll on one of the roll stands while a roll is unwinding on the other roll stand. However, the formation of a splice with such roll stands has been heretofore accomplished manually. In addition, in order to form a splice it is usually necessary when the web consuming machine requires the web at a relatively high speed, to slow down the web consuming machine and even then the manual formation of the splice is often missed. When this happens the web consuming machine must be stopped and rethreaded and the result is a serious loss of valuable production time. In addition, when the failure to form a splice occurs or when there is an urgent need to stop the unwinding web suddenly, particularly with a full heavy roll, it is extremely difficult with a conventionall shaftless roll mounting to couple the braking device effectively to the roll to bring the roll to a stop quickly so as to avoid the spillage of an excessive amount of web.

It is accordingly an object of the present invention to provide a web unwind apparatus of the mobile roll stand type in which a splice may be formed automatically or on command to secure the leading end of the web from a ready roll to the expiring or trailing end of the running web.

Another object is to provide such an unwind apparatus in which the leading end of the ready web may safely be readied for splicing at a loading station away from the moving web.

Still another important object of the invention is to increase the reliability of splice formation so as to increase productivity.

In the achievement of the foregoing objects, a feature of the invention resides in a novel splicer comprising two mirror-image halves each mounted on one of two cooperatively associated mobile roll stands. The roll of web on one of the roll stands in the operative or unwind position is fed through a storage festoon to the related web consuming machine. While the unwinding of one roll continues, the other roll stand is moved axially away from the unwinding roll to a loading area or aisle to receive a fresh roll of web. The roll stand in the loading area picks up a web roll from the floor and the leading end of the new roll is prepared for subsequent splicing to the trailing end of the web roll then unwinding. The leading end of the new or ready web is prepared with double-faced tape supported by vacuum on a nip roller until the ready web roll is required. Then with both roll stands in the unwind position the splicer portion on the ready web stand cooperates with a splicer portion on the then unwinding stand to splice the leading end of the new roll to the running web.

According to another feature of the invention there is provided a highly compact knife assembly yet having sufficient capacity for cutting resistive webs. The knife which is secured directly to its fluid powered actuator is positioned to sever the web at the same point in space regardless of variables in the operation of the splicer and also to leave a short length of web or tail following the splice.

While the leading end of the ready web is supported on the nip roller a buffer roll interposed between the nip roller and the web supply roll provides a small quantity of web which is given up between the nip roller and the supply roll to compensate for the splice forming motion of the nip roller without causing the leading end of the ready web being stripped from the nip roller.

A high degree of reliability is obtained in splice formation in the present apparatus because of the fact that the splice is formed either on stationary web or on web moving at a very slow speed. This is possible while feeding web uninterruptedly to a web consuming machine which requires the web at a high speed because of a large web reservoir provided by a storage festoon. In addition, the festoon provides a signal varying according to the degree to which it is filled, for control of web tension. The passage of the web through the festoon also provides a conditioning period during which the web picks up moisture from the atmosphere and at the same time conditions the surface for improved reception of ink or adhesives.

According to another feature of the invention the roll stands are provided with devices for adjusting quickly and safely to accommodate web rolls of different widths. This is accomplished by a roller chain which is driven in a single direction through two web roll supporting arms. Two couplers are provided on each arm and by engaging either coupler to the chain the arm may be moved in either direction toward or away from the other arm.

The foregoing objects, features and numerous advantages of the present invention will be more fully understood from the following description of an illustrative embodiment taken in connection with the accompanying drawings in which:

FIG. 1 is a view in perspective and from the left rear of an apparatus according to the present invention showing one roll stand supplying web through a festoon while the other roll stand has been moved to a loading zone to pick up a fresh roll of web;

FIG. 2 is a view in side elevation of the apparatus depicted in FIG. 1 but showing both of the roll stands in operative position, a web being unwound from the stand to the left while the stand to the right carries a roll of ready web, its leading end ready to be spliced to the trailing end of the running web when the running web roll is exhausted;

FIG. 3 is a fragmentary detail view of a splicer portion carried by the roll stand to the left as seen in FIG. 2;

FIG. 4 is a view in side elevation and on a smaller scale showing both splicer portions in the process of forming a splice;

FIG. 5 is a view in rear elevation and on an enlarged scale of the roll stand shown at the left in FIG. 2;

FIG. 6 is a view in perspective of a portion of the roll stand depicted in FIG. 5;

FIG. 7 is a view also in perspective depicting a pair of roll-lifting arms forming a part of the roll stand of FIGS. 5 and 6;

FIG. 8 is a view in perspective and on an enlarged scale showing a pair of couplers forming a part of a mechanism for moving the arms of FIG. 7;

FIGS. 9 and 10 are detail views of one of the couplers of FIG. 8 in disengaged and engaged positions respectively;

FIG. 11 is a detail view of a web cutting knife.

Turning now to the drawings particularly FIGS. 1 and 2 there is shown a web supply apparatus comprising left and right mobile roll stands indicated generally by reference numerals 20 and 22 respectively. The roll stand 20 is shown supporting a partially depleted roll 24 which is being unwound through a storage and control festoon indicated generally at 26. The roll stands 20 and 22 are mirror images of one another and completely equivalent in construction. Accordingly, a detailed description of the left roll stand 20 will provide a full understandng when supplemented as necessary with details of the cooperation of the two roll stands.

Typically the roll stand 20 comprises a pair of base stretchers 30 secured to a base shaft 32 as also seen in FIGS. 5 and 6. At the rear, the stretchers 30 carry grooved wheels 33 and at the front smooth wheels 34 to engage floor mounted tracks 36 and 38 best seen in FIGS. 1 and 2. A roll support frame forming a part of the roll stand 20 comprises a tube 40 pivotally supported on the shaft 32. The support frame is in the form of a weldment and includes a pair of offset vertical arms 42 and 44 welded to the ends of the tube and extending upwardly and forwardly. A pair of cylindrical parallel bars 46 supported in the distal end portions of the arms 42 and 44 provide an adjustable mounting for a pair of triangular roll supporting arms 48 and 50. An adjusting mechanism is provided to slide the arms 48 and 50 to various positions along the length of the bars 46 to accomodate web rolls of different widths. In addition, the roll support frame is pivoted about the shaft 32 to lift a new web roll from the floor.

Rotary web roll supports are provided at the lower end of the arms 48 and 50. Typically the arm 48 as seen in FIG. 5 is formed at its lower end with a bearing housing 54 in which a flanged hollow shaft 56 is journalled in bearings 58. The interior of the shaft 56 provides a cylinder in which is slidably supported a core chuck 60 pressed by compressed air into engagement with the interior of a core 62 of the web roll 24. The shaft 56 includes a hollow extension or tail shaft 64 upon which is mounted a commercially available brake assembly 66 whose frame is secured to the bearing housing 54. Air under pressure which is admitted to the cylinder at the interior of the shaft 56 through a rotary joint 68 causes the core chuck 60 to be pressed into the core 62. Driving engagement is established through commercially available driving members fitted to the core chuck 60 but forming no part of the present invention. The brake assembly 26 is preferably of the water disc type operated by compressed air, the timing and pressure of which is regulated by the quantity of web present in the storage festoon 26 at any given time in a manner similar to that disclosed in U.S. Pat. No. 3,414,208, granted Dec. 3, 1968 upon application of Richard A. Butler et al.

For moving the arms 48 and 50 along the length of the bars 46 in order to adjust for rolls of different widths there is provided a roller chain 70 driven by a motor-reducer combination 72 having a sprocket 4 which turns in a clockwise direction as seen in FIG. 1. The chain 70 passes through suitable openings in the arms 48 and 50. Mounted on the arms 48 and 50 between the bars 46 are couplers comprising cylinders 80 and 82 on the arm 48 and couplers comprising cylinders 84 and 86 on the arm 50. The operation of the couplers is shown more clearly in FIGS. 8 to 10 inclusive in which there is shown a locking wedge 90 which engages the chain 70 when pressurized fluid is admitted to the cylinder 80. The wedge 90 is fixed to the end of a piston rod 92 of the cylinder 80 and a similar wedge is provided at the other cylinders 82, 84 and 86, a wedge 94 being shown fixed to the end of a piston rod 96 operating in the cylinder 82. Backing the chain 70 is a slotted block 98 fixedly supported on the arm 48. When the wedge 90 is projected into engagement with the chain 70 by introducing fluid under pressure to the cylinder 80, the chain is deflected slightly in the slot of the block 98 and thereby clamped to the arm 48. When the fluid is exhausted from the cylinder 80, the wedge 90 is retracted out of engagement with the chain 70 as shown in FIG. 9.

The couplers including the cylinders 80, 82, 84 and 86 all have similar actions. Pressurized fluid is admitted either to one or to two of the cylinders to impart a required adjustment to the related arm at any given time. The arms 48 and 50 are provided with conventional manually operated clamps (not shown) for securing the arms in place on the bars 46. After releasing the clamps, pressurizing the cylinder 80 causes the arm 48 to move to the right and pressurizing the cylinder 82 causes the arm 48 to move to the left. Similarly, pressurizing the cylinder 84 causes the arm 50 to move to the right and pressurizing the cylinder 86 causes the arm 50 to move to the left. In addition to the motion of a single arm at one time, two cylinders may be simultaneously pressurized so as to move both arms at the same time. Thus when the cylinders 80 and 86 are pressurized, the two arms 48 and 50 move closer together whereas the two arms move farther apart when the cylinders 82 and 84 are pressurized. In addition the pressurizing of the cylinders 80 and 84 causes both the arms 48 and 50 to move to the right, and pressurizing the cylinders 82 and 86 causes both arms to move to the left. The introduction of pressurized fluid into the cylinders may be accomplished by a nine position manually operated rotary valve or alternately, particularly if from a distance, through the operation of solenoid actuated valves. In this latter case the solenoids of the valves are energized from a conveniently located panel having a bank of eight push button switches which are temporarily depressed. For picking up and lifting a new web roll, the arms 42 and 44 are pivoted downwardly with the core chucks 60 retracted and a roll is positioned between the arms 48 and 50.

The loading function of the roll stand is illustrated in connection with the right roll stand 22 shown in FIG. 1 about to receive a new web roll 90 between triangular support arms 92 and 94 corresponding respectively to the arms 48 and 50 of the roll stand 20. The support arms 92 and 94 depend adjustably from parallel bars 96

corresponding to the bars 46 of the roll stand 20. The bars 96 are in turn supported in parallel relationship in the distal end portions of offset arms 98 and 100 corresponding respectively to the arms 42 and 44 of the roll stand 20. In the roll stand 22, the support arms 92 and 94 together with the arms 98 and 100 comprise a web roll support assembly which is lowered to pick up the web roll and then raised to operative position by a pair of double acting hydraulic cylinders one of which is indicated at 102. A corresponding arrangement is provided for the roll stand 20 and includes a like cylinder 104. Slidable in the cylinder 102 is a piston on a rod 106 pivotally connected at 108 to the offset arm 98. The cylinder 102 is pivoted at 110 to a base stretcher 112 corresponding to the stretcher 30 of the roll stand 20. The piston in the cylinder 102 divides the cylinder into forward and rear chambers, into which hydralulic fluid is selectively admitted. When hydraulic fluid is admitted into the forward chamber, the roll support assemblly is lowered to the position depicted in dot-dash lines in FIG. 2. The roll support assembly is raised to its operating position shown in the solid line position of FIG. 2 by the flow of pressurized fluid into the rear chamber of the cylinder 102.

Although single cylinders 102 and 104 have been shown on the roll stands 22 and 20 respectively, two like cylinders, one on each side of each roll stand are actually employed. The use of the two cylinders not only yields obviously better balanced lifting conditions but also permits the use of cylinders which are more commonly commercially available and therefore more economical.

The splicing of the leading end of the ready web is accomplished by a novel splicer assembly divided into two halves each the mirror image of the other and each mounted on one of the roll stands 20 and 22. The splice is formed by pressing a double faced pressure sensitive tape on the leading end of the ready web into engagement with the running web. This is accomplished by a pair of nip rollers 112 and 114 mounted on the roll stands 20 and 22 respectively. Associated with the nip roller 112 is a buffer roller 116 while a similar roller 118 is associated with the nip roller 114. Air cylinders 120 and 112 are provided for imparting a splicing motion to the rollers 112 and 114 respectively. While the cylinders 110 and 122 are shown as single cylinders actually two cylinders 120 are provided as seen in FIG. 5 for actuating the nip roller 112 and similarly two cylinders 122 are provided for the nip roller 114.

Since the two halves of the splicer assembly are alike in construction only the left half as seen in FIGS. 1 and 2 will be described in detail with reference to FIGS. 3 and 6 inclusive. The roller 112 is mounted on ball bearings on a non-rotating shaft 124 the ends of which are hung in vertical links 126. The upper end of each link 126 is pivoted on a pin 128 pressed into a mounting plate 130 which is fixedly supported upon the arms 42 and 44. The shaft 124 is interconnected by a link 132 to pivot 134 at the lower end of one of the arms of a generally verticall lever 136 pivoted at 138 on the plate 130 and supporting at its upper end a shaft 140 upon which the buffer roller is rotatably supported. The pivot pin 134 also serves as a connection for a piston rod 142 of the cylinder 120. As seen in FIG. 5, the roller 112 is perforated so that a source of vacuum connected to the interior of the roller is effective for holding the leading end of the web in readiness for the formation of a splice. In order to assist in the preparation of the leading end of the web, there is provided a table in the form of a perforated shield 144 for the roller 122. Since the shield 144 is perforated, the leading end of the web is supported by it when the shield is in the position shown in dot and dash lines in FIG. 3 in which it contacts the roller 112. When the preparation of the leading end of the web is completed, the shield 144, which is pivoted on links 146, is merely lifted to its full line position as seen in FIG. 3. As this occurs, the web merely slides off the shield 144 and is retained in splicing position on the roller 122 by the vacuum.

The buffer roller arrangement performs a dual function when the cylinders 120 and 122 are actuated to press the nip rollers 112 and 114 together as seen in FIG. 4. The first function is that of yielding slack in the ready web to the extent required for the motion of the nip roller 112. This prevents the leading end of the ready web from being pulled back from approximately the horizontal center line of the nip roller 112 as the nip rollers are being brought together to form the splice. The second fucntion which is performed by the buffer roller arrangement is that of providing a fixed position where the running web may be severed from the depleted roll as the leading end of the ready web is spliced to the running web. This is illustrated in FIG. 3 in which it is shown that the web trained over the buffer roller 116 and under the nip roller 112 always passes close to the axis of the pivots 138 regardless of the positions of the rollers 112 and 116.

As seen in FIG. 3, a web severing knife assembly including a knife blade 148 is mounted between the plates 130 so that the blade is aligned with the axis of the pivots 138. A brush 150 is positioned behind the web in line with the path of the blade 148. The knife assembly best seen in FIG. 11 comprises an elongated rectangular piston 160 to which the blade 148 is secured by pins 161. A seal 162 is mounted on the rearward end of the piston 160 by a retainer 164 and undulating springs 166 are provided to urge the blade 148 into a retracted position in a U-shaped body or housing 168 in which the piston 160 is slidable. The springs 166 are interposed directly between the piston 160 and guard plates 169 secured to the forward end of the housing 168. When compressed air is introduced into the chamber behind the piston 160 a short forceful stroke capable of severing the most resistive webs likely to be encountered is imparted to the blade 148 so that it penetrates the web in contact with the brush 150. The brush is mounted in a holder 170 pivoted at 172 so that the brush may be moved out of the way for greater convenience in threading the web around the buffer roller 116 from the supply roll by the cutting position and under the nip roller 112. Tapped openings 174 are formed in the body 178 for connection of appropriate air supply hoses for actuating the blade 148.

The formation of the splice after the simple preparatory steps may be accomplished on command by closing a switch to initiate the splice or the splice may be initiated automatically as is indicated in the above identified Butler et al patent. Starting at a time when web is unwinding from the roll 24 on the roll stand 20, the web roll 90 is picked up at the loading position depicted in FIG. 1 by the roll stand 22. The leading end of the web roll is trained over the buffer roller 118 and after being prepared on a perforated shield (not shown) but corresponding to that indicated at 144 in

FIG. 3 for the nip roller **112,** the leading end of the web roll **90** having been prepared with double faced tape is supported on the nip roller **114** and the roll stand **22** is then returned to a position adjacent the roll stand **20** which is still controlling the unwinding of the web through the festoon **26.** As in the above identified Butler et al patent the festoon **26** feeds an appropriate signal to the brake **66** so that control braking is applied to the unwinding web roll **24.** The spacing and alignment of the two roll stands **20** and **22** before the formation of the splice is accurately determined by a combination latch and stop (not shown) which locates the two roll stands accurately with respect to one another and in line with the festoon **26.** At the time of splice formation both the cylinders **20** and **22** are connected to a supply of compressed air causing both the rollers **112** and **114** to move together. The rollers **114** and **116** are of such length and the mechanism sufficiently loose that the two cylinders **120** and the two cylinders **122** one at each end of each of the nip rollers causes the rollers to establish complete contact, an uninterrupted nip being formed the entire length of the rollers to assure uniform splicing pressure. The formation of the splice as in the above identified Butler et al patent is preceeded by a period of braking to bring the roll **24** to a complete stop so that the web on the roller **112** is stationary when the nip rollers come together to form the splice. Simultaneously with the formation of the splice, compressed air is introduced behind the pistoin **160** to actuate the knife **148** through its web cutting stroke. After the formation of the splice, appropriate valving is employed to shift the control function of the festoon **26** to a brake on the roll stand **22** associated with the web roll **90.**

The usual difficulty of coupling braking devices effectively through a full web roll so as to permit the roll to be brought to an emergency stop has already been mentioned. In order to assist in the coupling, an auxiliary roll-engaging device is shown at the right side of FIG. **5** and includes a web roll edge engaging diaphragm **180** urged into engagement with the edge of the roll by compressed air. The diaphragm **180** is fixedly supported on a rotary plate **182** formed with passages to bring compressed air into contact with the diaphragm which is secured to the plate by concentric rings **184, 186** and **188.** Compressed air impinging upon the diaphragm **180** causes the diaphragm which is sufficiently flexible to billow beyond the retaining rings **184** and **186** and **188** and into engagement with the edge of the web roll. The necessary compressed air is introduced to the diaphragm through a stationary flange **190** integral with the bearing block **54.** The rotary plate **182** has a rotating seal arrangement with the flange **190** and is retained on the flange by a ring **192.** When this auxiliary coupling device is employed, appropriate valving is provided to introduce full line air pressure to the diaphragm **180** at any time that an emergency stop is made while the web supply roll is almost full. The auxiliary web roll coupling can be rendered inoperative either by the manual operation of appropriate valving or automatically by a device which continually measures the diameter of the roll.

Having thus disclosed our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. A web cutting apparatus comprising an elongated blade, a piston coextensive with the blade upon which the blade is mounted, means for removably securing the blade to the piston, a housing in which the piston is slidable and from the open end of which the blade is projectable, means for introducing fluid under pressure between the piston and the closed end of the housing to project the blade from the open end of the housing and into cutting engagement with adjacent web, guard plates partially closing the open end of the housing, but allowing the blade to be projected beyond the guard plates and a spring interposed between the guard plates and the piston to cause retraction of the blade when pressurized fluid is exhausted from the housing.

* * * * *