

Sept. 14, 1954

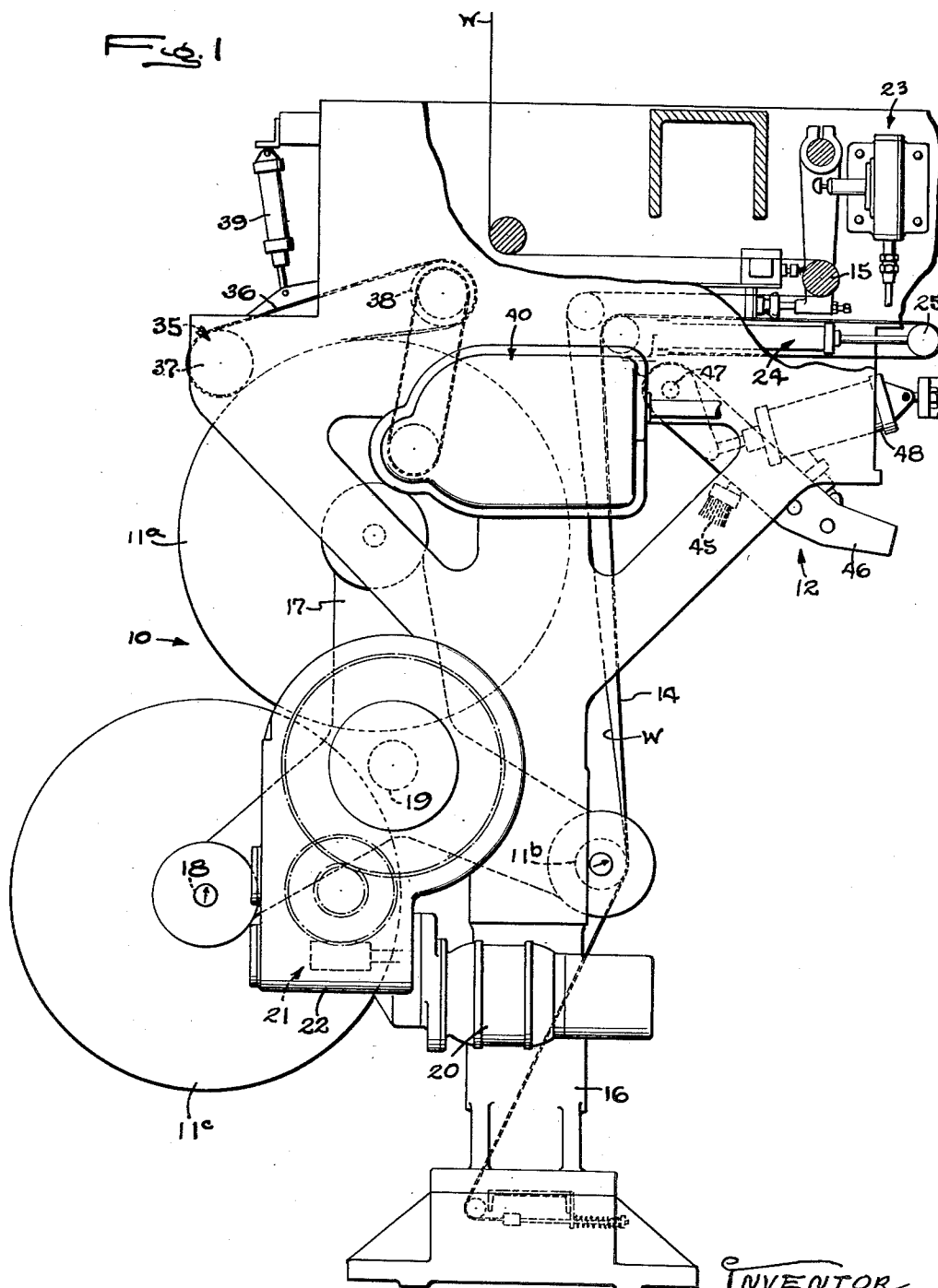
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2,689,095

WEB SUPPLY MECHANISM FOR PRINTING PRESSES

Filed July 31, 1951

9 Sheets-Sheet 1



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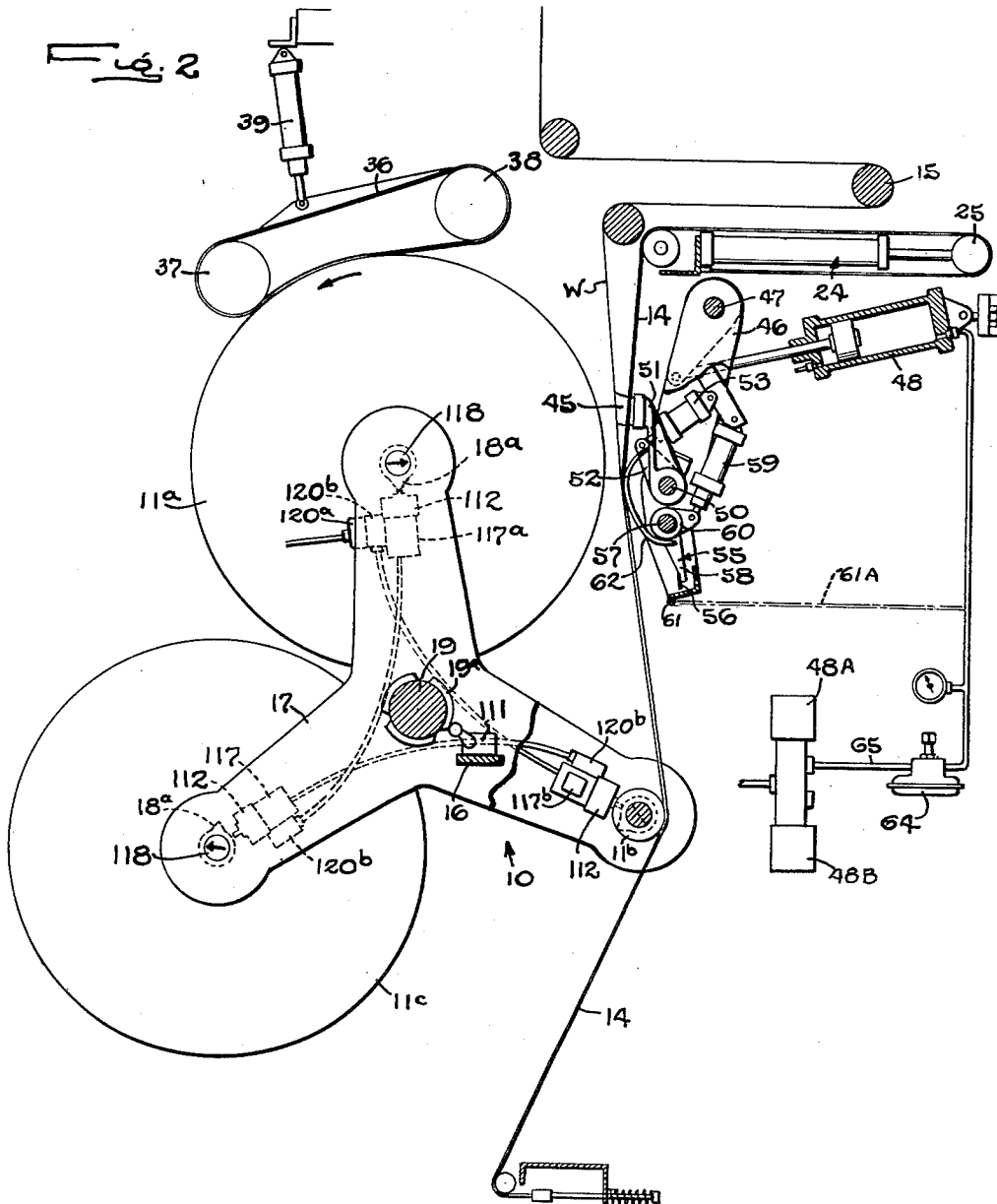
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9 Sheets-Sheet 2



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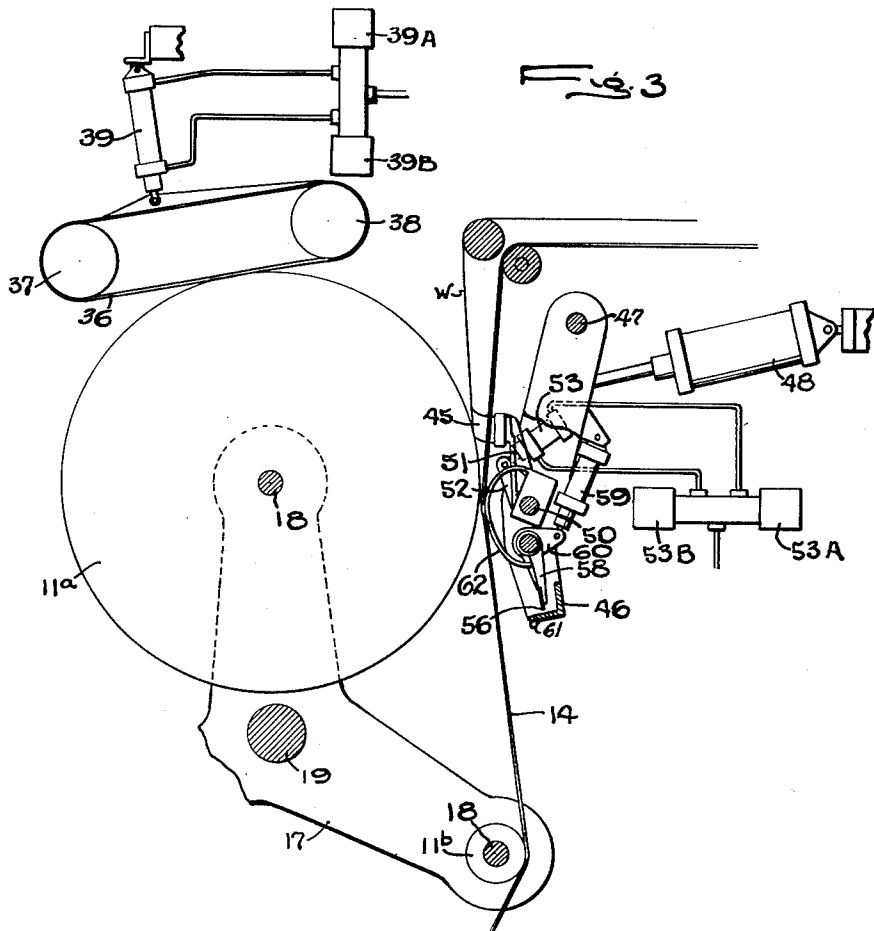
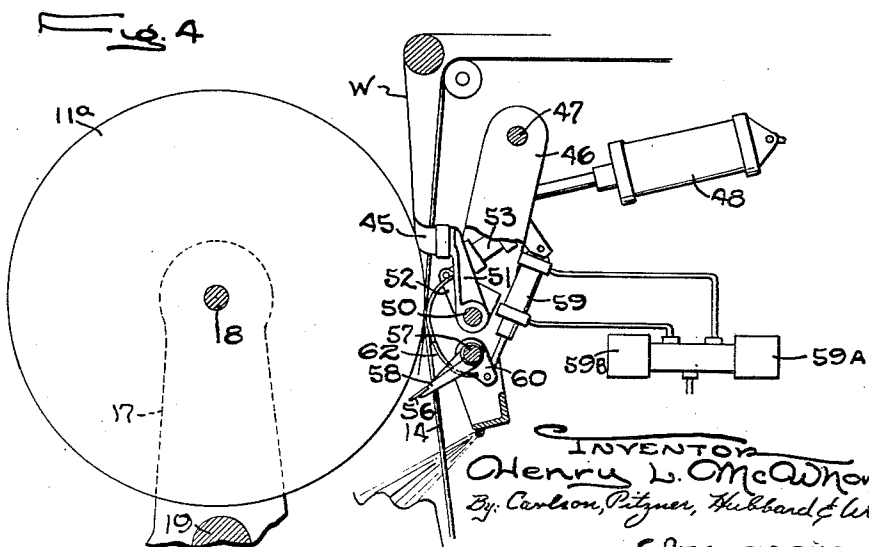
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9 Sheets-Sheet 3



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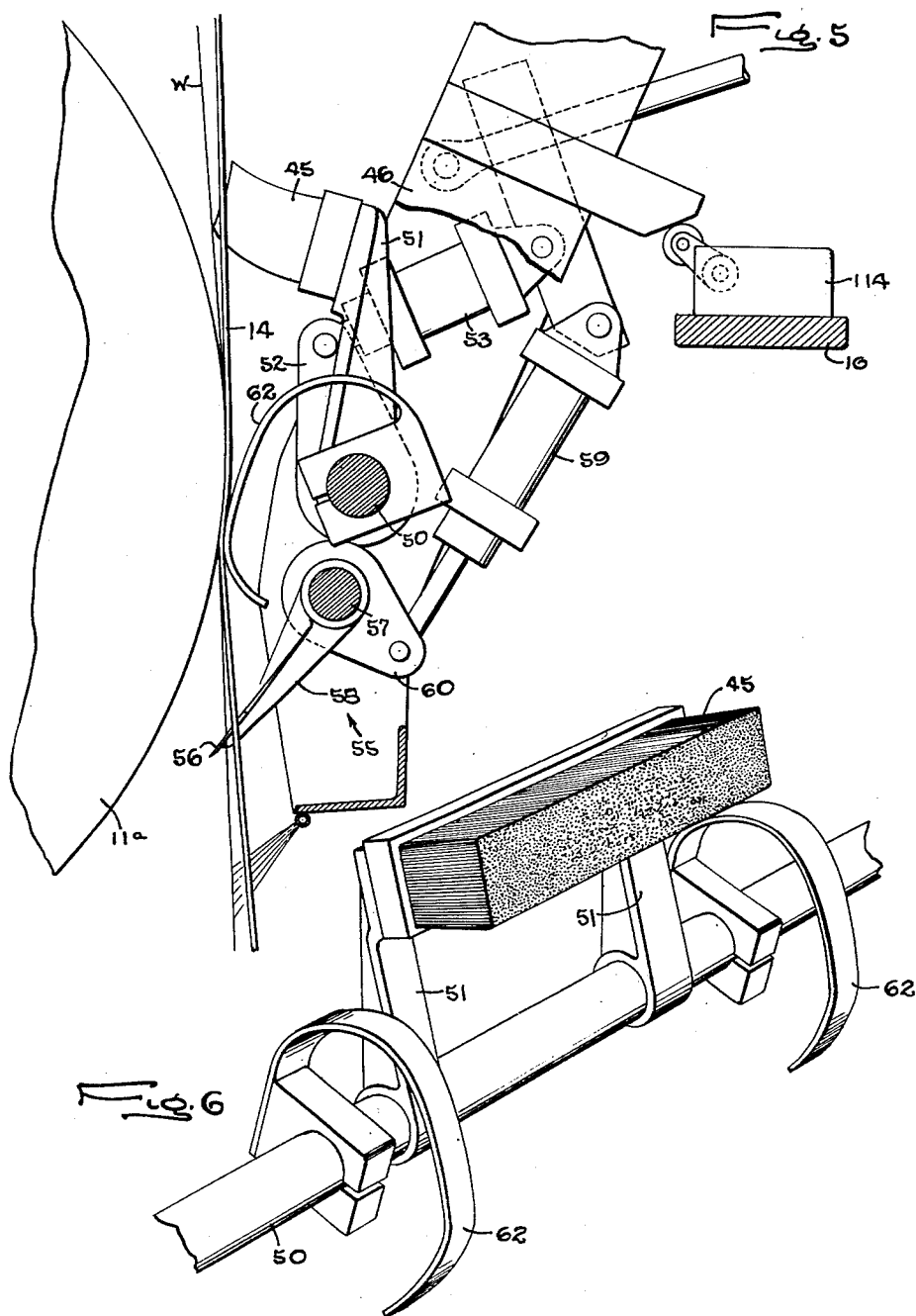
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9 Sheets-Sheet 4



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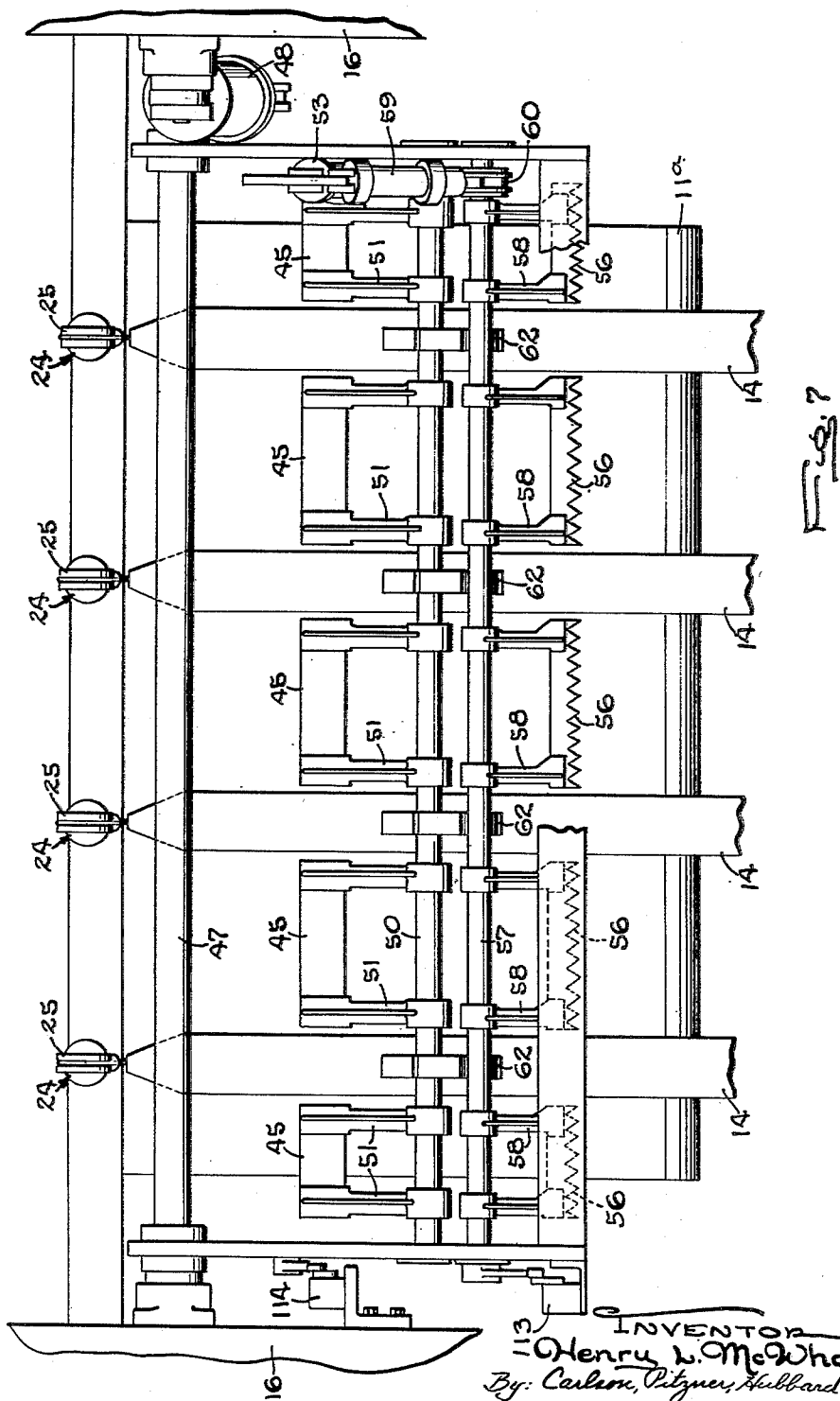
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9 Sheets-Sheet 5



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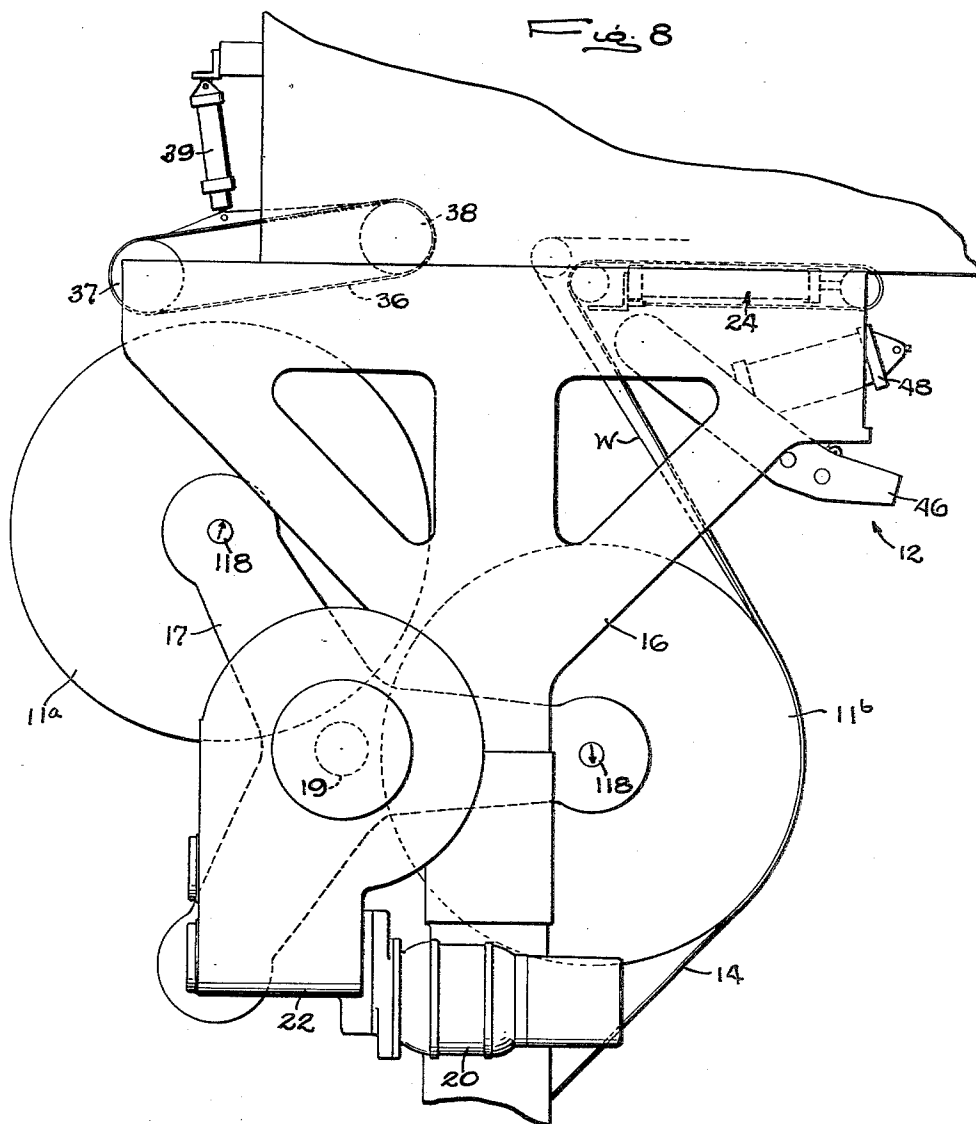
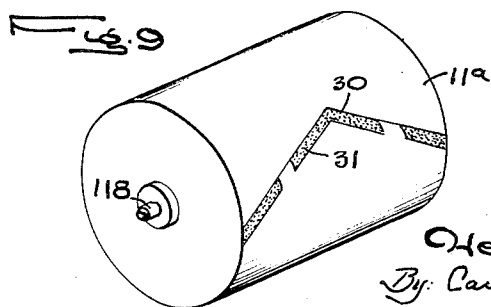
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9 Sheets-Sheet 6



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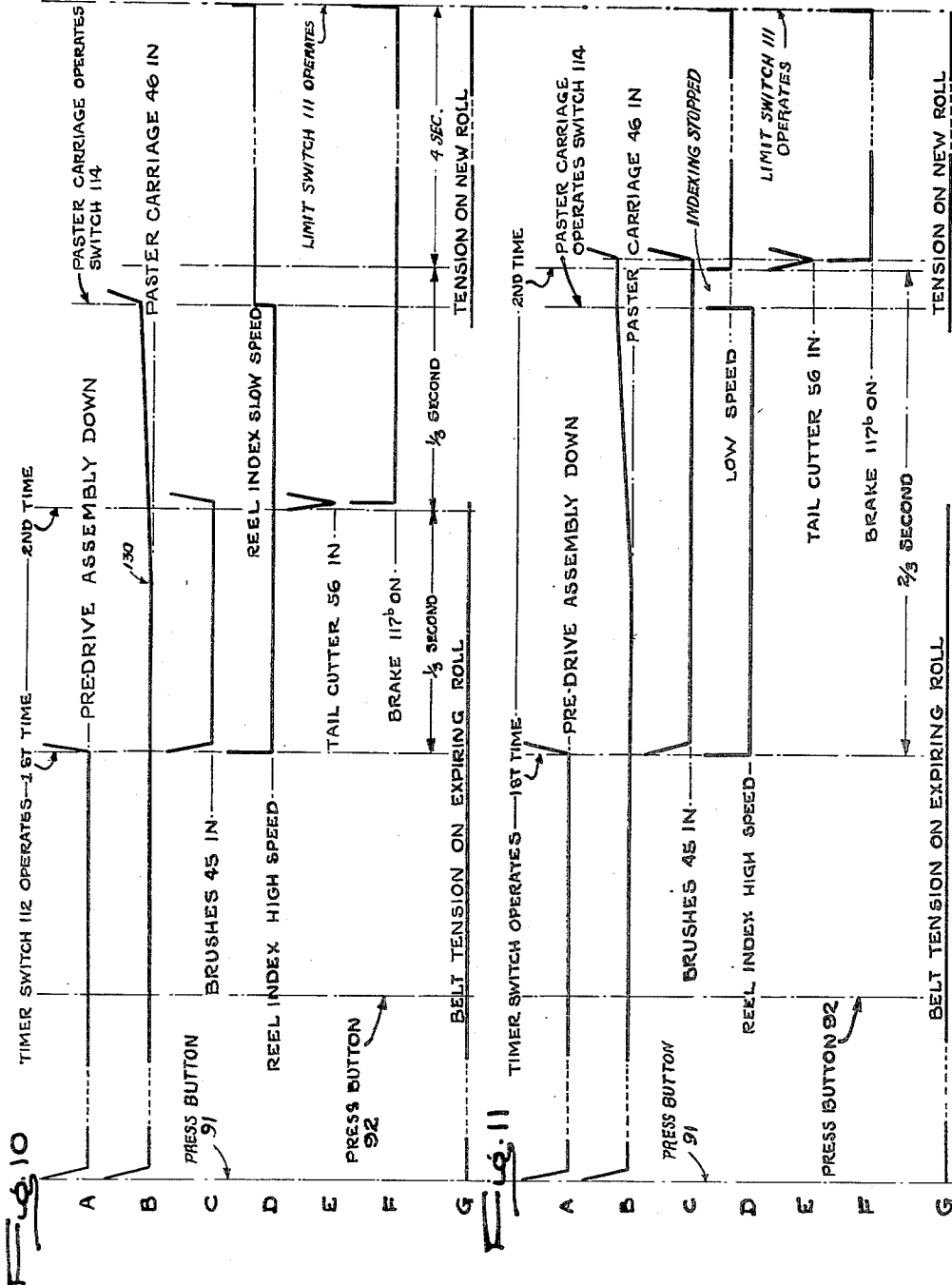
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9 Sheets-Sheet 7



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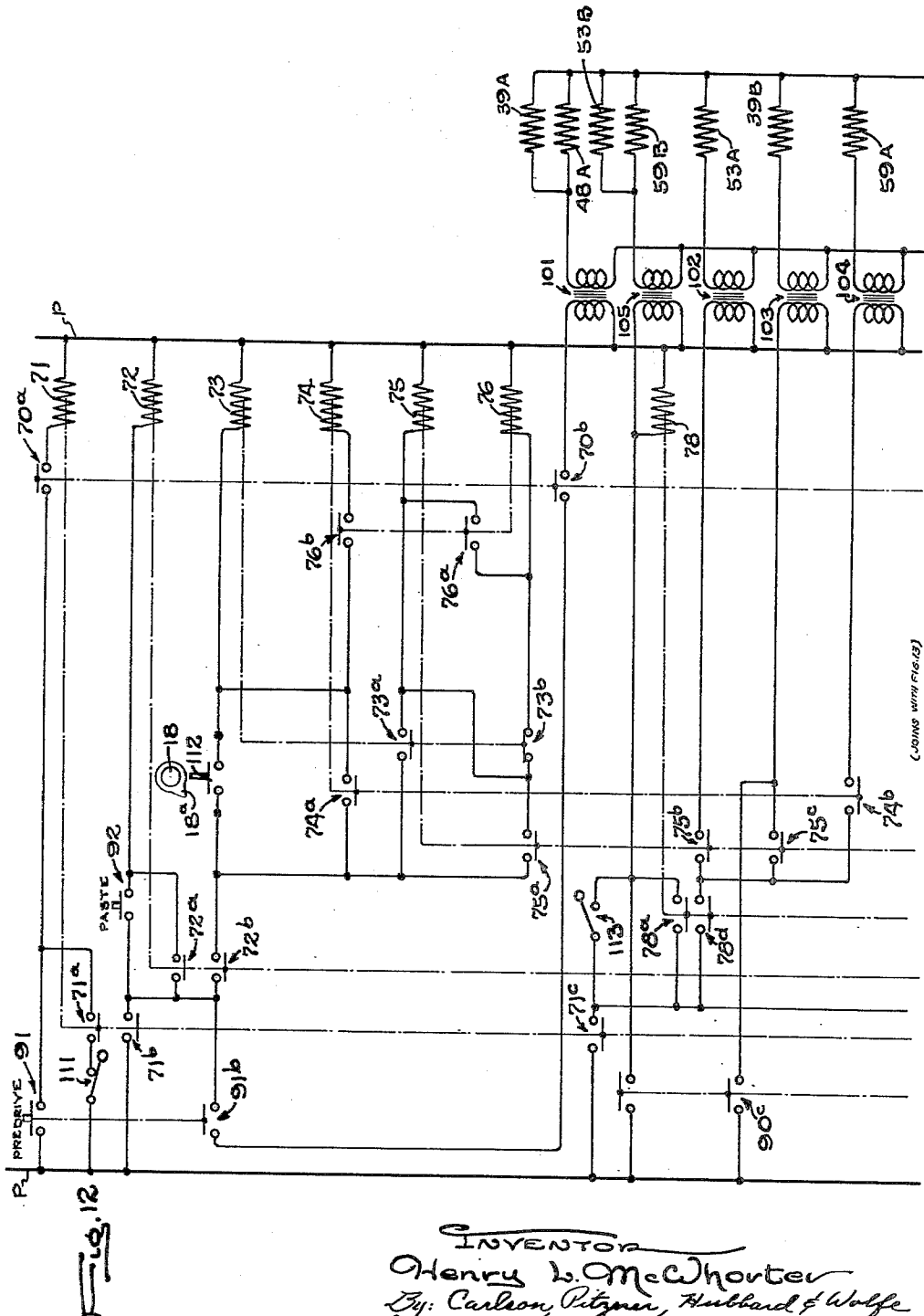
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WEB SUPPLY MECHANISM FOR PRINTING PRESSES

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9 Sheets-Sheet 9

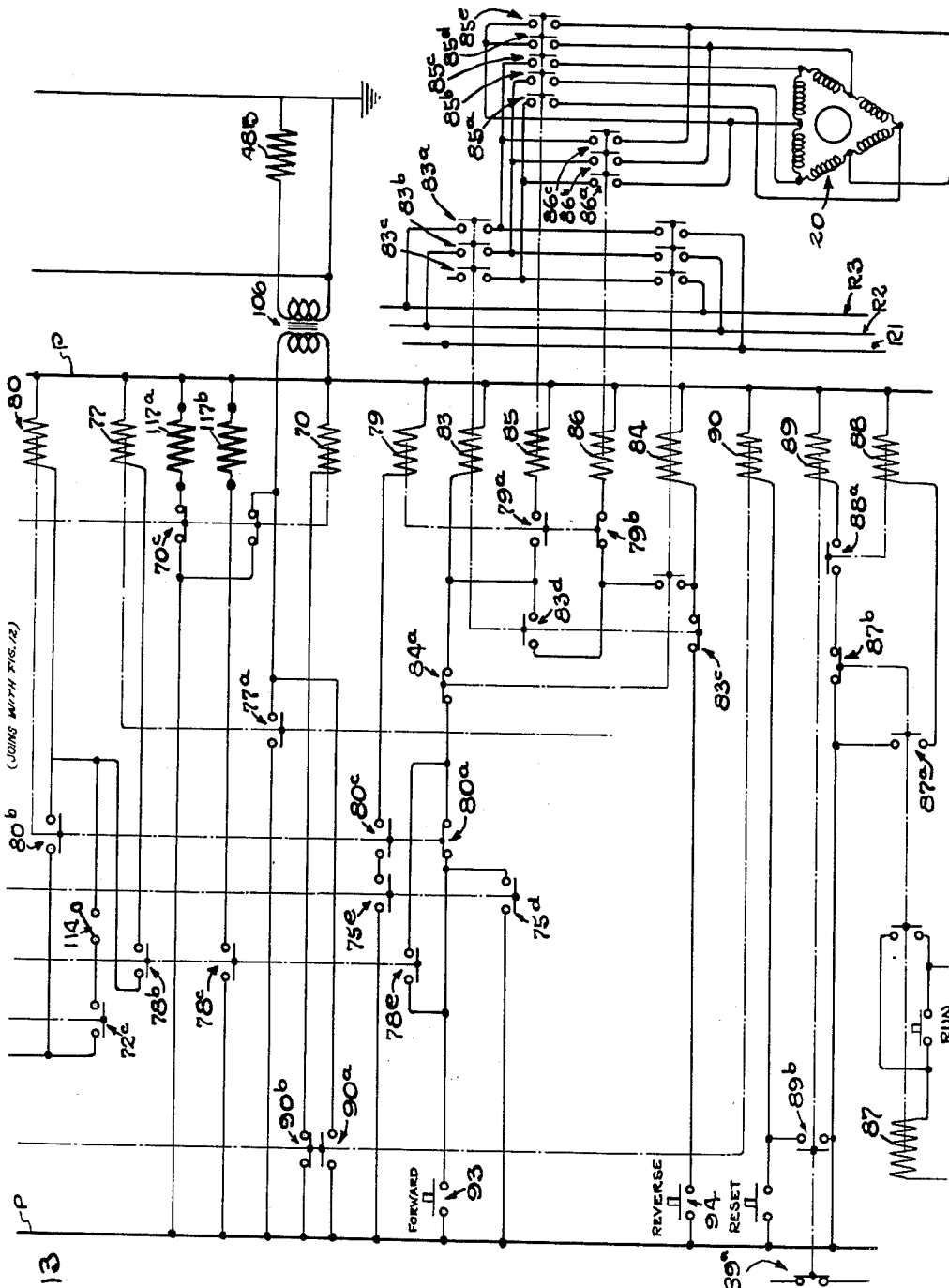


Fig. 13

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UNITED STATES PATENT OFFICE

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WEB SUPPLY MECHANISM FOR PRINTING PRESSES

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Application July 31, 1951, Serial No. 239,542

6 Claims. (Cl. 242—58)

1

The present invention relates generally to web fed printing presses and more particularly to the supply of the paper web thereto.

Successful operation of presses of the above character, particularly those employed in the printing of newspapers depends in large measure on the maintenance of a continuous supply of paper thereto. Press installations for this purpose thus include, in addition to the actual printing press itself, apparatus generally referred to as a paper reel. The reel includes supporting means for a roll of paper, called the running web roll, from which the paper web is withdrawn and supplied to the press and for a new or reserve roll of paper from which the press is to be supplied upon expiration of the running web roll. It also includes means for effecting a splice or paster of the leading end of the paper on the new roll to the running web as the running web roll is about to expire so that paper supply to the press is uninterrupted. In addition to the foregoing, paper reel installations include means for controlling the tension in the running web of paper as it is supplied to the press.

It will be apparent to those skilled in the art that the truly critical period in the operation of press installations of this character, especially at the high speeds required in the publication of a large daily newspaper, is when the web supply is changed from the expiring roll to the new roll, that is, at the time when the paster is made. It has been found that in order for pasters to be made successfully so that the changeover of paper supply from the old to the new rolls obtains without a break in the web occurring, web tension must be maintained substantially constant. It will be obvious that a sudden increase in web tension will result in a web break, and a decrease in web tension will permit a momentary oversupply of paper which when taken up by the press will result in a sudden jerk on the web with a consequent break therein.

Running web tension is normally controlled through the application of a braking force to the periphery of the running web roll by means of belts. Such belts therefore must partially wrap around the running web roll in order to be effective. It will be apparent that as the running web roll is about to expire the new roll must be moved into position to take its place. Nevertheless, as long as the paper web is being supplied from the expiring roll, the belts must be effective to apply a braking force thereto to maintain tension control of the running web. Thus the belts are not normally capable of applying a braking

2

force to the periphery of the new roll until the new roll has been moved far enough into the belts so that some wrap-around of the belts thereon obtains.

It is an object of the present invention to provide improved means for effecting pasters which will operate reliably over the range of press speeds and in which the risks of making pasters at high speeds are largely eliminated.

Still another object is to provide means for effecting pasters which not only is reliable in operation but is also of durable and simple construction and which permits of economical manufacture.

A more specific object of the invention lies in the provision of means for maintaining tension in the running web during the period of transfer of web supply from the expiring roll of paper to the new roll of paper to the end that the transfer can be effected even at high press speeds.

Another object of the invention is to provide two-speed reel indexing: first, a relatively high speed to quickly attain web tension control of the web supplied from a new paper roll by the normal tension control means; and a relatively low speed thereafter to allow time for the normal tension control means to adjust itself to accommodate the new roll and to facilitate positioning of the paper roll supporting means.

A still further object of the invention is to eliminate flutter in the running web from the expiring web roll as a paster is about to be effected so as to preclude the making of a paster prematurely and also to get the severed web portion or tail of the expired web roll quickly out of the way after a paster has been effected.

The objects of the invention thus generally set forth together with other objects and ancillary advantages are obtained by the construction and arrangement shown by way of illustration in the accompanying drawings, in which:

Figure 1 is a side elevation of a paper web supply assembly for a printing press embodying the features of the present invention and illustrating component relationship as a paster is about to be effected.

Figs. 2, 3 and 4 are fragmentary side elevational views similar to Fig. 1 but illustrating various relative positions of the web supply assembly at successive steps during the making of a paster.

Fig. 5 is a fragmentary side elevation of the paster carriage and its associated components.

Fig. 6 is a fragmentary perspective view of a portion of the paster carriage illustrated in Fig. 5.

3

Fig. 7 is a fragmentary front elevation of the paster carriage and its associated components shown in Fig. 5.

Fig. 8 is a side elevation like Fig. 1 but showing component relationship after a paster has been completed.

Fig. 9 is a perspective view of a new paper roll prepared for making a paster.

Figs. 10 and 11 are operational charts indicating the sequence of events in making pastings at high speed and low speed respectively.

Figs. 12 and 13 are a schematic line-to-line diagram illustrative of a suitable electric circuit for controlling the operation of the instant web supply mechanism.

While the invention is susceptible of various modifications and alternative constructions, there is shown in the drawings and will herein be described in detail the preferred embodiment, but it is to be understood that it is not thereby intended to limit the invention to the form disclosed, but it is intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring more particularly to the drawings, there is shown a paper web supply assembly comprising, in general, a reel 10 for supporting paper rolls 11a, 11b, and 11c from which a paper web W is fed to a printing press (not shown); a paster mechanism 12 for joining the leading end of the paper of the new roll 11a to the running web W from the expiring roll 11b; and a web tension control system including stationary belts 14 and a floating roller 15 engaging in a loop in the running web W. The reel 10 includes a pair of upright supporting frames 16 of generally Y-shape which comprise the support for the entire web supply assembly.

The reel 10 is disposed between the frames 16 and includes a pair of spaced, three-arm spiders 17 for the support of spindles 18 upon which the paper rolls 11a, 11b and 11c are rotatably mounted. The spiders 17 are carried by a central shaft 19 which is journaled on the Y-frame supporting structure 16. The central shaft 19 and the spiders 17 are adapted to be rotated by means of a two-speed, constant torque motor 20 through the medium of a suitable speed reduction gear train 21 enclosed within a housing 22.

The motor 20 is effective to index the rolls of paper 11 between three primary positions; a loading position, a reserve position, and an operative feeding position. These positions are shown particularly in Figure 8 wherein the arm of the spider 17 supporting the running web roll is substantially horizontal.

The web tension control system, per se, forms no part of the present invention. For details thereof reference is made to copending application, Serial No. 304,405, filed August 14, 1952. Suffice it to say for present purposes that the web tension control system, which includes the stationary belts 14 and the floating roller 15, is effective to maintain a particular desired web tension in the running web W, by the application of a braking force to the running web roll 11b by the engagement of the belts 14 with the periphery thereof. The floating roller 15 which, as previously noted, is disposed in a loop in the running web is effective to sense changes in web tension from the particular desired tension setting and upon so doing is operative through suitable mechanical linkage with a jet pipe hydraulic regulator 23 to control the supply of pressure

4

fluid to a hydraulic actuator 24 for the belts 14. The latter comprises a piston and cylinder operators for extending and retracting tension pulleys 25 engaged in loops in the belts 14 so as to effectively lengthen or shorten the same. Thus the braking force applied by the belts to the running web roll 11b is altered to compensate for tension variations from a particular control setting.

The present invention contemplates a construction and arrangement which is exceedingly simple yet nevertheless is effective to join the leading end of the paper on the new roll 11a to the running web W from the roll 11b as the latter is about to expire, and to do so without the necessity for either stopping the press or reducing its speed. In order to accomplish the above aim, it will be apparent that the new roll 11a must be initially rotated so as to have a peripheral speed substantially equal to that of the running web, and the leading end of the paper thereon must be prepared so that it can be joined to the running web simply by pressing the two together.

For the latter purpose the leading end of the paper on the roll 11a is prepared substantially as shown in Fig. 9. It will there be seen that the leading end of the paper is formed into a substantially right angular point 30 which is releasably attached to the body of the paper roll. Along the leading edges of the end of the paper a suitable cement is applied as indicated at 31, which cement has the property of remaining sticky.

In order to bring the new roll 11a up to press speed, a predrive mechanism 35 is provided. The predrive mechanism includes belts 36 which run about spaced pulleys 37 and 38 and are adapted to be moved into engagement with the peripheral surface of the reserve roll 11a by means of a pneumatic actuator 39. The belts 36 are adapted to be driven by means of an endless belt between the pulley 38 and a differential mechanism indicated generally at 40, the latter being driven from the main press drive shaft (not shown).

When the new web roll 11a has been brought up to press speed, the reel 10 is indexed so as to position the surface of the new roll in closely spaced relation to the running web W. In order to effect the joining of the leading end of the paper on the roll 11a with the running web W, not only is the new roll 11a indexed into the path of the running web, but also, and simultaneously with the indexing, the running web is deflected out of its normal path and into engagement with the new roll 11a. For this latter purpose the paster 12 includes a set of web engaging brushes 45 which are carried by and are movable with respect to a carriage 46. The carriage 46 is pivotally supported on a transverse shaft 47 which is journaled between the Y-frames 16 for movement toward and away from the running web. As shown, movement of the carriage 46 toward and away from the running web W is effected by means of a pneumatic cylinder and piston actuator 48 which also is supported on the frame 16.

The brushes 45 are rockably supported on the carriage 46 for movement toward the running web W to deflect the same out of its normal path. Thus the brushes are mounted on a transverse rock shaft 50 by means of arms 51 which are suitably apertured to receive the rock shaft. The rock shaft 50 is journaled at its ends on the carriage 46 and adjacent one end thereof is

5

equipped with a rigid lever 52 which extends radially therefrom. As shown, the outer end of the lever is connected to the piston of a pneumatic actuator 53 by means of which it is adapted to be rocked. It will be apparent that the lever 52, the rock shaft 50 and the brush supporting arms 51 form in effect a bell-crank so that upon operation of the actuator 53 the brushes are rocked with respect to the carriage 46 and into the running web W to deflect the same into engagement with the peripheral surface of the new roll 11a as the new roll is indexed toward the running web. When the glued leading end of the paper of the new roll 11a, upon rotation thereof, comes into contact with the running web, a paster is effected, and the paper is led from the new roll along with the running web W up into the printing press.

After the paster has been effected and the leading end of the paper from the roll 11a has been drawn upward into the printing press, the paper from the new roll becomes the running web and the paper from the old roll 11b must be severed. For this purpose the paster carriage 46 is equipped with a tail cutter 55 which includes a row of serrated knives 56 extending transversely of the web W. The knives 56 are supported on a rock shaft 57 by means of supporting arms 58. The rock shaft 57 is journaled at its ends on the carriage 46 and, as shown, is adapted to be rotated by means of a pneumatic actuator 59 acting through a lever 60 rigid with the shaft 57.

To eliminate flutter in the running web from the expiring web roll 11b as a paster is about to be effected, to preclude premature contact of the running web W with the glued leading edge of the paper on the new web roll 11a, and further to get the severed tail of the expired web roll quickly out of the way after a paster has been effected, air jet means is provided for applying a current of air against the running web W. As shown in the drawings, this means comprises small pipe 61 disposed along the lower forward edge of the paster carriage 46 and which is provided with a longitudinally spaced series of small holes. Suitable connection (indicated diagrammatically at 61A in Fig. 2) is made between the jet pipe 61 and the air line supplying compressed air to the rear cylinder chamber of the carriage actuator 48 to the end that upon admission of compressed air to such chamber to advance the carriage 46 and maintain the same in its lowered position, compressed air is simultaneously supplied to the pipe 61. This compressed air, finding its way through the pipe and the holes therein is thus directed as line jets entirely across the running web W. These jets of air have been found to effectively eliminate flutter in the running web which is due to irregularities in the contour of the expiring web roll 11b as it approaches its core. The location of the air jets along the lower edge of the paster carriage 46 thus eliminates the flutter prior to the approach of the web to the new web roll 11a. By the same token, the air jets are effective, as indicated in Fig. 4, to blow the tail of the paper from the expired web roll 11b inwardly and downwardly and thus out of the way immediately upon its severance by the action of the tail cutter 55.

As hereinbefore noted, the key to making successful pasters is to maintain substantially constant tension in the paper web supplied thereto. It will be apparent upon an inspection of

6

the drawings that at the moment that the paster is made the new roll has not reached a point far enough in its path of movement to press into the belts so as to effect sufficient wrap-around thereof so that the belts can apply a braking force to the new roll. The reason for this is that the belts are so positioned as to maintain wrap-around engagement with the expiring roll 11b to control the tension of the running web W as it is withdrawn therefrom until the same is severed by operation of the tail cutter 55.

In carrying out the invention, therefore, provision is made for the application of a braking force to the new web roll 11a when the paster is made as an incident to the relative movement between the new roll and the paster assembly 12. More particularly, a braking force is applied to the roll 11a by indexing the roll at high speed toward the paster assembly and into the belts 14, the paster assembly being operative to hold the belts against the new roll with a constant force. To this end, the carriage 46 is equipped with arcuate feet 62 which correspond in number and spacing to the belts 14 and are adapted to engage the belts and deflect the same toward the new roll 11a as the carriage 46 is moved toward the running web by operation of the carriage actuator 48. The actuator 48, as previously noted, is pneumatically operated and the compressed air supplied thereto is maintained constant under the control of a suitable pressure regulating valve 64 interposed in its supply line 65 which in turn is connected to a suitable source of compressed air (not shown). Thus the arcuate feet 62 are operative to exert a constant force on the tension belts 14 to press the same into engagement with the new roll 11a. As the reel 10 is indexed, the new roll 11a, of course, exerts a force against the belts and therefore against the feet 62 as well. Since the feet 62 are held against the belts with a constant force as determined by the air pressure supply to the actuator 48, continued indexing of the reel 10 will cause the feet 62 and the paster carriage 46 to be moved outwardly or to the right (as shown in the drawings) as the new roll 11a is moved toward normal operative web feeding position. When movement of the roll 11a has progressed so that there is sufficient wrap-around of the belts 14 thereon, and thus the belts are capable of applying sufficient braking force to maintain normal web tension through the operation of the tension control system, the carriage actuator 48 is operated to retract the carriage 46 into its out-of-the-way position. At the same time, high speed indexing is stopped and movement of the new roll 11a into normal operating position, as shown in Fig. 8, progresses at slow speed.

The slow-speed indexing of the reel 10 into the position shown in Fig. 8 facilitates accurate location of the spider arms 17 between which the old web roll 11b was supported in loading position where the core of the roll 11b can be removed and a new paper roll 11c loaded thereon. This new roll of paper, which may weigh about a ton, is ordinarily transported to the reel 10 on a suitable dolly or the like. Because of its weight, and because of space limitations, accurate positioning of the spider arms to receive the same is necessary so that the new roll 11c can be supported on the spindles 18 without necessity for lowering or raising the roll.

As hereinbefore noted, braking force applied by the belts 14 to the periphery of the web supplying roll is under the control of the hydraulic

actuator 24. Since the new roll 11a from which the web is now being supplied to the press is of considerably larger diameter than that of the expired web roll, a correspondingly greater belt length must be provided to accommodate the new roll. Thus it is necessary that the piston of the actuator 24 and the tension pulley 25 carried thereby be retracted so as to afford the necessary additional belt length. The retracting force is of course derived from the indexing of the new roll into the belts. By indexing the new web roll 11a at slow speed toward the position shown in Fig. 8, the normal operating position, sufficient time is allowed for the relatively large volume of the hydraulic fluid behind the piston of the actuator 24 to be expelled from the actuator.

Electrical control system

In the illustrative embodiment of the invention a suitable electric circuit, as shown in Figs. 12 and 13 is utilized to control the operation of the elements of the above-described paper web supply mechanism. This control circuit includes relays 70—90, push button type switches 91—94, transformers 101—106, and limit switches 111—114. Contacts which are operatively associated with, i. e. open and closed by, particularly relays are denoted by the reference numeral assigned to the relay followed by a suitable lower case letter suffix, "a", "b", "c", etc. Solenoid operated valves for controlling the supply of compressed air to the various pneumatic actuators will also be included in the following discussion. Thus the solenoids are denoted by the same reference numeral applied to the actuator with which they are associated with an upper case suffix, "A", "B", etc.

Referring more particularly to Figs. 12 and 13 of the drawings, the electric control is there shown in the condition for normal press operation before the making of a paster is undertaken. Thus relay 70 is energized and relays 71—82 inclusive are de-energized; all pneumatic actuators and operators 39, 48, 52 and 59, respectively, for the predrive assembly 35, the paster carriage 46, the brushes 45 and the tail cutter 55, are in retracted position. The limit switch contacts 111—114 are open.

When the printing press attendant observes that the running web roll 11b is about to expire so that it is necessary to transfer web supply from the roll 11b to the new roll 11a, he first ascertains that the new roll 11a is in the position shown in Fig. 1 and then operates the predrive push button 91. This first energizes the relay 71 since its coil, together with predrive push button 91 are in series with contacts 70a of the relay 70 across the power mains P—P. The contacts 70a are closed since the relay 70 is energized as noted above. Upon operation of relay 71, its contacts 71a and 71b are closed. The predrive push button 91 is equipped with an additional set of contacts 91b which are also closed upon operation of the relay 71 so as to complete a series circuit consisting of the primary of transformer 101, the contacts 70b of relay 70, and the contacts 71b of the relay 71.

Upon energizing the primary of the transformer 101, its secondary energizes the predrive and paster carriage actuator solenoids 39A and 48A. The armatures of those solenoids are directly connected with the pneumatic control valves for the predrive and paster carriage actuators 39 and 48, respectively. Upon actuation of the solenoids, they are operative to open the valves to supply compressed air to the actuators

so as to lower the predrive belts 36 into contact with the periphery of the new paper roll 11a and to move the paster carriage from its retracted, out-of-the-way position shown in Fig. 1 into its lowered position as shown in Fig. 2. Upon indexing the reel 10 into the position shown in Fig. 1, limit switch 111 was closed by means of a cam actuator 19a disposed in coaxial relation with the central reel shaft 19 (Fig. 2). With the limit switch 111 closed, the relay 71 remains energized through its contacts 71a, the limit switch 111, the contact 71a and the relay coil 71 being in series between the power mains P—P (self-holding).

When the relay 71 is energized thus closing, in addition to its self-holding contacts 71a, the contacts 71b, a circuit for operating the actuator 53 for the web deflecting brushes 45 is conditioned for completion by the action of the press attendant at the moment that he determines that the paster should be made. When that moment arrives, the attendant presses the paster push button 92. In so doing, relay 72 is energized closing its contacts 72a, 72b and 72c. The contacts 72a bridge the push button 92 so as to maintain the relay 72 energized (self-holding). Upon closing the contacts 72b, a timing circuit including relays 73, 74, 75 and 76 is conditioned for operation, which can take place upon closing of limit switch 112. The limit switch 112 is disposed on the spider arm supporting the new paper roll 11a and is adapted to be actuated by a cam 18a rotatable with the paper roll spindle 18 supported by the spider arms 17. It will be apparent, therefore, that the sequence of events to follow are timed in accordance with the speed of rotation of the new web roll 11a. For this reason, each of the spider arms 17 is equipped with a similar cam actuator 18a and timing limit switch 112 for sequence control when they support a paper roll which will be the new web roll. It is necessary, however, to describe only one actuator and switch since the others are identical with it.

For proper operation of the timing limit switch 112 by the cam operator 18a therefor, care must be taken in preparing the leading end of the paper on the new web roll 11a to insure that the peripheral extent of the paste or glue applied thereto is only to a point immediately opposite the limit switch cam operator 18a. For this purpose, a suitable indicator such as an arrow 118 is provided on the outer end of each spindle 18 to indicate the position of the cam operator 18a and thereby denote the limit point for the glue along the roll upon initially preparing the same.

Having conditioned the timing circuit upon operation of the paster push button 92 with the consequent closing of the relay contact 72b, upon rotation of the paper roll 11a and its spindle 18 the limit switch 112 is closed by the cam 18a. Thus the relay 73 is energized so as to close its contacts 73a. When the contacts 73a close, the relay 75 is energized thereby closing its contacts 75a, 75b and 75c. The contacts 75a are the self-holding contacts for the relay 75. The contacts 75b, upon closing, complete a series circuit including additionally the relay contacts 71c and the primary of transformer 102, which series circuit is across the power mains P—P. The secondary of the transformer 102 then serves to energize the solenoid operator 53A for opening the pneumatic supply valve to the belt deflecting brush actuator 53.

Also upon energizing the relay 75 its contacts 75c are closed to complete a series circuit through the contact 71c of the relay 71 and the primary

of transformer 103. The secondary of the transformer 103, thus energized, is effective to operate a solenoid 39B to supply compressed air to the predrive actuator 39 to retract the predrive assembly 35. The relay 75 is equipped with still other sets of contacts 75d and 75e so that simultaneously with the retraction of the predrive assembly 35 and with the operation of the web deflecting brush actuator 53, relay 33 is energized by the completion of a series circuit between the power mains P—P which circuit includes in addition to the contacts 75d the normally closed contacts 80a of relay 80, the normally closed contacts 84a of relay 84 and the coil of relay 33. Upon energization of the relay 33, its contacts 83a—83d are closed so as to condition the reel motor power circuit for forward operation. The latter circuit includes a conventional three-wire power line, R₁, R₂, and R₃. When the relay 75 was energized so that its contacts 75e were closed, relay 79 was energized through the completion of a series circuit including in addition to the coil of the relay 79 and the contacts 75e, the normally closed contacts of relay 80. The relay 79 operates to close its contacts 79a and to open its normally closed contacts 79b. When the contacts 79a and 79b are respectively closed and opened, relays 85 and 86 are respectively energized and cut out of the circuit. Upon energization of relay 85, its contacts 85a—85e are closed so that the reel motor 20 is not only operated in a forward direction but also at high speed.

After the cam operator 18a passes the limit switch 112 the limit switch opens thereby de-energizing the relay 73, opening its contacts 73a and closing its contacts 73b. When the contacts 73b close, the relay 76 is energized by the establishment of a series circuit including the coil of the relay 76, the contacts 75a, 72b and 71b, in addition to the contacts 73b, which series circuit is across the power mains P—P. The relay 76 operates to close its contacts 76a and 76b, the former being operative to maintain current flow through the coil of the relay 76 so that it is self-holding.

Upon closing the contacts 76b, the series circuit comprising in addition to such contacts the coil of relay 74, its contacts 74a, the contacts 72b, and the contacts 71a, is conditioned for operation. After the roll 11a has made one complete revolution, the timing limit switch 112 is again closed by means of the cam operator 18a. This completes the above-mentioned series circuit that was conditioned upon closing of the relay contact 76b. The relay contacts 74a maintain the relay energized and thus self-holding.

Upon completion of the energizing circuit for the relay 74 so that the same is operated, its contacts 74b are closed thereby energizing the primary of transformer 104. The secondary of transformer 104 thus becomes effective to operate the solenoid 59A to open the pressure fluid supply valve for the tail cutter actuator 59 so as to move the tail cutter into engagement with the running web from the expiring roll 11b to sever the same.

At the end of the forward stroke of the tail cutter 55, it engages a limit switch 113 to close the same. When the limit switch 113 is closed, relay 78 and the primary of transformer 105 are energized through the completion of a series circuit which, in addition to the coil of relay 78 and the primary of transformer 105 and the limit switch 113, includes the contacts 71c of

the relay 71. The relay 78 by means of its contacts 78a is self-holding upon energization thereof, and when it is energized its contacts 78b are closed thereby completing a circuit through relay 77, the contacts 80b of relay 80, and the contacts 71c of relay 71 between the power mains P—P. Upon the energization of relay 78, an additional set of contacts 78c are also closed thereby completing a circuit which additionally includes a solenoid 117b carried by the spider arms 17 supporting the expiring roll 11b. This solenoid 117b is operative to apply a brake (not shown) to the spindle 18 supporting the expiring roll 11b to stop the same and thus minimize the amount of paper run off after the web being drawn therefrom is severed by the tail cutter 55.

Energization of the primary of the transformer 105 results in the production of a current in its secondary so as to operate solenoids 53B and 59B respectively carried by the web deflecting brush actuator 53 and the tail cutter actuator 59 to operate the pressure fluid control valves thereof in such manner that the actuators retract the brushes 45 and the tail cutter 55.

At the same time, normally closed contacts 78d of the relay 78 are opened thereby de-energizing transformers 102, 103 and 104.

It will be recalled that all during this time the reel motor 20 is indexing the new web roll 11a at high speed into the belts 14 and against the feet 62 of the paster carriage 46 thus moving the same rearwardly. Mounted on the supporting structure 16 is a limit switch 114 which is adapted to be engaged by the carriage 46 when the new web roll 11a is into the belts far enough for the belts to exert sufficient braking force thereon for web tension control by the operation of the tension control system (the latter including in addition to the belts 14, the belt actuator 24, pressure regulator 23 and floating roller 15). When the limit switch 114 is closed the relay 80 is energized since its coil is in a series circuit including in addition to the limit switch 114 the contacts 72c of relay 72 and contacts 71c of relay 71. It might be noted at this point that the contacts 72c of the relay 72 are included in the circuit so as to prevent completion thereof as the carriage 46 is advanced because the relay 72 is not operated until after the carriage 46 has been fully advanced. As previously noted, the relay 80 is self-holding by means of its contacts 80b.

Upon operation of the relay 80 its normally closed contacts 80c are opened thereby de-energizing relay 79 which is included in the series circuit with the contacts 80c. Upon de-energizing the relay 79, its contacts 79a are opened and 79b are closed. As a result of the opening of contacts 79a the relay 85 is de-energized thereby opening its contacts 85a—85e.

With the closing of relay contacts 79b, relay 86 is energized, thereby closing its contacts 86a, 86b and 86c. These latter contacts are inserted in the supply lines for the reel motor 20 from ordinary three-phase power mains R₁, R₂ and R₃. Thus, with the high-speed circuit opened, the motor then indexes the reel 10 at low speed toward its normal operative feeding station as indicated in Fig. 3.

It will be recalled that when the relay 78 is actuated its contacts 78b complete the circuit including the coil of relay 77 so as to energize the same. When the relay 77 is energized its contacts 77a are closed thereby energizing the primary of transformer 106. The secondary of transformer 106 is included in a series circuit

including a solenoid 48B. The solenoid 48B is operative to move the control valve for the paster carriage actuator 48 into position whereby the actuator retracts the carriage 48 into its out-of-the-way position.

The foregoing sequence of operations having been completed, the pasting operation is now completed. The reel motor 20, however, continues to operate indexing the new web roll 11a toward the position shown in Fig. 8. When it reaches such position, the limit switch actuator 111a carried by the reel 10 disengages the limit switch 111 so as to open the same. When the limit switch 111 is opened, the circuit including the relay 71 is broken thereby de-energizing the relay 71. This opens its contacts 71a, 71b and 71c. Contacts 71a are the self-holding contacts for the relay. The contacts 71b comprise what might be termed the holding switch for the paster circuit, and the contact 71c comprises what might be termed the holding circuit for the tail cutter and carriage circuits. With the opening of these latter contacts, the relays 72 through 78 and 80 are de-energized. Upon de-energizing the relay 77, the primary of transformer 106 is also de-energized. Upon opening of the relay contacts 77a, the carriage actuator 48 is left held in retracted position so as to maintain the carriage in its out-of-the-way position. The system is now in the same condition as it was in the beginning of this description.

The foregoing description has contemplated the sequence and operation for the making of a paster at a relatively high speed of operation of the printing press, on the order of 50,000 newspapers per hour for example. Under slow speed operation, on the order of 25,000 newspapers per hour or less, the operational sequence changes as follows: With the reel motor 20 operating at high speed, the new web roll 11a indexes into the paster carriage 46 before the tail cutter 55 is advanced and before the web supplied from the expiring web roll 11b is severed. Thus the carriage 46 is moved rearwardly by the advancing web roll 11a to close limit switch 114. When this switch is closed the series circuit including the limit switch, the contacts 71c, 72c and the relay 80 is completed thereby energizing the relay 80. Since the tail cutter has not advanced, the relay 78 is not energized because the circuit in which it is included is completed by the closing of limit switch 113 upon forward movement of the tail cutter 55. As a result of operating the relay 80 the normally closed contacts 80a and 80c are opened. This causes the relay 79 to be de-energized thereby opening its contacts 79a. When the contacts 79a are opened, the relay 85 is de-energized with the result that its contacts 85a, 85b and 85c are opened, and power supply from the mains R₁, R₂ and R₃ is interrupted. This stops further indexing of the reel 10 and the new web roll 11a. When the web roll 11a has made a complete revolution, the limit switch 112 is again closed. The tail cutter advances closing limit switch 113. This causes relay 78 and the primary of transformer 105 to be energized. When the transformer 105 is energized, its secondary becomes effective to operate the solenoids 59B and 53B with the result that the web engaging brushes and the tail cutter are retracted. With the operation of the relay 78 its contacts 78c are closed so as to apply a brake to the spindle of the expired web roll 11b.

When the relay 79 was de-energized upon the operation of relay 80 so as to open its contacts

80c, relay contacts 79b return to their normally closed position thereby energizing relay 85. This results in a closing of contacts 86a, 86b and 86c to re-effect a connection between the power mains R₁, R₂ and R₃ and the reel motor 20 but in such manner as to operate the motor at low speed. The reel 10 and thus the new web roll 11a are therefore indexed at slow speed toward the position shown in Fig. 8.

When the relay 78 was energized, its contacts 79b were closed thereby energizing the relay 77 with the result that the contacts 77a of the latter were closed so as to energize the primary of transformer 106. The secondary of this transformer then becomes effective to operate the solenoid 48B whereby the paster carriage actuator valve is operated so as to cause the actuator 48 to retract the paster carriage 46.

As the reel continues to advance, the cam actuator 111a disengages the limit switch 111 so as to open the same. As a result relay 71 drops out with the corresponding interruption of the circuits for relays 72 through 78 and 80. When the relay 77 drops out, the primary of transformer 106 is de-energized and thus the solenoid 48B is de-energized leaving the carriage retracted. With the interruption of the relay circuits noted above, the relays drop out, and the entire circuit is left in the condition it was found at the beginning of this description.

With the press operating at any printing speed, the relay 87 is energized thereby closing its contacts 87a, and opening its contacts 87b. The closing of the contacts 87a energizes relay 88 so as to close its contacts 88a. This conditions a series circuit interposed between the power mains P—P that includes the coil of a relay 89. If a break in the paper web W should occur, the relay 87 is de-energized and its normally closed contacts 87b are again closed thereby completing the circuit that includes the contacts 87b, the contacts 88a and the coil of the relay 89. Upon energizing the relay 89, its normally closed contacts 89a are opened with the result that a contractor is de-energized and a brake (not shown) is applied to the press. The relay 89 has a set of normally open contacts 89b in the circuit of a reset relay 90 so that when the relay 89 is actuated, reset relay 90 is energized to close its contacts 90a, 90b, 90c and 90d. The contacts 90a complete a series circuit between the power mains P—P to energize the primary of transformer 106. This causes the solenoid 48B in the secondary circuit of transformer 106 to be energized to operate the pressure fluid control valve of the carriage actuator 48 so that the carriage is retracted. The contacts 90b are normally closed so that upon energizing the relay 90 these contacts are opened. The contacts 90b are in the coil circuit of the relay 70 so that when the contacts are opened the relay 70 drops out. This relay 70 includes a set of normally closed contacts 70c. When the relay 70 is de-energized, the contacts 70c are closed. This completes a circuit between the power mains P—P which includes a solenoid 117. This solenoid is effective to apply a brake to the spindle of the new web roll 11a to prevent it from running off a large amount of paper which, due to the web break cannot be used.

When the relay 70 dropped out (upon energizing relay 90), its contacts 70b opened. With the opening of the relay contacts 70b, the primary of transformer 101 is de-energized, and this de-energizes the solenoids 39A and 48A, respectively, which were effective to operate the pressure fluid

control valves to advance the predrive actuator 39 and the carriage actuator 43. At the same time, because of the operation of the relay 90, the relay contacts 90c and 90d are closed with the result that the primaries of the transformers 103 and 105 are energized. Thus the solenoids 39B, 53B and 59B, which are in series with the secondaries of these transformers, are energized to operate the pressure fluid control valves for the predrive, brush and tail cutter actuators 39, 53 and 59, respectively, to retract the predrive assembly 35, the paster brushes 45 and the tail cutter 55.

A similar sequence of events as above described for stopping the web supply to the printing press in the case of a web break occurs if there is a power failure in the main power circuit P—P at any point in the cycle.

As hereinabove noted, certain of the elements of the electric circuit were noted as being disposed on the reel 10 or its spider arms 17. These elements include the solenoids 117 and the timing limit switches 112 disposed at the ends of the spider arms 17 adjacent the spindles 18 journaled therein. Preferably, connection is made to these elements by means of a movable plug and jack arrangement 120a, 120b. The jack 120b is disposed on the spider arm 17 adjacent the end of the spider arm (Fig. 2). The plug is, of course, mounted on the end of a suitable cable the opposite end of which is appropriately connected to the solenoid brake actuator circuit and the circuits with which the timing limit switch 112 is associated, as above described, through the medium of any suitable arrangement of terminal connections within a housing, not shown, for the control system relays.

Each of the spider arms 17 is equipped with a solenoid 117 for operating the spindle brake thereon and a timing limit switch 112 so that any pair of the spider arms can be utilized for successively supporting new web rolls 11a. Thus each one of the spider arms is equipped with a similar jack 120b, and only one plug 120a is required. When the paper roll supported between a particular pair of the arms 17 is to become the new web roll, as herein indicated by the reference numeral 11a, the plug 120a is simply shifted from the spider arm supporting the then expiring web roll 11b to the jack 120b of the spider arm which is supporting the new web roll. This plug transfer takes place before the predrive push button 91 is pressed to initiate the sequence of events which will ultimately result in making a paster.

As hereinbefore noted, not only is it necessary to make provision for operating the brake applying solenoid 117a to brake the new web roll 11a (as in the case of an emergency red-button stop), but provision must be made also for the operation of the solenoid 117b so as to brake the expiring roll 11b when the tail is cut. Since the plug 120a is received in the jack 120b for the new roll 11a, interconnection with that jack and the solenoid 117b must be provided on the reel 10. A suitable interconnection network of conductors for this purpose is diagrammatically illustrated in Fig. 2.

Summary of operation

Having thus described the construction and arrangement of the instant paper web supply mechanism and the electrical control system therefor, the operation of making a paster may be summarized as follows. For this purpose reference is made particularly to Figs. 10 and 11

wherein the sequence of events in relation to time is graphically illustrated.

It will be recalled that after the paper web from the roll 11b was severed and the new web roll 11a was indexed into the position shown in Fig. 8, indexing was stopped when such position was reached. In this position of the reel 10 the spider arms 17 for the roll 11b were in position for the removal of the remaining core of the roll 11b and the loading of a full paper roll 11c therebetween from a suitable dolly or the like. As soon as that new paper roll 11c was loaded, the press attendant prepared the leading end of the paper on the roll by folding it into a substantially right angular point and applying a suitable glue thereto. This new paper roll 11c, thus prepared, becomes the new web roll 11a upon indexing the reel 10 into the position shown in Fig. 1. By the same token of course, the previously denoted roll 11a becomes the roll 11b.

When the press operator notes that the paper on the roll 11b is beginning to run out so that it is nearly time to change web supply to roll 11a, the plug 120a is removed from the jack on the spider arms 17 supporting the roll 11b and inserted in the jack 120b on the spider arm supporting the roll 11a. By means of suitable push button switches 93 or 94 (Fig. 13) at his control station, the operator causes power to be applied to the reel indexing motor 20 to operate the same either forwardly or in the reverse direction to locate the roll 11a in the position shown in Fig. 1. In this position, the periphery of the new web roll 11a is spaced approximately one-half to one inch from the running web W. At this point, everything is in readiness for the making of a paster when the press attendant notes that such time has come.

For purposes of discussion, it will be assumed that the press is operating at high speed, e. g. at a production rate of approximately 50,000 newspapers per hour. At this press rate the web is drawn into the press at about thirty feet per second. It will be assumed also that the circumference of the new web roll 11a is ten feet.

Referring now particularly to Fig. 10, when the press attendant notes that the expiring web roll 11b has diminished to a diameter of twelve to fifteen inches, he presses the predrive push button 91. This initiates the sequence of events and is denoted by the first vertical dotted line in Fig. 10. Operation of the predrive button results in actuation of the predrive actuator 39 to lower the predrive assembly 35 so that its belts engage the periphery of the new web roll 11a. Movement of the predrive assembly into roll engaging position is indicated at A in Fig. 10.

Simultaneously with the lowering of the predrive assembly the paster carriage 43 is lowered by operation of its actuator 43. Thus the paster carriage is in position wherein the brushes 45 and the tail cutter 55 can engage the running web W. Movement of the paster carriage is indicated in Fig. 10 at B.

The predrive assembly is, of course, maintained in its lowered position until the new web roll 11a is brought up to press speed. This may take approximately twenty-five seconds or more when the press is being operated at high speed. By this time the running web roll 11b will be down almost to its core whereupon the press attendant operates the paste push button 92. With the web W being withdrawn into the press at the rate of approximately thirty feet a second and with a new roll 11a with a circumference of ten

15

feet, according to the above assumptions, then one-third of a second or less will elapse between the time the paste button is pushed and subsequent action is initiated. The actual time depends on the angular position of the timing switch actuator 18a with respect to the timing switch 112 according to the position of the web roll 11a and its supporting spindle 18 when the paste button is pressed.

When the limit switch actuator 18a operates the timing limit switch 112, the electrical control system is effective to move the valve controlling the supply of compressed air to the brush actuator 53 to advance the brushes 45 and deflect the running web W toward the new web roll 11a. Simultaneously with the operation of the brush actuator 53, the reel 10 is indexed at high speed toward the paster carriage 46 and into the belts 14. Movement of the brushes is indicated in Fig. 10 by line C. The indexing speed of the reel 10 is indicated by line D.

It will be noted upon reference to line B that the paster carriage continues to be held down while the brushes are advanced to deflect the web and the reel is indexing at high speed. However, upon advancing of the brushes and initiation of the high-speed indexing of the reel 10, the predrive assembly 35 is retracted by the operation of its actuator 39.

Before another complete revolution of the new web roll 11a has been completed so as to again operate the timing limit switch 112, the reel motor 20 will have indexed the reel 10 so that the new web roll 11a engages the belts 14 which are backed up by the resilient feet 62. The latter are mounted on the paster carriage 46 which is held down with a constant force as determined by the force of the pressure fluid in the actuator 48. Continued indexing of the reel 10 into the belts 14 and against the feet 62 opposes the action of the carriage actuator 48 and initiates rearward movement of the paster carriage 46. The point of engagement between the periphery of the new web roll 11a with the belts 14 and feet 62 is indicated at 130 in line B in Fig. 10, and the initial rearward movement of the paster carriage is indicated by an upward slanting of the line B.

After a short time has elapsed between the engagement of the new web roll 11a with the belts 14 and feet 62 on the paster carriage 46 (such time being allowed to insure that the feet 62 attain sufficient deflection caused by the new roll 11a so as to be effective to exert a braking force on the new web roll), and one-third of a second after the limit switch 112 was operated, the new web roll 11a will have made a full revolution. Thereupon the limit switch 112 is again operated by the actuator 18a. As a result, the tail cutter is advanced to sever the web withdrawn from the expiring web roll 11b. This second operation of the limit switch 112 causes the electrical control system to become effective to operate the brush actuator 53 to withdraw the brushes 45 and at the same time to cause the spindle brake for the spindle 18 supporting the expired core to be applied.

As soon as the tail cutter reaches its advanced position and has severed the web from the roll 11b, the tail cutter operates its limit switch 113 and the tail cutter actuator 59 is operated to immediately retract the tail cutter 55. Tail cutter operation is indicated by line E in Fig. 10, and expired core brake operation is indicated by line F.

16

Approximately one-third of a second after the last operation of the limit switch 112, the paster carriage 46 will be moved rearwardly far enough by the action of the indexing new web roll 11a to engage and operate the limit switch 114. When this takes place, the paster carriage actuator 48 is operated to retract the paster carriage into its out-of-the-way position. Simultaneously reel indexing at high speed is stopped, and the reel is indexed at low speed. The reel continues to index at low speed until the new web roll 11a reaches the position shown in Fig. 8 which is the normal operative feeding position. As this position is reached the limit switch actuator 111a centrally of the reel 10 actuates the limit switch 111 restoring the electrical control system to normal running condition, and the pasting operation is completed. The tension control system including the floating roller 15, jet pipe regulator 23, belt actuator 24 and belts 14 operates normally to control tension in the running web W. It is to be noted that by the time the new web roll 11a is indexed far enough to move the paster carriage back against the action of its actuator 48 so that the limit switch 114 is operated, the new web roll 11a is far enough into the belts 14 so that the belts are capable of applying sufficient braking force thereto to control web tension by means of the tension control system.

When the limit switch 111 is operated to restore the electrical control system to normal running condition, the brake applied to the spindle 13 supporting the expired roll core is released. Thus the spindle is freed for removal of the core and loading of a new roll of paper.

The elapsed time between the moment the paster carriage is retracted fully and the reel begins to index at slow speed and the moment the limit switch 111 is operated, as determined by the actual speed at which the reel 10 is indexed, amounts to approximately four seconds.

The total elapsed time, therefore, according to the above assumptions of roll circumference and running web speed, between the time the paste button is pressed and the time the paster operation is completed, amounts to approximately five seconds. Taking into consideration the time necessary for bringing the new web roll up to press speed, the overall time required for the entire operation is but one-half of a minute.

The operation is slightly different, as previously noted in the discussion of the electrical control circuit, when the printing press is operated at relatively slow speed, for example at a production rate of 25,000 newspapers or less per hour. Such operation is indicated in Fig. 11 wherein line A illustrates predrive assembly movement, line B indicates paster carriage movement, line C indicates brush movement, line D indicates indexing speed, line E indicates tail cutter movement, and line F indicates expired core brake operation. For the discussion of slow speed operation, it will be assumed that the running web W is being withdrawn into the press at the rate of approximately fifteen feet per second and that the new web roll 11a has a circumference of ten feet. As before, sufficient time is allowed between the pressing of the predrive button and the pressing of the paste button to allow the predrive assembly to bring the peripheral speed of the new web roll 11a up to press speed. This time may be on the order of twenty seconds more or less. When the predrive button 31 is pressed, the predrive assembly 35 is lowered so that its belts 36 engage the periphery of the

17

running web roll. Simultaneously, the paster carriage is lowered so that the brushes 45 are adjacent the running web W.

After sufficient time has been allowed for the new web roll 11a to attain a peripheral speed equal to the press speed, the press attendant operates the paste button 92. Two-thirds of a second or less later, depending on the initial angular position of the actuator 18a relative to the limit switch 112, the limit switch is engaged by the actuator so as to cause the predrive assembly 35 to be retracted, the brush actuator 53 to be operated to advance the brushes 45 into engagement with the running web W to deflect the same toward the new web roll 11a, and to cause the reel indexing motor 20 to operate at high speed to index the reel 10 and the roll 11a rapidly toward the running web W and the paster carriage 46. In this instance and as shown by line G, with the press operating at slow speed, the new roll 11a will be indexed into the belts 14 far enough for them, by means of the normal tension control system, including the floating roller 15, to be capable of controlling web tension before new web roll 11a has made a complete revolution so as to again actuate the limit switch 112. When this point in the path of travel of the new web roll and the carriage occurs, the carriage 46, as before, operates the limit switch 114 which, in low speed operation, results in stopping of the indexing of the reel 10 rather than causing indexing to change from high speed to low speed operation as it does in high speed operation. This occurs because low speed indexing is begun simultaneously with the retraction of the brushes 45 by operation of the actuator 53, the advance of the tail cutter 55 by its actuator 59, and the application of the brake 117b to the expired core, all of which action takes place through the operation of limit switch 112. The limit switch 112, however, is operated only on the completion of one revolution of the new web roll 11a which, in low speed operation, has not taken place at the time that the new web roll and the paster carriage 46 have reached the position wherein the carriage limit switch 114 is actuated. After the roll 11a has completed one revolution so that the limit switch 112 is operated, the tail cutter 55 is then operated and the core brake applied. Actuation of the limit switch 112 also effects the retraction of the brushes 45 and of the paster carriage 46. At the same time, reel indexing at low speed is begun and continues until the new web roll 11a reaches the position shown in Fig. 8 whereupon the limit switch 112 is actuated to cut off the indexing motor, release the core brake and restore the control circuit to normal running condition.

I claim as my invention:

1. In a web supply mechanism, the combination comprising an indexible reel for supporting both a first paper roll from which the web is running and a second paper roll to which web supply is transferred as the first roll is about to expire, tension control means including a brake belt initially in braking engagement with the first roll and finally in braking engagement with the second roll upon transfer of web supply thereto to maintain normal running web tension, and a paster assembly for joining the leading end of the paper on the second roll to the running web and severing the paper from the first roll, and means for indexing said reel initially at relatively high speed when web supply is transferred to the second roll and for subsequently

18

at relatively slow speed when the second roll attains braking engagement with said belt and until the second roll attains normal web supply position.

2. In a web supply mechanism, the combination comprising an indexible reel for supporting both a first paper roll from which the web is running and a second paper roll to which web supply is transferred as the first roll is about to expire, tension control means including a belt initially in braking engagement with the first roll and finally in braking engagement with the second roll upon transfer of web supply thereto to maintain normal running web tension, said tension control means also including a hydraulic operator for said belt to determine the force applied by said belt to said paper rolls, and a paster assembly having means for joining the leading end of the paper on the second roll to the running web and means for severing the paper from the first roll, and means for indexing said reel first at relatively high speed when web supply is transferred to the second roll and for indexing the same at relatively slow speed when the second roll attains braking engagement with said belt and until the second roll attains normal web supply position for allowing exhaust of fluid from said operator so that said tension control means can accommodate the second roll.

3. In a web supply mechanism, the combination comprising a reel for supporting both a first paper roll from which the web is running and a second paper roll to which web supply is transferred as the first roll is about to expire, means for indexing said reel to move said second roll toward the running web, a paster assembly movable into a position adjacent the running web upon indexing said reel for joining the leading end of the paper on the second roll to the running web, and severing the paper from the first roll and means operative as an incident to the movement of said assembly to direct an air jet against the running web so as to eliminate flutter in the web from the first roll and to blow the paper from the first roll out of the way upon severance thereof.

4. In a web supply mechanism, the combination comprising a reel for supporting both a first paper roll from which the web is running and a second paper roll to which web supply is transferred as the first roll is about to expire, means for indexing said reel to move said second roll toward the running web, a paster assembly for joining the leading end of the paper on the second roll to the running web and severing the paper from the first roll, a pneumatic actuator for said assembly to move the same between an out-of-the-way position and a position adjacent the running web, and air jet means carried by said assembly and operatively associated with said actuator to apply an air stream against said running web from the first roll when said assembly is adjacent the same so as to minimize flutter therein and to blow the paper from the first roll out of the way upon severance thereof.

5. In a web supply mechanism, the combination comprising a reel for supporting both a first paper roll from which the web is running and a second paper roll to which web supply is transferred as the first roll is about to expire, means for indexing said reel to move the second roll toward the running web, a paster assembly operative to first join the leading end of the paper on the second roll to the running web and then to sever the paper from the first roll, and means for applying a jet of air to the running web from the first roll

19

when a paster is about to be made to minimize flutter therein and to blow the paper from the first roll out of the way upon severance thereof.

6. In a web supply mechanism, the combination comprising a reel for supporting both a first paper roll from which the web is running and a second roll to which web supply is transferred as the first roll is about to expire, means for indexing said reel to move the second roll toward the running web, a paster assembly operative to join the leading end of the paper on the second roll to the running web and to sever the paper from the first roll, a pneumatic actuator for moving said assembly into operative position adjacent said running web, and means effective as an incident to

5

10

15

20

the operation of said actuator to apply an air jet to the paper from the first roll.

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