

Jan. 29, 1957

D. J. SCOTT

2,779,546

WEB ROLL SPLICING MECHANISM

Filed Oct. 27, 1954

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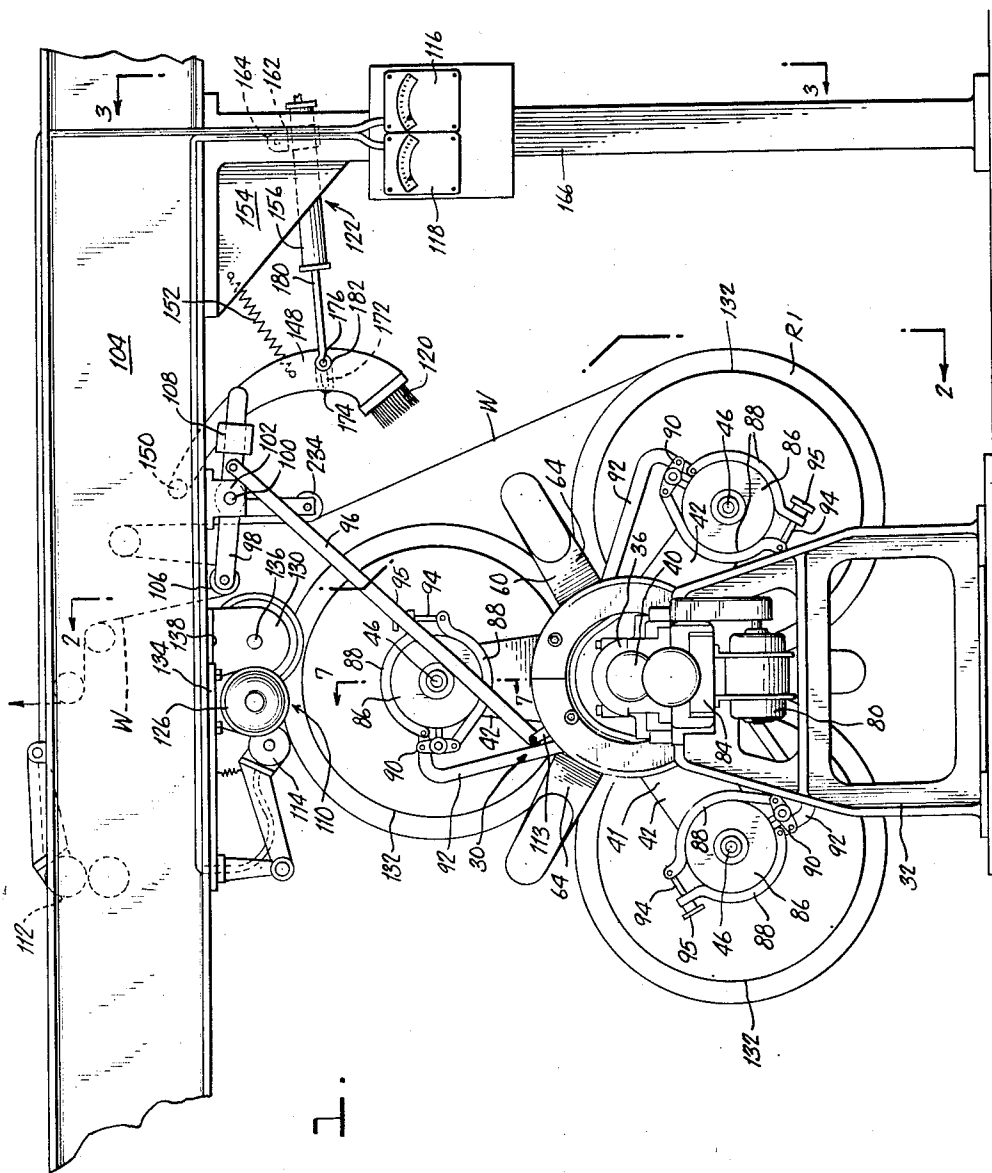


Fig. 1.

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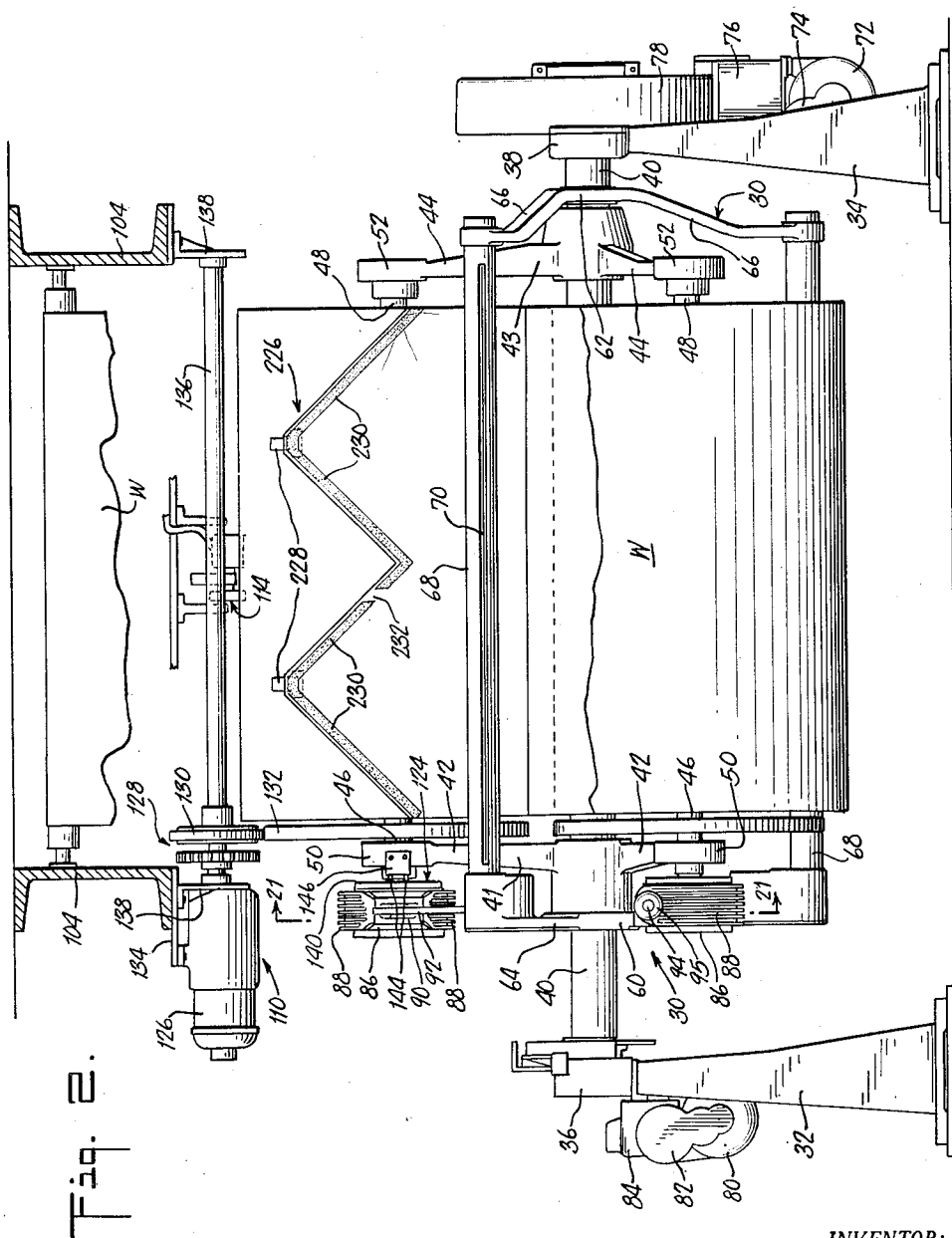
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WEB ROLL SPLICING MECHANISM

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8 Sheets-Sheet 2



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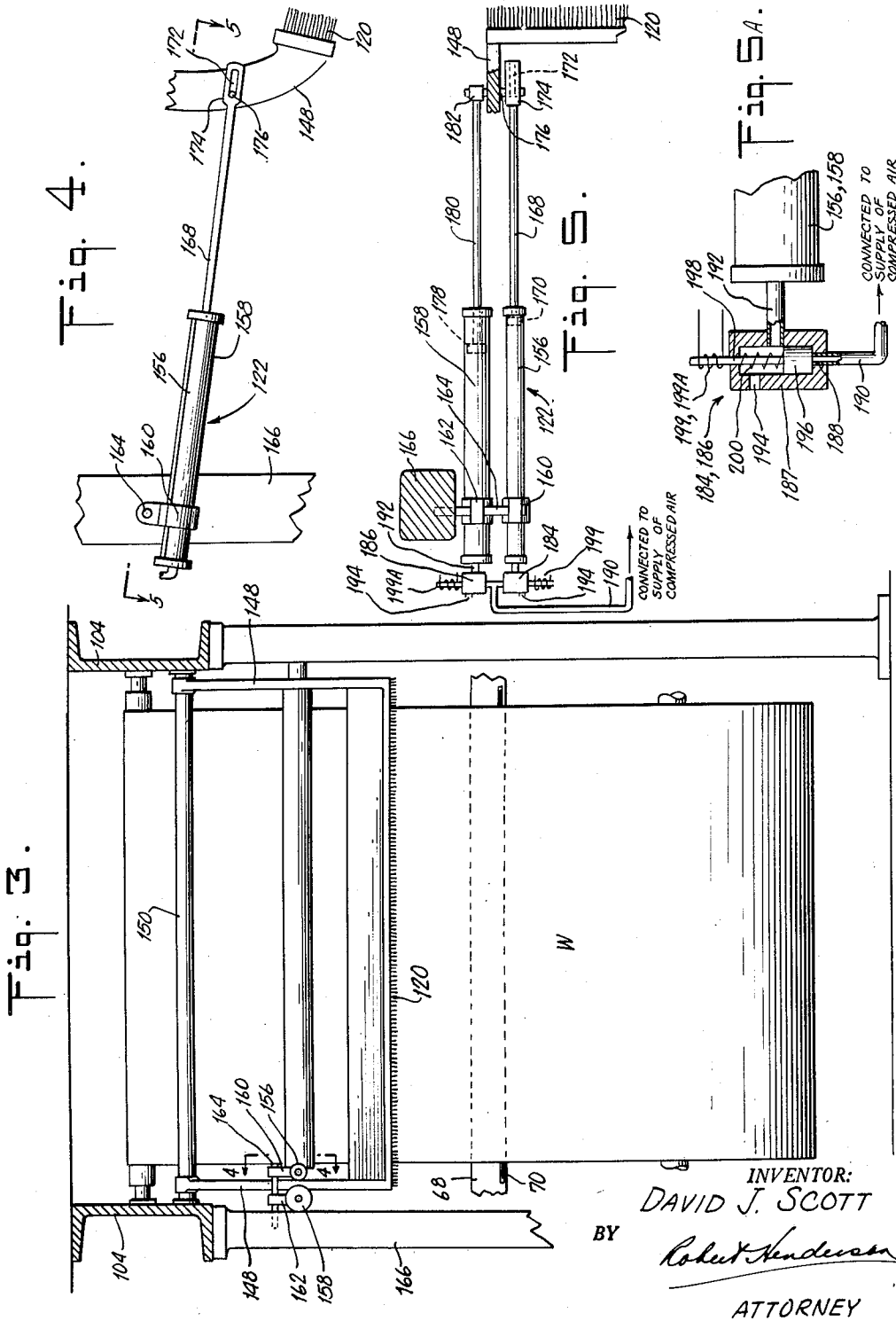
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WEB ROLL SPLICING MECHANISM

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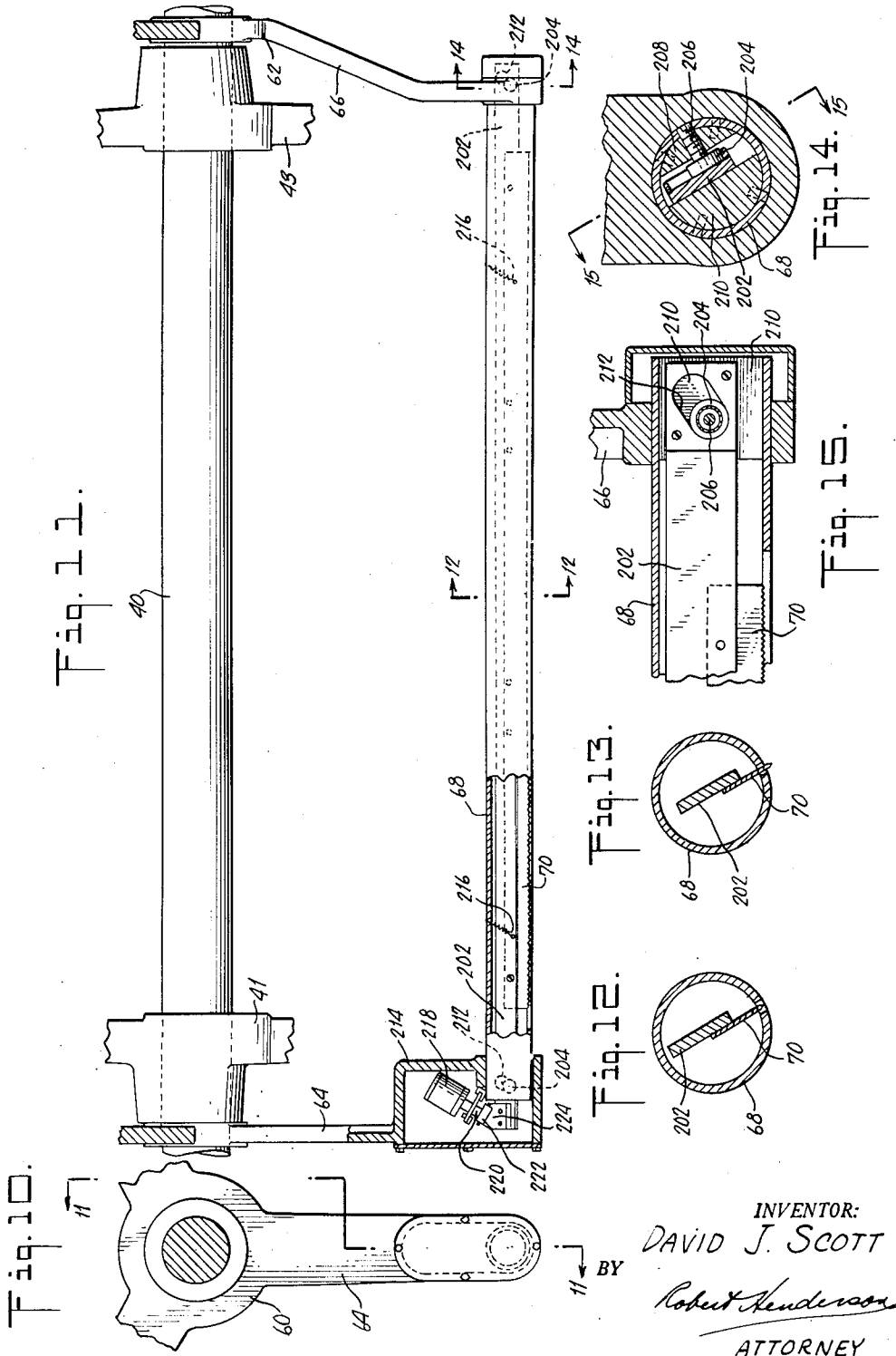
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WEB ROLL SPLICING MECHANISM

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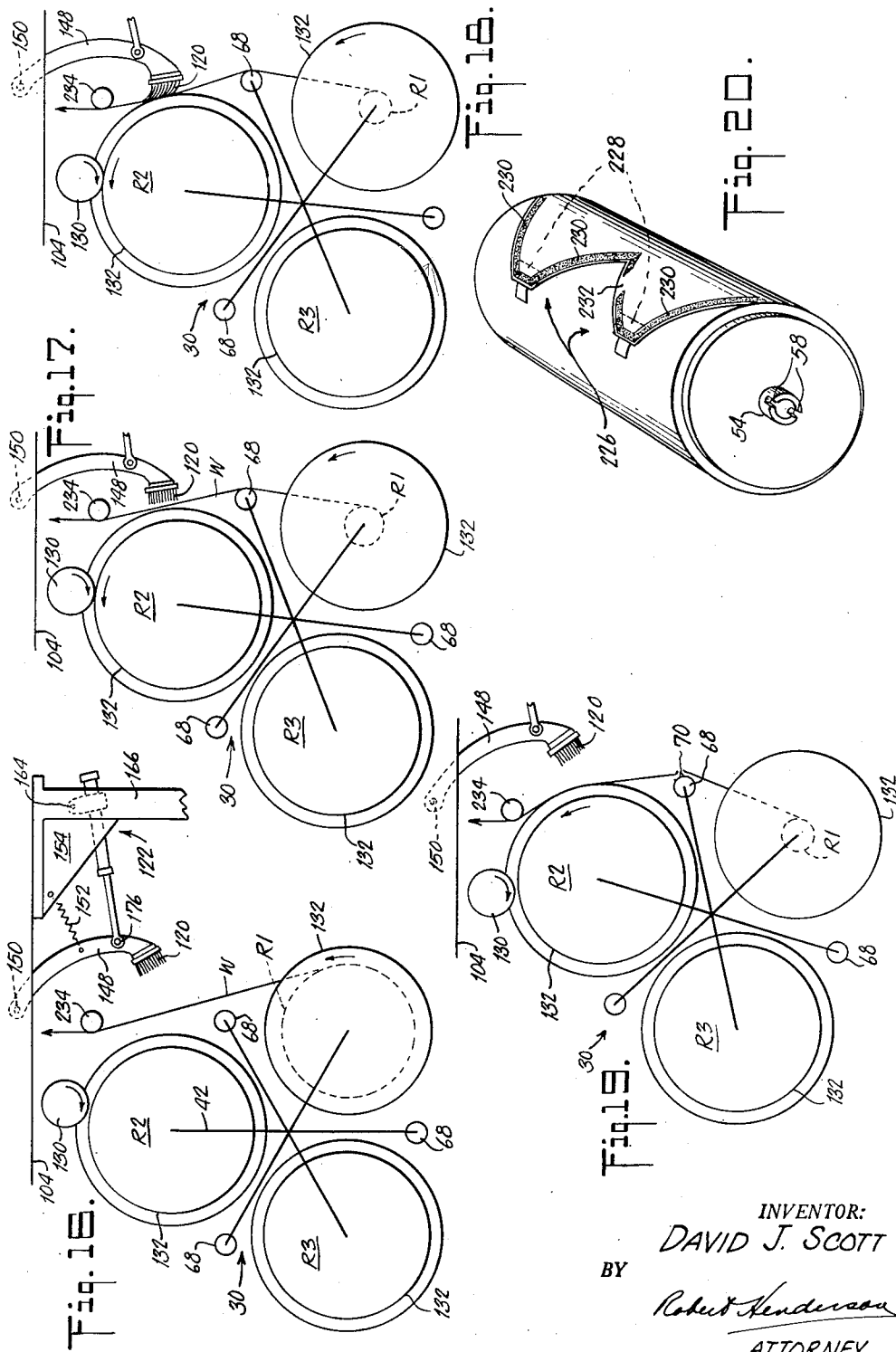
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WEB ROLL SPLICING MECHANISM

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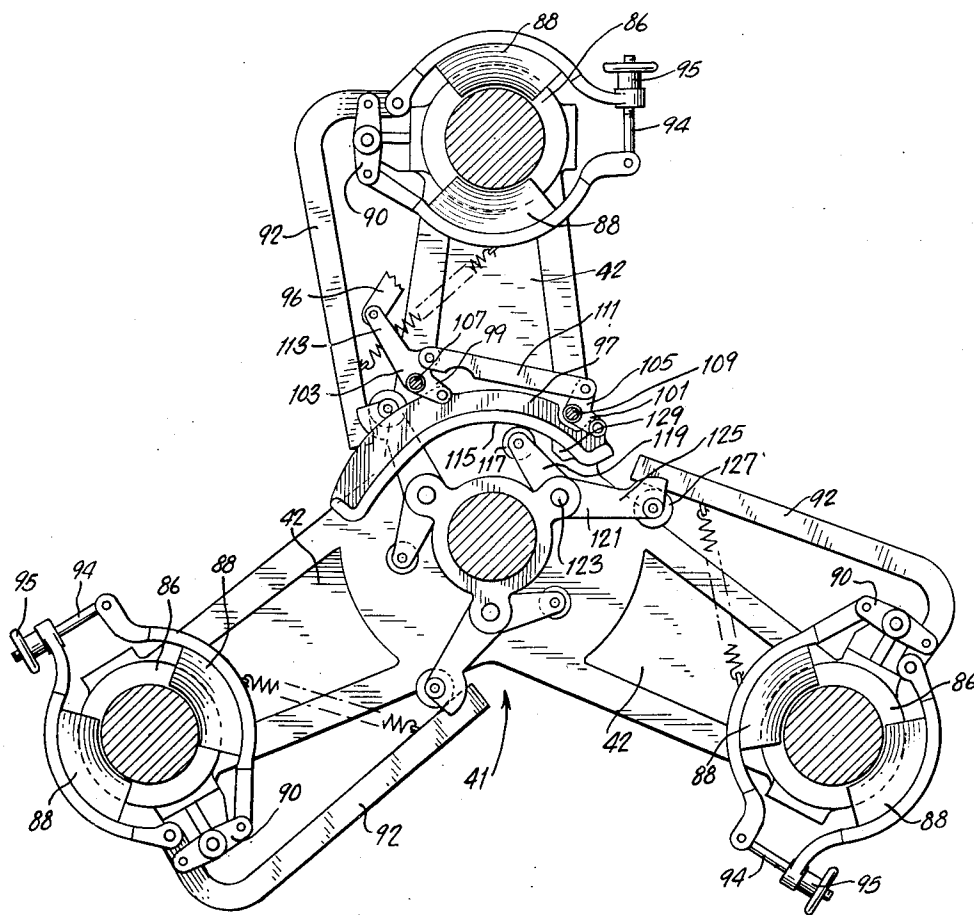
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WEB ROLL SPLICING MECHANISM

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Fig. 21.



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WEB ROLL SPLICING MECHANISM

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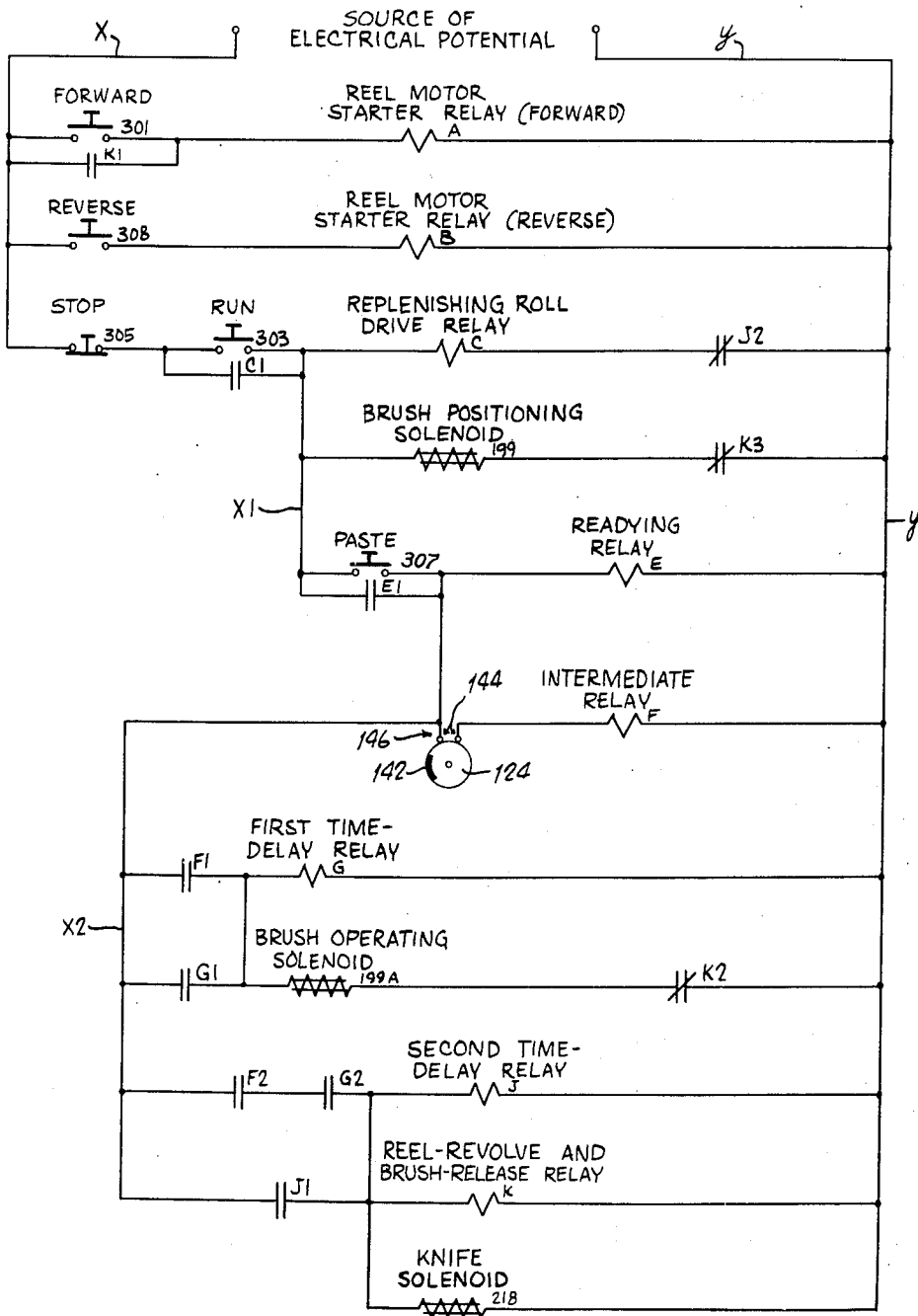


Fig. 22.

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2,779,546

WEB ROLL SPLICING MECHANISM

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Application October 27, 1954, Serial No. 465,090

1 Claim. (Cl. 242—58)

The present invention relates to a splicing mechanism by which a leading end of a new or replenishing web roll of paper, such as is employed in printing newspapers, is spliced to a trailing end of an expiring web roll without interruption in the feeding of the web to a related printing press. Although the invention is described herein as applied to apparatus commonly used in feeding paper to newspaper presses, it is believed that the same invention may be useful in relation to various other types of apparatus wherein a running web is printed or otherwise operated upon.

An important object of this invention is to provide such a splicing mechanism which is substantially infallible in operation and which may be operated without stopping or even slowing down the apparatus which is drawing the web material for processing from such rolls.

Another important object is the provision of improved means by which the surface speed of a replenishing roll may be coordinated with the web speed of the expiring roll so that a splice between the webs of two said rolls may be effected without interruption or material change in the speed of the web supply.

Another important object is the provision of such a splicing mechanism having improved means for driving the replenishing roll to bring it to a surface speed corresponding to that of the web being drawn from the expiring roll.

Another important object is the provision of such a splicing mechanism which is controlled by electrical means including a contact bridge or conducting patch arranged to move in relation to contacts which it bridges in a direct unvarying ratio to the rotation of the axis of the replenishing roll, irrespective of the diameter of the latter roll, and wherein such a contact bridge operates to activate certain electric controls which are arranged to function, in a certain desired sequence and timing, to paste a leading end of the replenishing roll web to a trailing end of the expiring roll web, to press the two said ends tightly together to firmly fix the splice, to discontinue spindle drive of the replenishing roll, and to cut said trailing end from the remainder of the expiring roll.

The foregoing and other objects, which will become more or less apparent from a consideration of the following description and the accompanying drawings, are accomplished by the present invention which, for illustrative purposes and without specifically limiting the invention thereto, is shown in the accompanying drawings in one of numerous possible embodiments.

Referring to the drawings, Figure 1 is a side elevational view of a reel adapted to carry three rolls of web material, including splicing apparatus according to the present invention; the side illustrated in this figure being the side which may be considered as the front or brake side of the mechanism;

Fig. 2 is a vertical, transverse, sectional view of said reel and parts of said splicing mechanism substantially on the line 2—2 of Fig. 1;

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Fig. 3 is a fragmentary end elevational view of portions of the splicing mechanism substantially as viewed from the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary side elevational view of a mechanism for actuating a brush which tightly presses and sets the splice; the structure shown in this figure being viewed substantially from the line 4—4 of Fig. 3;

Fig. 5 is a top plan view of the brush-actuating mechanism shown in Fig. 4;

Fig. 5A is a diagrammatic view of an air valve such as may be employed with two air cylinders in the brush-actuating mechanism;

Fig. 6 is a side elevational view of the side of the reel and splicing mechanism opposite to the side illustrated in Fig. 1, which opposite side may be considered as the rear or chucking side of the mechanism;

Fig. 7 is a fragmentary view, partially in section substantially on the line 7—7 of Fig. 1, illustrating the disposition of a switch associated with, and controlled by, said previously mentioned contact bridge;

Fig. 8 is a side elevational view of a commutator disk having the mentioned contact bridge embedded in the surface thereof, this view being taken on the line 8—8 of Fig. 7;

Fig. 9 is a fragmentary view of an end portion of one of the roll-carrying arms of the reel as seen from the line 9—9 of Fig. 7;

Fig. 10 is a side elevational view of a knife-carrying arm located at the front side of said reel;

Fig. 11 is a side elevational view, partly sectionalized, of said front knife-carrying arm and related means by which a web-severing knife is rigidly supported as a part of the reel structure; the sectionalized portions of this figure being substantially on the irregular line 11—11 of Fig. 10;

Fig. 12 is a cross-sectional view of a tubular knife-carrying bar and a web-severing knife therewithin, substantially on the line 12—12 of Fig. 11; the knife, in this view, being shown in its retracted or non-cutting position;

Fig. 13 is a cross-sectional view similar to Fig. 12 but showing the knife in its extended or cutting position;

Fig. 14 is a cross-sectional view of an end portion of a rear knife-supporting arm substantially on the line 14—14 of Fig. 11;

Fig. 15 is a fragmentary, sectional view of a rear portion of the knife structure substantially on the line 15—15 of Fig. 14;

Figs. 16 to 19 inclusive are diagrammatic views of the mechanism as viewed from the front side thereof, illustrating a sequence of operation pursued by the mechanism in a complete splicing operation;

Fig. 20 is a perspective view of a replenishing roll of web material showing the manner in which the end of the web is pasted both against unintentional loosening and, also, to permit it, in a hereinafter described series of operations, to become pasted to a trailing end of a web on the expiring roll;

Fig. 21 is a somewhat diagrammatic view of roll brakes and certain portions of the mechanism for operating said brakes; this structure being substantially as viewed from the line 21—21 of Fig. 2; and

Fig. 22 is a diagram of electrical controls and circuits relating to the improvements of this invention.

As the present invention resides not only in certain more or less accessory parts constituting a splicing mechanism but, also, in the relation and coaction of those parts with a heretofore developed roll-carrying reel, it is necessary, to an understanding of this invention, that the description refer both to said reel and to the various mechanisms associated therewith for splicing purposes.

The reel, designated 30, is mounted upon spaced front and back pedestals 32 and 34 respectively, suitably fastened down to a floor or other supporting surface and, respectively, having front and back bearings at 36 and 38, in which are disposed the opposite ends of a reel shaft 40 on which are keyed, for rotation therewith, opposite substantially similar triple-arm, front and back roll-supporting spiders 41 and 43, comprising similar roll-supporting arms 42 and 44, having at their ends suitable front and back stub spindles 46 and 48 carried in front and back bearings 50 and 52 on the ends of said roll-supporting arms. The front arms 42 are exactly opposed to the back arms 44, and the inner ends of the spindles 46 and 48 protrude partly within opposite ends of a horizontal, tubular core 54 (Figs. 7 and 20) which functions as a part of the roll upon which the web of the roll is tightly wound at the time of formation of the latter.

The mentioned rear stub spindles 48 are retractable axially to permit the removal of a roll core 54 with the remnant of an expired roll and the placing between said spindles of a new or replenishing roll. Each front spindle 46 is preferably formed with inner end tongues 56 which fit complementally into end slots 58 in each roll core 54 to constrain the latter and its related front spindle 46 to turn in unison. There are three arms 42 or 44 on each of the two roll spiders, which arms are equidistant from each other, thereby providing for support of three rolls of paper which, by reference to Fig. 17, are identified as an expiring roll R1, a prepared replenishing roll R2, and a replacement roll R3.

The reel 30 also has substantially similar, triple-arm, front and rear knife-carrying spiders 60 and 62 respectively, which, like the roll-supporting spiders, are keyed to or otherwise constrained to turn with the reel shaft 40 and with the roll-supporting spiders. The front knife-carrying spider 60 has three similar equidistant arms 64 and rear knife spider 62 has three arms 66 which are similar to each other and substantially similar to arms 64 and exactly opposed to the latter. The arms 64, 66 are radially midway of the roll-supporting arms 42, 44 and the ends of opposed arms 64 are interconnected by tubular knife housings 68 within each of which is operatively mounted a retractable web-severing, preferably serrated, knife 70.

The reel 30 is rotated by a reversible reel-turning motor 72 through suitable reduction transmission gears operative between said motor and reel shaft 40. These parts are mounted on the back pedestal 34. The gears, being conventional, are not shown in the drawings, but their general location is ascertainable from their casings, identified as 74, 76 and 78.

Mounted on front pedestal 32 is a reversible, reel-shifting motor 80, which, through suitable gears within casings 82, 84, is operatively connected to the front end of reel shaft 40 to shift the latter and reel 30 axially in either direction to maintain the webs of paper on the paper rolls in axial alignment with web-receiving rolls in a related printing press or other web-processing mechanism.

Practical web-feeding mechanisms are usually provided with means for maintaining a substantially continuous, uniform tension on the web as otherwise it would readily break. For this purpose, in the illustrated paper-feeding mechanism, each front roll spindle 46 has a brake drum 86 fixed thereon for rotation therewith; and brake bands 88 are contracted upon the brake drum by a contracting link 90 and lever 92. The bands 88 are also linked together, at a point opposite to link 90, by an adjusting link 94 having an adjusting nut 95 threaded on its end for effecting a general adjustment of the brake bands. Very similar brake and web-tensioning means are disclosed in my U. S. Patent No. 2,009,707, dated July 30, 1935.

The braking arrangement, just described, is duplicated

on each roll-supporting arm 42, but said arrangement is only operative for web-tensioning purposes on one paper roll at a time, i. e., on the roll identified herein as expiring roll R1. This limitation of brake operation results from an arrangement wherein an arcuate cam 97 (Fig. 21) is pivotally supported at the ends of arms 99, 101 of levers 103, 105 which are pivoted at 107, 109 to an adjacent front roll-supporting arm 42 and pivotally linked in a parallelogram arrangement by link 111. Through the levers 103, 105, the cam 97 is actuated by an actuating rod 95 pivotally connected, at its lower end to an arm 113 of lever 103 and at its upper end to one end of a tension lever 98 (Fig. 1) which is pivoted at an intermediate point 109 to a bracket 102 fixed to a beam 104 of a structure, generally a press structure, beneath which the mechanism is housed. The lever 98 and its supports are duplicated at opposite sides of the mechanism, and between the ends of said opposite levers 98, at their ends remote from the rod 96, is rotatably supported a floating roll 106 which extends across and rests upon a portion of the paper web W. An adjustably shiftable weight 108 is provided on the actuating rod end of the tension lever 98 to permit adjustment of the weight or force with which the roll 106 bears upon the web W.

As the tension of the web W increases or decreases, usually due to some irregularity in the expiring paper roll, or change of speed of the press, the roll 106 rises or falls, thereby causing rod 96 to simultaneously raise or lower cam 97. In consequence, surface 115 of cam 97, in engagement with a roller 117 on the end of arm 119 of bell-crank 121 which is pivoted at 123 to the hub of front roll-supporting spider 41, slightly rocks said bell-crank back and forth about point 123 so that the bell-crank's other arm 125, through a roller 127 on its end, bears against brake lever 92 to tighten or loosen the brake bands 88 as needed to maintain substantially uniform tension on web W.

The mentioned cam assembly is so angularly positioned with respect to the axis of rotation of the reel 30, and so designed, that, when the several rolls are in their positions shown in Fig. 17, the cam assembly, for web tensioning purposes, is functioning to operate only the brake of expiring roll R1 but, at about the time the several paper rolls, with clockwise rotation of the reel, reach their positions of Fig. 19, the brake of what was the replenishing roll R2 comes under the influence of the cam assembly and the floating tension roll 106 to maintain the desired tension in the web thereafter being drawn from the latter roll which has become an expiring roll. The brake of former expiring roll R1 may continue to be operated by a downwardly extending cam surface 129 of the cam 97 to stop completely the turning of the then expired roll. The described shifting of the tension effect from one roll to the other, occurs, as a result of turning of the reel 30, at about the time the knife cuts off the expired roll as hereinafter described.

The means more directly concerned with the present invention will now be described. These means comprise chiefly an improved replenishing roll driving mechanism generally identified as 110, a web speed tachometer generator 112, a replenishing roll speed tachometer generator 114, speed indicators 116 and 118 connected respectively to tachometer generators 112 and 114, a web-pressing brush 120, a brush-actuating mechanism 122, an electric-circuit activating commutator 124 and electrical devices and circuits for controlling the apparatus. The previously-mentioned parts of the mechanism function with the just-enumerated parts to achieve the objects of this invention.

In splicing the leading end of the web of a replenishing roll to the trailing end of an expiring roll, the instrumentalities of this invention cause replenishing roll R2 to turn at a surface speed closely approximating the speed of web W, whereafter, preferably subject to an

operator's control, the commutator 124 initiates the operation of electric circuits and electrical devices which, in rapid succession, cause brush 120 to press web W against an adhesive-coated leading end of the web on the replenishing roll, after which the brush is retracted and, approximately simultaneously with such retraction, knife 70 severs the trailing end of the web of the expiring roll, and reel 30 turns to bring roll R2 from its place as a motor-driven replenishing roll to a new place as an expiring roll, supplying web material to a printing press or other web-processing mechanism. This turning of the reel operates, also, as hereinafter explained, to terminate the driving effect of replenishing roll driving mechanism 110.

The mechanism 110 for driving the replenishing roll R2 includes a motor 126 arranged to turn, through gearing 128, a rubber-tired driving wheel 130 which operates to turn the replenishing roll through engagement of its rubber periphery with the periphery of a large wheel 132 which is suitably keyed to front spindle 46 of the replenishing roll. The motor 126 is mounted on a bracket 134 suitably secured to beam 104, and the wheel 130 and gearing 128 (in part) are fixed for rotation in unison on a shaft 136 supported at its opposite ends in brackets 138 fixed to beams 104. The motor 126, preferably, is made to include an electrically controlled clutch so that, although said motor operates continuously, it drives the wheel 130 and the replenishing roll R2 only in accordance with the operation of said clutch under separate, and usually remote, control means. The wheels 130 and 132 and the replenishing roll turn in directions indicated by arrows thereon in Fig. 17.

The commutator 124 is a flat, circular dielectric disk 140, suitably fixed to the inner side of each brake drum 86 and having fixedly embedded, in its inner face, a metal, contact bridge in the form of a conducting patch 142, the exposed surface of which is coplanar with the inner face of the disk 140. The latter, of course, turns with the brake drum and with a related replenishing roll R2 and, at a certain point in its revolution, the patch 142 bridges two poles or contacts 144 of a switch 146, suitably fixed to roll-supporting arm 42, to close an electric circuit through said switch for purposes hereinafter explained.

The brush 120, as may be seen in Fig. 3, is somewhat longer than the width of the widest web W with which the device may be called upon to operate. It is supported at each end by swing arms 148, pivotally connected at their upper ends, through a cross shaft 150, to beams 104. A tension spring or springs 152 connected between one or both of arms 148 and a bracket or brackets 154 of a related press-supporting structure hold the brush 120 yieldably, fully retracted, substantially clear of web W as in Figs. 1, 6, 16 and 19.

As best seen in Figs. 4 and 5, the brush-actuating mechanism 122 includes two pneumatic cylinders 156 and 158, having mounting straps 160, 162 through which the cylinders are pivotally supported in side-by-side parallelism on a horizontal pivot pin 164 screwed into or otherwise fixed to a column 166 which may be part of a structure which supports the press or machine to which the web is supplied.

Cylinder 156 may be referred to as a "readying" cylinder as it functions to ready the brush 120 for splicing operation by moving the brush into close association with but, nevertheless, clear of web W as shown in Fig. 17. Cylinder 156 has a piston rod 168, actuated by a piston 170 and having a slot 172 in a head 174 to engage there-within, with possible lost motion, a pin 176 fixed in one of the brush arms 148. Under the force of air pressure in cylinder 156, piston 170 and rod 168 are urged to an extreme rightward position as viewed in Figs. 4 and 5. In this position of the rod 168, the pin 176 remains in the left end of slot 172 due to the retractive force of spring

152, and the brush is in what may be termed its "ready" position close to but clear of web W as in Fig. 17.

Cylinder 158, which may be referred to as a "brush-pressing" cylinder, is preferably somewhat larger in diameter than cylinder 156. It has a piston 178, piston rod 180 and a head 182 which pivotally engages pin 176 without material lost motion.

Cylinders 156 and 158 are provided with similar, electrically operated air-supply valves diagrammatically shown respectively at 184 and 186 in Fig. 5, and shown, still diagrammatically but in some detail, in Fig. 5A. Each of these valves has a cylindrical casing or body 187 formed with a supply port 188 connected by a pipe 190 to a source of supply of compressed air, a charging port 192 connected to its related cylinder 156 or 158, and an exhaust port 194 open to atmosphere. Each of said air valves also has a reciprocable, spool-like valve element 196 with an integral or integrated stem 198 extending through one end of the valve casing to form a core of an electrical actuating solenoid 199 related to valve 184 and a similar solenoid 199A related to valve 186.

An internal compression spring 200 may be employed to hold the valve element 196 in its exhaust position shown in full lines in Fig. 5A in which the valve provides communication between cylinder 156 or 158 and ambient atmosphere, and the solenoid 199, when electrically energized, may shift the spool 196 to its charging position shown in broken lines in Fig. 5A in which compressed air is charged through the valve into cylinder 156 or 158. It should be understood that the present diagrammatic showing of a spool-type valve is only for illustrative purposes. Other types of valves, capable of yielding the operation necessary to this invention, may be employed.

Each of the three knives 70 and their related operating mechanisms are alike and are similar in many respects to such mechanisms disclosed in my mentioned U. S. Patent No. 2,009,707, dated July 30, 1935. Describing only one of such mechanisms as best illustrated in Figs. 10-15, the knife 70 is disposed within, and is almost as long as, its tubular housing 68. Along its back edge margin, it is fixed to an elongate, flat bar 202, mounted within said housing and guided for longitudinal and radial movement therewithin by guide rollers 204 which are mounted for rotation on studs 206 fixed in filler inserts 208 at each end of the housing 68. Opposed filler inserts 210, cooperating with the rollers 204 and inserts 208, restrain the bar 202 and its related knife against shifting out of the plane of its mentioned movement and the rollers 204 work in similar obliquely disposed slots 212 which guide the bar 202 and knife 70 to constrain it to move obliquely in a longitudinal and radial path.

The mechanism for obliquely moving the knife is housed within an enlargement 214 of the outer end of arm 64 of the front knife-carrying spider 60. The knife is yieldably held in its retracted or rightward position, as viewed in Fig. 11, by suitable spring means such as tension springs 216 and is urged to its extended leftward or cutting position by an electric solenoid 218, the core 220 of which, when said solenoid is energized, abuts an obliquely disposed roller 222 supported for rotation in a yoke 224 suitably riveted or otherwise fixed to one end of the knife bar 202. The solenoid 218 is so associated with the roller 222 that the flat end of the core 220 not only causes some rolling motion of said roller as the knife bar is pushed to its cutting position but the core slides axially of said roller. This sliding and rolling action permits the solenoid to operate the knife bar, notwithstanding the fact that, for compactness of structure, said solenoid is fitted snugly within the enlargement 214 with its core 220 at an angle relatively to the line of movement of the knife bar 202.

It should be understood that successive rolls of paper are moved into position to feed to a related press or other processing mechanism by turning of the reel 30 through successive steps of 120° and that the only one

of the three knives 70, which operates at any one time, is the knife which is between the replenishing roll and the expiring roll. In order to cause such selective knife operation, each of the circuits of the three solenoids 218 preferably includes a limit or position switch (not shown) which partially completes said circuit only when the knife which it controls is approximately in the angular position which it must occupy to cut the web W from the expired roll. A similar limit switch (not shown) also assures that only the conducting patch 142 in dielectric disk 140 of a then replenishing roll will function as hereinafter described.

In operation of the described splicing mechanism, a new roll, which first goes in place on the reel as a replacement roll R3, is made ready by cutting the outer or leading end of the paper web to the shape of a W as at 226 (Fig. 20) and by inserting small, double-faced pasters 228 between the tips of said leading end and the underlying turn of the web to prevent premature, uncontrolled unwinding of the web. In addition, adhesive 230 is applied to outer marginal portions of said leading end leaving an adhesive-free area 232. The thus prepared roll is so placed in the reel that, when it becomes the replenishing roll, the web will be drawn from its outer side.

In Fig. 16, the arm 42, which supports a replenishing roll R2, is substantially out of line with the axis of roll-driving wheel 130 so that the latter is clear of driving contact with the wheel 132 which is associated with roll R2; also, the web W runs directly from roll R1 to a guide roll 234, being clear of the nearest knife housing 68 harboring the knife 70 which will function in a cycle of operation now to be described.

An understanding of a complete cycle of operation can best be had by referring to the electric diagram of Fig. 22 as well as to various other figures of the drawings. It should be noted that in order to simplify said wiring diagram, certain relays and parts thereof which structurally are mechanically associated are shown in the diagram with their parts separated.

Such relays which are commonly used in electrical control apparatus consist of a magnetic coil and one or more contactors which are either opened or closed magnetically when the coil is energized. Thus, for example, the coil of a reel-revolve and brush-release relay is shown toward the bottom of the diagram and marked K. Structurally, three contactors are associated with and magnetically actuated by the coil K, and these contactors have been indicated in the diagram at K1, K2 and K3 by the use of two short parallel lines. K2 and K3 are indicated as normally closed contactors by the placing of a diagonal line across the parallel lines, while K1 is indicated as a normally open contactor by the absence of such a diagonal line. The reference to contactors as being normally closed or normally open is derived from their condition when the related coil, such as, for example, coil K, is in a deenergized condition.

It should also be observed that all electric circuits shown in the diagram of Fig. 22 proceed from a source of electric potential at a main lead x at the left side of said diagram, or from a dependent lead x1, sometimes connected to lead x by a "run" switch 303 or a relay contactor C1, or from a sub-dependent lead x2, which is sometimes connected to lead x1 by a "paste" switch 307 or a relay contactor E1; and all such circuits proceed to the source of electric potential at a main lead y at the right side of the diagram. Each of such circuits, when closed, energizes any relay coil or solenoid through which it passes.

When the operator observes that the web W nears exhaustion on expiring roll R1 (or sooner if desired), he manually closes a "forward" switch 301 to cause coil A of a reel motor starter relay (forward), through contactors (not shown) to cause reel turning motor 72 to operate to turn the reel 30 forwardly, approximately to

its angular position shown in Fig. 17 with driving wheel 130 in driving engagement with wheel 132. Reverse switch 308 similarly controls coil B of reel motor starter relay (reverse) to cause motor 72 to operate reversely to turn reel 30 in the opposite direction if desired. As the contactors associated with relay coils A and B function only as an alternative to putting the circuits from switches 301 and 308 directly through the coils of motor 72, said contactors are not shown in the diagram.

After reel 30 reaches its Fig. 17 position, the operator releases and opens switch 301 to permit the reel to remain at rest in its said position. Then, upon observing that the paper remaining on roll R1 is approaching exhaustion, the operator manually closes a "run" switch 303, thereby energizing coil C of a replenishing roll drive relay which causes relay contactor C1 to close and establish a holding circuit around switch 303. This closing of contactor C1 establishes dependent lead x1, for the time being, as a part of main lead x as a connection to the source of electric potential at the left side of the diagram. The energization of relay coil C also causes the latter to operate contactors (not shown) which control the electric clutch associated with motor 126 to cause the latter, through said clutch, to drive rubber-tired driving wheel 130 and thereby turn replenishing roll R2 about its axis.

The mentioned electric clutch arrangement per se does not constitute an essential part of this invention and, therefore, it is not fully described herein. One such clutch mechanism which is suitable for present purposes is a speed-synchronizing apparatus known commercially as "Ajusto-Spede" drive which is produced by the Dynamatic Division of Eaton Manufacturing Company, of Kenosha, Wisconsin.

The mentioned clutch arrangement is such that, without regard to further control apparatus hereinafter described, it serves to so control the clutch connection between motor 126 and driving wheel 130 that the latter will bring the surface speed of replenishing roll R2 up to the speed of web W and substantially maintain the similarity of said speeds, although, as a matter of preference, in the operation of the apparatus constituting the present invention, the splice of the replenishing roll to the expiring web is usually accomplished just about as the surface speed of replenishing roll R2 reaches the speed of web W. However, if the operator were to delay the actual splicing—and assuming that the expiring roll is not completely spent—the mentioned maintenance of speed equality would become effective through the mentioned clutch arrangement. In the maintenance of such speed equality, the tachometer generators 112 and 114 function, respectively, to sense the speeds of the web W and of the surface of replenishing roll R2 to participate in the control of the mentioned clutch mechanism.

The mentioned closing of run switch 303, in addition to causing the replenishing roll to be driven as already described, also energizes brush-positioning solenoid 199, which operates valve 184 to admit compressed air there-through into cylinder 156 to cause piston 170 and piston rod 168 to move brush 120 against the tension of spring 152 to its Fig. 17 position close to but clear of web W.

During the described rotation of roll R2 about its axis, tachometer generator 114, coacting with the surface of said roll in axial alignment with adhesive-free area 232, causes the speed of said roll to be shown at indicator 118 while tachometer generator 112 causes the speed of web W to be shown at indicator 116. It is within the present invention that, when the two speeds thus indicated are similar, the similarity may automatically bring further control means into play to cause further operations now to be described; however, for practical reasons, it is preferred to have the operator of the mechanism exert control at this point.

When the operator observes, from indicators 116 and

118, that the web and replenishing roll speeds are approximately similar, he manually closes a "paste" switch 307, thereby energizing coil E of a readying relay which causes contactor E1 to close and establish a holding circuit around paste switch 307. This closing of contactor E1 establishes sub-dependent lead X2, for the time being, as a part of dependent lead x1 and of main lead x as a connection to the source of electric potential at the left side of the diagram.

The mentioned closing of contactor E1 partially prepares lead x2 to participate in controlling a brush-operating solenoid 199A, a knife solenoid 218, and a reel-revolve and brush-release relay K, as well as coils G and J of first and second time-delay relays, but the operation of these parts cannot be such that it will necessarily take place instantaneously upon the closing of paste switch 307 by the operator, because those parts must operate only at certain points in the revolution of replenishing roll R2, more particularly, when the adhesive-coated leading end of the paper on said roll is passing through a certain part of its rotary movement.

At this point, it should be noted that when the operator originally placed what is now being discussed as the replenishing roll R2 into the reel 30, the adhesive-coated leading end was not prepared until after the tongue 56 on the end of front spindle 46 was seated within slot 58 in the tubular core 54 of the roll, with the roll firmly held against rotation relatively to the spindles 46 and 48 and, consequently, in a fixed angular relationship with commutator 124. After such mounting of the roll, the operator formed the W-shaped leading end of the paper on the roll at such a predetermined angular distance from the metal conducting patch 142 of the commutator as would permit the hereinafter described steps to occur in a pasting cycle.

It may, on occasions, occur that the mentioned closing of paste switch 307 would instantaneously give rise to the following described operational steps; however, it may be assumed, for present purposes, that the closing of paste switch 307 and of contactor E1 would occur at a time when contacts 144 of commutator switch 146, in the rotation of the latter with the replenishing roll R2, would not be in bridging or circuit-closing association with conducting patch 142. However, as soon as patch 142, in the rotation of replenishing roll R2, turns to a point at which it serves to bridge the contacts 144, it has the effect of closing commutator switch 146 to energize coil F of an intermediate relay which causes contactor F1 to close immediately and energize coil G of a first time-delay relay and also to energize brush-operating solenoid 199A.

The energizing of relay coil G causes contactor G1 to close instantly to establish a holding circuit around contactor F1, which remains closed only during the short space of time when the conducting patch 142 is in bridging association with contacts 144 of commutator switch 146. The energizing of coil G also has the effect that contactor GE is closed only subsequent to a delay terminating after conducting patch 142 has passed and opened contacts 144 of commutator switch 146.

The mentioned energizing of solenoid 199A operates valve 186 to admit compressed air into cylinder 158, thereby causing piston 178 and piston rod 180 to push brush 120 forcibly against web W as in Fig. 18 (pin 176 sliding in slot 172 to permit this movement) to press the web against replenishing roll R2, the brush remaining in said position at least during the time in which the adhesive-coated portion of the paper on roll R2 is moving against web W. Thus, the brush causes web W to adhere firmly to the paper on roll R2 and instantly to tear pasters 228 to free the leading end of the paper on the roll to become a part of the web continuously being supplied by the apparatus to a related press.

The described momentary energizing of coil F, in addition to momentarily closing contactor F1, also mo-

mentarily closes contactor F2 but, as the latter contactor is in series with contactor G2 which, at that time, has not yet been closed, contactor F2 cannot then function to establish any circuit. After contactor F2 has reopened by opening of commutator switch 146, coil G causes a delayed closing of contactor G2 which, like contactor G1, remains closed until the end of the operational cycle being described. This closing of contactor G2 does not immediately establish any circuit, however, because contactor F2 then is open. Thus, in response to the energizing of the first time-delay relay coil G under the control of the conducting patch 142 when the latter first closes commutator switch 146, the only result in the controlled apparatus is the operation of the brush to cause the paper on replenishing roll R2 to be pasted to web W.

As the conducting patch 142 approaches contacts 144 for a second time in the cycle being described, contactor F2 is open because coil F at that time is in a deenergized condition, while contactor G2 is held closed because coil G is maintained energized by its circuit through contactor G1. However, when conducting patch 142, for the second time in the cycle, engages and conductively bridges contacts 144 of commutator switch 146, the coil F of the intermediate relay is again energized and again closes contactors F1 and F2. This closing of contactor F1 is of no effect because contactor G1 is then closed, but this closing of contactor F2 completes a circuit through and energizes a coil J of a second time-delay relay which instantly closes contactor J1 to provide a holding circuit around contactors F2 and G2 until the end of the cycle being described.

The mentioned circuit through contactors F2 and G2 and through holding contactor J1 also completes circuits through a coil K of a reel-revolve and brush-release relay and through a knife solenoid 218. The closing of the circuit through coil K causes the latter to do two things, to wit: (1) it closes contactor K1 to energize coil A of a reel motor starter relay (forward) to cause motor 72 to turn the reel 30 from its Fig. 18 position toward its Fig. 19 position, and (2) it opens contactors K2 and K3 to deenergize solenoids 199A and 199, which, in turn, operate valves 186 and 184 to exhaust air from cylinders 158 and 156 so that brush 120 can be retracted to its Fig. 19 position by spring 152.

As the mentioned circuit through knife solenoid 218 is established simultaneously with the establishment of the circuit through coil K, the energizing of the said solenoid, substantially simultaneously with the commencement of the mentioned forward movement of reel 30 and with the retraction of brush 120, causes knife 70 to be projected from its tubular housing 68 to engage and sever the expired roll R1 from the web W.

Shortly thereafter, following a delay to which coil J is adjusted, the latter coil opens contactor J2, thereby deenergizing coil C of the replenishing roll drive relay to discontinue the turning of wheel 130 by motor 126 and causing contactor C1 to open. As contactor C1 has functioned as a connection of electric energy source lead x to leads x1 and x2, the opening of said contactor assures that relay coils E, F, G, J and K and their related contactors and solenoids 199, 199A and 218 will be instantly restored to their conditions as of the beginning of the described cycle of operation in readiness for another splicing operation.

It will be understood that the time delay under which contactor J2 is opened by coil J, to open contactor C1 to deenergize coil K to open contactor K1 to stop motor 72, corresponds approximately to the time required for said motor to turn reel 30 from its Fig. 18 to rest at its Fig. 19 position. The mentioned opening of contactor C1, in addition to terminating the rotation of reel 30 as just described, deenergizes knife solenoid 218, thereby permitting knife 70 to be retracted by springs 216. With the electrical system thus restored, the reel motor starter relays A and B can only be operated manually, this man-

ual operation being necessary to enable the operator to turn the reel to permit removal of the expired roll and installation and preparation of a new roll in the reel.

It is important to observe that the drive of the replenishing roll by wheel 130 is automatically discontinued by rotation of the reel 30 immediately after pasting of the web W to the replenishing roll; also, that immediately after such pasting and as a result of such reel rotation, the operation of the described web-tensioning mechanism automatically shifts from the expired roll to the roll (formerly a replenishing roll) which takes its place as a web supplier. An important result is that proper tension is maintained continuously on the running web and the driving effect of the wheel 130 does not interfere with the described means by which tension is maintained on the renewed web. Thus, the possibility of a tension-variation break in the web is obviated.

The described arrangement wherein the replenishing roll is driven through its axis rather than at its outer surface is advantageous in avoiding undesirable bubbling or wrinkling of the outermost turn of web on said roll and in permitting satisfactory, uniform driving of the replenishing roll, regardless of any irregularity in the shape of said roll.

It should be apparent that the concepts of this improvement may be utilized in various structures other than those described herein without departing from the invention as set forth in the following claim.

I claim:

A splicing mechanism for attaching a leading end of a web of a replenishing web-roll to a web moving from an expiring web-roll, comprising a rotatable reel having plural pairs of radial roll-supporting arms by which said rolls are carried for movement in a common circular path which includes a first position occupied by a replenishing roll and a second position occupied by an expiring roll, similar roll-revolving means carried by each of said pairs of arms for rotatably supporting a roll, said means including a driven wheel and having a brake mechanism associated therewith for braking said roll-revolving means and a roll supported thereby, an electrically conductive patch, associated with each of said pairs of arms, mounted, apart from said supported roll, for rotation in a circular path in unison with the supported roll, a driving wheel fixedly located at one point adjacent to said

circular path and drivingly coacting with any one of said driven wheels to rotate a roll rotatively related to said one wheel when the latter roll is in said first position, a floating web-tensioning roll coacting with such a moving web to reciprocate in response to increases and decreases of the tension in said moving web, means operative between said floating web-tensioning roll and said brake mechanism associated with a web-roll in said second position for operating the latter brake mechanism to compensate instantaneously for conditions tending to vary the tension of the moving web, web-pressing means for pressing said moving web against an adhesive-coated leading end of a replenishing web-roll, web-severing means for severing the trailing web from an expiring web-roll, reel-turning means for moving a web-roll from said first to said second position, and electrical operating means the operation of which is initiated by the closing of a circuit through said conductive patch at a point in the rotation of the replenishing web-roll which is in predetermined angular relation to the latter's adhesive-coated leading web end, said electrical means being adapted to operate said web-pressing, web-severing and reel-turning means to cause the moving web to be thus pressed and severed and the replenishing web-roll to be thus moved to said second position, the latter movement bringing the brake mechanism for said moved web-roll under the tension control of said web-tensioning roll.

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