

Jan. 15, 1963

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3,073,495

WEB FEEDING APPARATUS

Filed June 22, 1959

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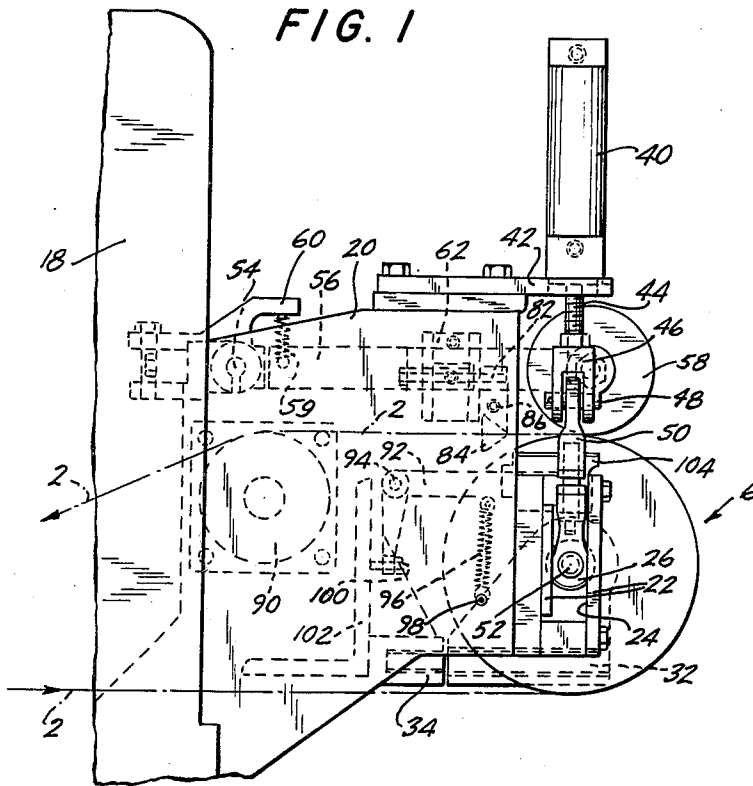
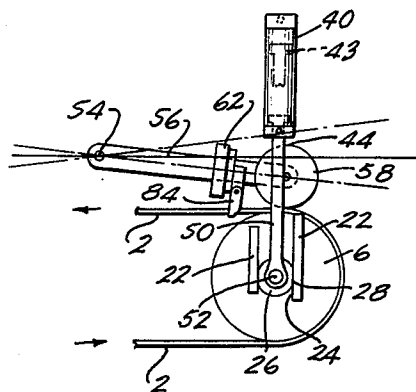


FIG. 3



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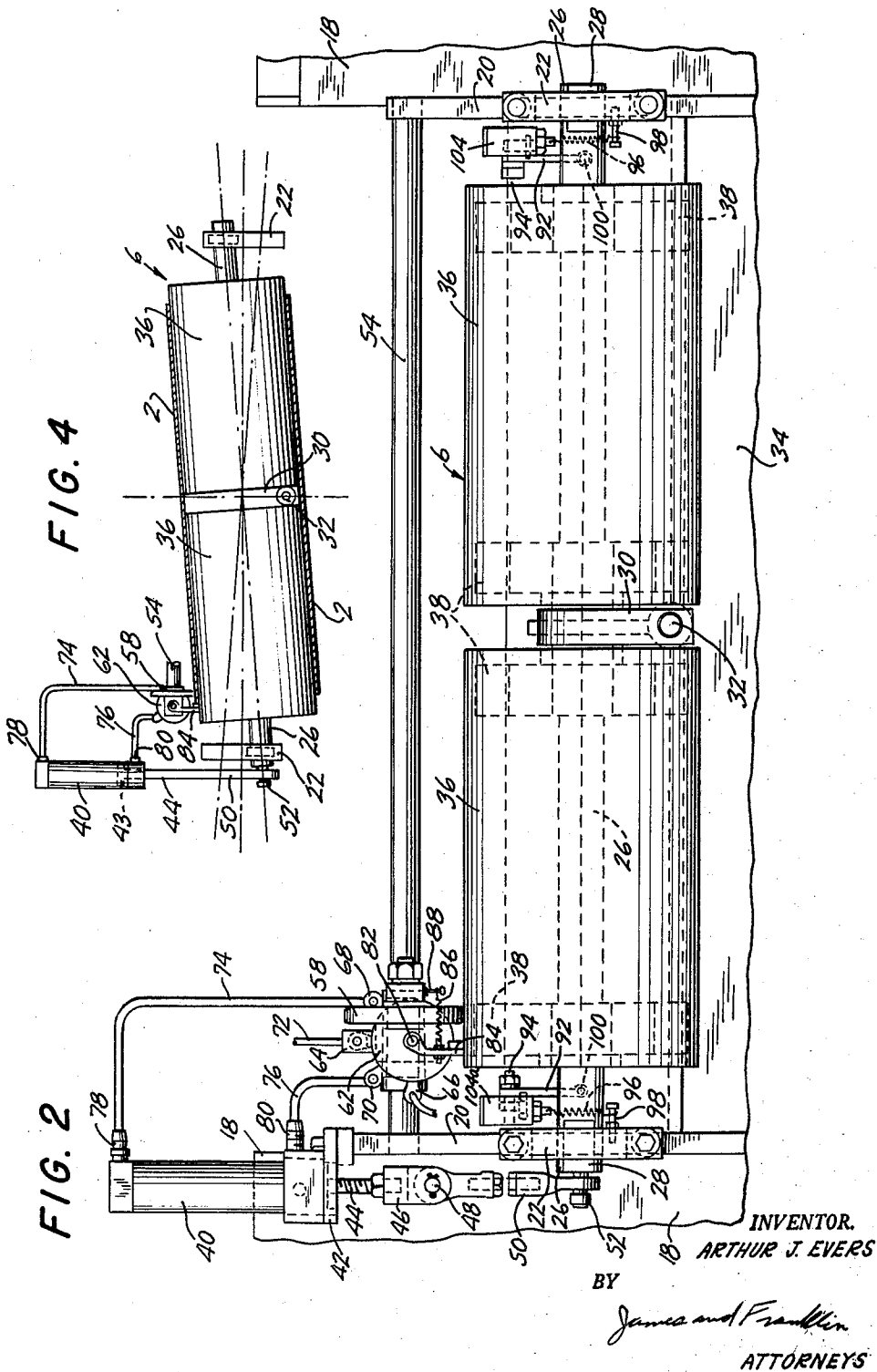
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FIG. 5

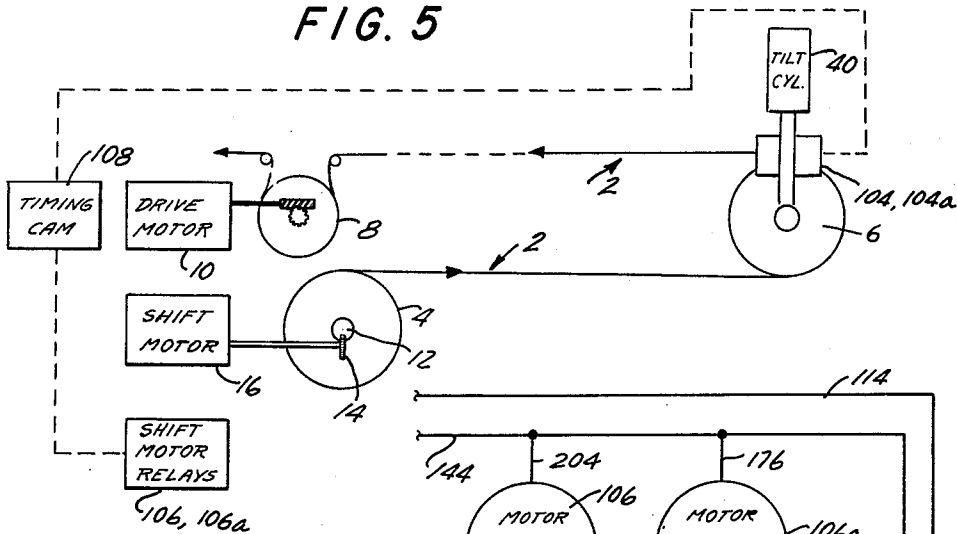
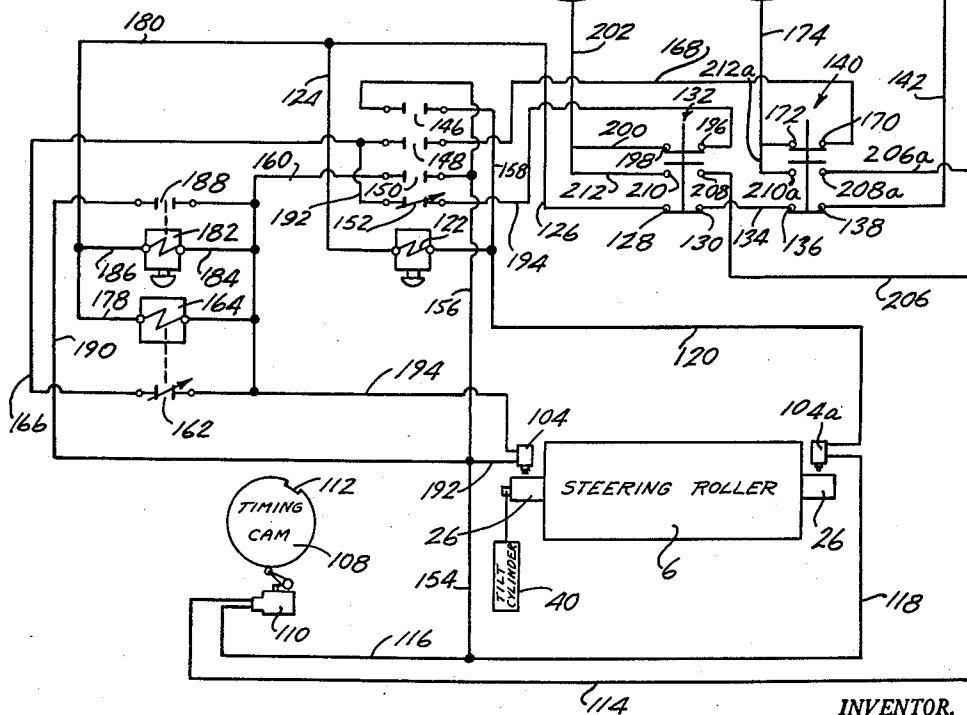


FIG. 6



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WEB FEEDING APPARATUS

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6 Claims. (Cl. 226-23)

The present invention relates to apparatus for feeding a web of material and for ensuring accurate lateral location of that web during its feeding movement.

The feeding of elongated flexible sheets of material, often at high speed, is a common operation, particularly in the printing and stamping arts. The nature of the operation performed on the traveling web of material usually requires that the material be accurately laterally located as it travels. One widely used means for adjusting the lateral position of the web as it is fed is the so-called "steering roller," a guide over which the web passes which is adapted to be tilted about a non-axial point in one direction or the other relative to a normal direction at right angles to the direction of movement of the web, the tilt thereof reacting upon the web so as to cause the latter to shift sidewise and thus bring itself back to desired lateral position.

In systems employing a steering roller means are provided for sensing the lateral position of the web and for causing the steering roller to tilt in such a direction and to such a degree as will tend to restore the web to its desired lateral position. In the past these sensing means have been located at some distance from the steering roller itself. This made for a time lag between the sensing of the mispositioning of the web and the taking of action to correct that mispositioning which reacted adversely upon the accuracy of the system and which often produced overcontrolling and hunting. In addition, the action of the steering roller in correcting the lateral position of the web was found to be relatively ineffective or excessively slow when large or continuing web misalignments occurred. In some instances the web misalignments arose because of misalignments of the web supply, as where the roll from which the web was unwound was laterally uneven or tilted.

It is the prime object of the present invention to devise a system and apparatus which will quickly sense departures of the web from its desired lateral position and promptly and accurately restore the web to its proper position. In accordance with the present invention a steering roller is used to achieve small corrections in the location of the web, large and continuing dislocations of the web being corrected by shifting the lateral position of the web supply, the entire system being coordinated so as to prevent over-control.

In order to improve the accuracy and speed of response of the system the device which senses the lateral position of the web is located as close as possible to the point at which the web leaves the steering roller. Hence once the desired correction has been made, bringing the web back to its normal position, the steering roller is returned to the means which senses the web position is made independent of the tilting of the steering roller so that the position of the web is sensed accurately with respect to the overall apparatus which is adapted to operate upon the web.

To this end a finger is provided which is adapted to engage the side of the web and thus be positioned according to the instantaneous lateral position of the web, that finger in turn controlling the action of an instrumentality such as a pressure cylinder which is active upon the steering roller to tilt it in one direction or the other. The finger is located quite close to the steering roller by means of an arm articulately mounted on the frame of the machine so as to be movable only in a plane substan-

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tially perpendicular to the plane in which the steering roller tilts, the mounting of the arm on the frame being independent of the mounting of the steering roller on the frame. Hence tilting movement of the steering roller affects the lateral position of the web without affecting the sensing action of the finger.

Further means are provided for sensing the degree of tilt of the steering roller and for bodily laterally shifting the position of the web supply if the tilt of the steering roller exceeds a predetermined amount. Hence the steering roller itself provides for small corrections in the location of the web, while for larger corrections the web supply is shifted. In order to prevent over-control should a large lateral web dislocation be only temporary, the web supply shifting system is only intermittently energized, and the amount of lateral shifting of the web supply is limited to a predetermined amount for each energized actuation thereof.

To the accomplishment of the above, and to such other objects as may hereinafter appear, the present invention relates to the apparatus and system for guiding a moving web and controlling its lateral position, as defined in the appended claims, taken together with the accompanying drawings, in which:

FIG. 1 is a side elevational view of the mounting for the steering roller and associated control and actuating apparatus;

FIG. 2 is a front elevational view of the apparatus of FIG. 1;

FIGS. 3 and 4 are side and front diagrammatic views respectively of the steering roller and associated elements;

FIG. 5 is a combination schematic and block diagram illustrating the overall system, including the means for laterally shifting the web supply; and

FIG. 6 is a wiring diagram for the system controlling the lateral shifting of the web supply.

Having reference first to FIG. 5, the web, generally designated 2, and which may take the form of an elongated sheet of fabric, paper, rubber or flexible metal, is supplied in a conventional form such as the large roll 4. It is led from the supply roll 4 over a steering roller generally designated 6 and then over a driving roller 8 which is driven by drive motor 10. The web will, of course, ordinarily travel a much more circuitous path than is shown in FIG. 5, that figure merely illustrating the essential elements of the web guiding and feeding system insofar as they apply to the present invention. The supply roll 4 may be rotatably mounted on rod 12 the underside of which may be provided with a rack engaged by gear 14 driven by shift motor 16 in order to laterally shift the position of the web supply 4.

The mounting and functioning of the steering roller 6 is shown in FIGS. 1-4. The machine comprises a frame 18 having a pair of brackets 20 extending out therefrom, those brackets carrying at their extremities a pair of guides 22 defining therebetween a channel 24 in which the ends of shaft 26 are received for vertical slidable movement, said shaft ends being provided with flats 28 for that purpose. The shaft 26 does not rotate, and is provided with a central depending extension 30 which is pivotally mounted on pin 32 extending from the rear plate 34 of the apparatus. The steering roller 6 is defined by a pair of roller elements 36 rotatably mounted on the shaft 26 to either side of the extension 30 by means of bearings 38.

A pressure cylinder 40 is mounted in bracket 42 secured to one of the brackets 20. Piston 43 is slidable in cylinder 40, and piston rod 44 is connected thereto, extends from the cylinder 40, and is connected, by means of clevis 46, pin 48 and adjustable length connecting rod 50, to one end of the shaft 26, as by means of the pin 52 which passes through the lower end of the connecting

link 50 and into the end of the shaft 26. Movement of the piston in the cylinder 40 upward or downward in accordance with the application of overriding pressure to one side or the other thereof within the cylinder 40 will, it will be apparent, cause the steering roller 6 to tilt in one direction or the other about the axis of the pin 32 depending upon the direction of movement of the piston. Since the pin 32 about which the roller 6 tilts is displaced from the axis of the shaft 26, such tilting of the roller 6 will cause the web 2 passing thereover to shift its lateral position in well known manner.

A rod 54 extends between the brackets 20 at a point rearwardly spaced from, and above, the steering roller 6, and an arm 56 is pivotally mounted thereon adjacent one of the frame pieces 18. This arm carries at its end a rotatably mounted wheel 58 which is adapted to engage and rest upon the upper surface of one of the steering roller elements 36. While the weight of the arm will normally ensure engagement between the wheel 58 and roller section 36, a biasing spring 59 may be provided to further ensure this engagement, that spring being compression-active between the arm 56 and a bracket 60 secured to the rod 54. It will be appreciated that, because of its manner of mounting, the arm 56 can pivot only in a plane perpendicular to the rod 54.

The arm 56 carries a valve 62 having an inlet port 64, an exhaust port 66 and two additional ports 68 and 70. The inlet port 64 is connected by means of a flexible conduit 72 with a suitable source of fluid under pressure, and the ports 68 and 70 are connected respectively by flexible conduits 74 and 76 to the inlet ports 78 and 80 respectively at the top and bottom of the pressure cylinder 40. The valve is actuated by a shaft 82 extending out therefrom in a forward direction, and finger 84 is fixed to the shaft and extends down therefrom. A tension spring 86 is active between the finger 84 and a pin 88 and tends to cause the finger 84, and with it the shaft 82, to rotate in a counter-clockwise direction as viewed in FIG. 2. The finger 84 is so located as to be urged by the spring 86 into engagement with the edge of the web 2 very closely after that web leaves the steering roller 6 in the course of its feeding travel. As shown in FIGS. 1, 3 and 5, the web 2 initially engages the steering roller 6 at its lower surface and leaves it at its upper surface, the wheel 58 actually rolling over the web 2 itself (see FIG. 4), the web 2 then passing over guide roller 90.

L-shaped lever arms 92 are pivotally mounted on the brackets 20 at 94, one at each side of the apparatus. Springs 96 tensioned between pins 98 and horizontal portions of the arms 92 tend to cause those arms 92 to pivot in a clockwise direction as viewed in FIG. 1, the movement of the arms in that direction being limited by engagement between screws 100 on the vertical portions of the arms 92 and stops 102 on the brackets 20. The screws 100 are threadably adjustable in the arms 92 so as to permit adjustment of the pivoted position of the arms 92. Each of the arms 92 carry at its extremity a normally open microswitch 104 or 104a, the actuating element of which is normally spaced from the shaft portion 26 which it overlies but which is adapted to be engaged by that shaft portion, thereby to actuate the microswitch to close the circuit therethrough, when the steering roller 6 is sufficiently tilted in an appropriate direction.

The circuit diagram of FIG. 6 illustrates the manner in which the microswitches 104 and 104a are utilized to control the lateral shifting of the web supply 4. The web supply shift motor 16 is reversible and is provided with a pair of relays 106 and 106a for causing it to rotate in one direction or the other. The main drive motor 10 of the apparatus rotates, through appropriate gearing, a timing cam 108 which is active to close a normally open microswitch 110, the cam 108 being provided with a depressed area 112 of restricted length which, when it comes into operative engagement with the switch 110,

permits that switch to open. The total length of the cam 108 corresponds to a predetermined limited degree of feed of the web 2 which may, for example, be fourteen feet of travel, corresponding to the web distance between the web supply 4 and the steering roller 6. One end of the microswitch 110 is connected to electrical supply line 114, and its other end is connected to lead 116 which connects with normally open microswitch 104a via lead 118 and with normally open microswitch 104 via leads 154 and 192. The other end of microswitch 104a is connected by lead 120 to relay winding 122, the circuit through the relay winding being completed by means of leads 124 and 126, contacts 128 and 130 of the manual control unit generally designated 132, lead 134, contacts 136 and 138 of the manual control unit generally designated 140, and lead 142 to the other supply lead 144.

The relay winding 122, when energized, as it will be only when both microswitches 110 and 104a are closed, closes normally open contacts 146, 148 and 150 and opens normally closed contacts 152. Contacts 146, when closed, produce a holding circuit for the relay winding 132 independent of the actuation of the microswitch 104a, that holding circuit extending from lead 116 through leads 154 and 156, the contacts 146, and lead 158 to the right hand end of the relay winding 122. Closing of the contacts 150 establishes a circuit from leads 116, 154 and 156 through lead 160 and through the normally closed contacts 162 of time delay relay 164 to lead 166, which in turn connects to the contacts 148 of relay 122. (It also connects to contacts 152, via lead 192, but the contacts 152 have been opened by the energization of relay 122.) Since the contacts 148 are closed when the relay 122 is energized, a circuit will be completed through lead 168, the contacts 170 and 172 of manual control unit 140 and lead 174 to shift motor reverse relay 106a, and then via lead 176 to supply line 144. Hence the shift motor reverse relay will be energized, causing the shift motor 16 to operate in a given direction, for so long as the contacts 162 remain closed.

Energization of lead 160 through closing of the contacts 150 will also energize the coil of time delay relay 164, the circuit therethrough being completed by lead 178 and 180 to lead 126 and thence to supply line 144. The opening of the contacts 162 through energization of the relay 164 will be delayed for a predetermined period of time after energization thereof sufficient to permit the shift motor 16 to produce a predetermined amount of lateral shift of the web supply 4, for example, $\frac{1}{2}$ of an inch. Once the relay 164 opens the contacts 162 the shift motor reverse relay 106a will be de-energized and the motor 16 will stop.

Energization of lead 160 through the closing of relay 150 will also energize the winding of relay 182 via leads 184, 186 and 180. This will cause contacts 188 to close, but with relay 122 energized they will have no effect, since a closed circuit will be established from lead 156 through contacts 150, lead 160, contacts 188 and lead 190 back to lead 156.

If it is the microswitch 104 rather than the microswitch 104a which is closed during the time that the microswitch 110 is also closed, as will be the case if the steering roller 6 is tilted in the opposite direction, the closing of the microswitch 110 will connect supply line 114 to one side of the microswitch 104 via leads 116, 154 and 192. The other end of the microswitch 104 will be connected by lead 194 to energize the relays 164 and 182, the circuits through those relays being completed by leads 178 and 186 respectively and then through leads 180, 126, 134 and 142 to the other supply line 144. The energization of relay 182 closes contacts 188, which establishes a holding circuit for relay 182 independently of microswitch 104 via leads 116, 154, 190 and 184 to the relay winding 182. Current will also pass through the contacts 188 and through the closed contacts 162 to lead 166 and from there, via lead 192 through the normally closed contacts 152 of unenergized relay 122, along lead 194, and through

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contacts 196 and 198 of manual control 132 to leads 200 and 202, the latter connecting with shift motor forwardly relay 106, the other end of which is connected via lead 204 to supply line 144. Thus, for as long as the contacts 162 remain closed, which is determined by the time constants of the relay 164, the shift motor forward relay 106 will be energized and the shift motor 16 will be operated in an appropriate direction to laterally shift the position of the web supply 4 by the same predetermined amount of, for example $\frac{1}{32}$ of an inch.

The holding circuits completed by the contacts 146 and 188 for the relays 122 and 182 respectively when the microswitches 104a and 104 respectively are energized permit the timed energization of the shift motor relays 106a and 106 respectively even upon momentary closing of the appropriate microswitch 104a, 104.

All of these results will take place only during such time as the raised area of the timing cam 108 is operatively engaged with the microswitch 110. The depressed area 112 of the timing cam 108 will periodically permit the microswitch 110 to open, thus resetting the control system after the relay 164 has opened the contacts 162.

The manual control units 132 and 140 are provided for manual control of the operation of the shift motor 16 when that is desired. If the control unit 140 is actuated circuits are broken between the contact pairs 136, 138 and 170, 172, thus preventing automatic actuation of the shift motor reverse relay 106a, and at the same time relay 106a is actuated via lead 206a, contacts 208a and 210a and leads 212a and 174. Similarly manual actuation of control unit 132 opens the circuit between contact pairs 128, 130 and 196, 198 and energizes the shift motor forward relay 106 via lead 206, contacts 208, and 210, and leads 212 and 202.

It will be noted that by reason of the manner in which the arm 56 is mounted, the finger 84 which senses the lateral position of the web 2 engages that web immediately as it leaves the steering roller 6. Consequently any deviation of the web 2 from its desired position will be immediately sensed by the finger 84, the finger rotating relative to the valve 62 and thereby controlling the application of pressure to the upper or lower faces of the piston in the pressure cylinder 40 to cause the steering roller 6 to tilt in a direction appropriate to correct the deviation in the lateral position of the web 2. Moreover, as the roller tilts the lateral position of the finger 84 will not be affected. The finger 84 will rise or fall depending upon whether the end of the steering roller 36 engaged by the wheel 48 rises or falls, but since the arm 56 can move only in a vertical plane perpendicular to the rod 56 the sensing accuracy of the finger 84 will be unaffected.

As the web 2 is fed the control system of FIG. 6 will be periodically energized through the closing of the microswitch 110. If neither of the microswitches 104 and 104a is closed during those periods of energization, that is to say, if at that time the steering roller 6 is not tilted sufficiently to engage and actuate the appropriate microswitch 104 or 104a, then nothing will happen. If the microswitch 104a is closed during the time that the microswitch 110 is closed, then the shift motor reverse relay 106a will be energized and the shift motor 16 will rotate in such a direction, and for such a maximum period of time, controlled by the time delay relay 164 and its contacts 162, as to produce a maximum lateral shift of the web supply 4 of a predetermined small amount (such as $\frac{1}{32}$ of an inch) in an attempt to correct the lateral mispositioning of the web 2 which the steering roller has not been able to correct. The microswitch 110 will then open, de-energizing the control circuit of FIG. 6, and resetting the relays, including the relay 164, so that if the movement of lateral shift of the supply roll 4 is insufficient properly to position the web, another increment of shift will be brought about. Thus, if the web 2 has been properly laterally positioned, the finger 84 will sense that and restore the steering roller 6 to its normal horizontal position, both microswitches 104 and 104a will be un-

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actuated, and the control circuit of FIG. 6 will have no effect. On the other hand, if the lateral shift of the web supply 4 has not corrected the situation by the time that the microswitch 110 is again closed, a further shift of $\frac{1}{32}$ of an inch in the lateral position of the web supply 4 will take place. By limiting each individual lateral shift to a predetermined small amount, and by providing an appropriate time delay between possible successive lateral shifts of the web supply 4, the inherent time lag between cause and effect is compensated and over-control and hunting is effectively prevented. The steering roller functions accurately and quickly to correct for small departures of the web 2 from proper lateral positioning, while the lateral shifting of the web supply 4 is largely relied upon to correct for major or continuing dislocations in lateral positioning of the web 2.

While but a single embodiment of the present invention has been here disclosed, it will be apparent that many variations may be made therein, all within the spirit of the invention as defined in the following claims.

I claim:

1. A web feeding apparatus comprising a frame, a member over which a web is adapted to pass, said member being tiltably mounted on said frame, drive means operatively connected to said member for tilting it relative to said frame, an arm articulately mounted on said frame independently of said member and extending toward said member, means urging said arm into engagement with said member, a finger movably mounted on and extending from said arm to a position substantially immediately adjacent said member, and adapted to engage the edge of said web at a point substantially immediately after said web has left said member in the course of the feeding movement of said web, and means sensitive to the position of said finger relative to said arm and effective to actuate said driving means to tilt said member in accordance with said relative position of said finger.

2. The web feeding apparatus of claim 1, in which said member is mounted on said frame to tilt in a given plane, and in which said arm is mounted on said frame to move only in a plane substantially perpendicular to said given plane.

3. The web feeding apparatus of claim 1, in which said member is mounted on said frame to tilt in a given plane, in which said arm is mounted on said frame to move only in a plane substantially perpendicular to said given plane, and in which said finger is movable relative to said arm in a plane substantially perpendicular to the plane of movement of said arm.

4. A web feeding apparatus comprising a frame, a member over which a web is adapted to pass, said member being tiltably mounted on said frame, drive means operatively connected to said member for tilting it relative to said frame, an arm articulately mounted on said frame independently of said member and extending toward said member, means urging said arm into engagement with said member, said member being mounted on said frame to tilt in a given plane, said arm being mounted on said frame to move only in a plane substantially perpendicular to said given plane, a finger movably mounted on and extending from said arm to a position close to said member, and adapted to engage the edge of said web at a point closely after said web has left said member in the course of the feeding movement of said web, and means sensitive to the position of said finger relative to said arm and effective to actuate said drive means to tilt said member in accordance with said relative position of said finger.

5. The web feeding apparatus of claim 4, in which said finger is movable relative to said arm in a plane substantially perpendicular to the plane of movement of said arm.

6. A web feeding apparatus comprising a frame, a member over which a web is adapted to pass, said mem-

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ber being tiltably mounted on said frame, drive means operatively connected to said member for tilting it relative to said frame, an arm articulately mounted on said frame independently of said member and extending toward said member, means urging said arm into engagement with said member, a finger movably mounted on and extending from said arm to a position close to said member, and adapted to engage the edge of said web at a point closely after said web has left said member in the course of the feeding movement of said web, and means 10 carried by said arm, sensitive to the position of said fin-

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ger relative to said arm, and effective to actuate said driving means to tilt said member in accordance with said relative position of said finger.

References Cited in the file of this patent

UNITED STATES PATENTS

1,186,906	Hopkins -----	June 13, 1916
2,078,669	King -----	Apr. 27, 1937
2,666,598	Robinette -----	Jan. 19, 1954
2,853,295	Sabee -----	Sept. 23, 1958