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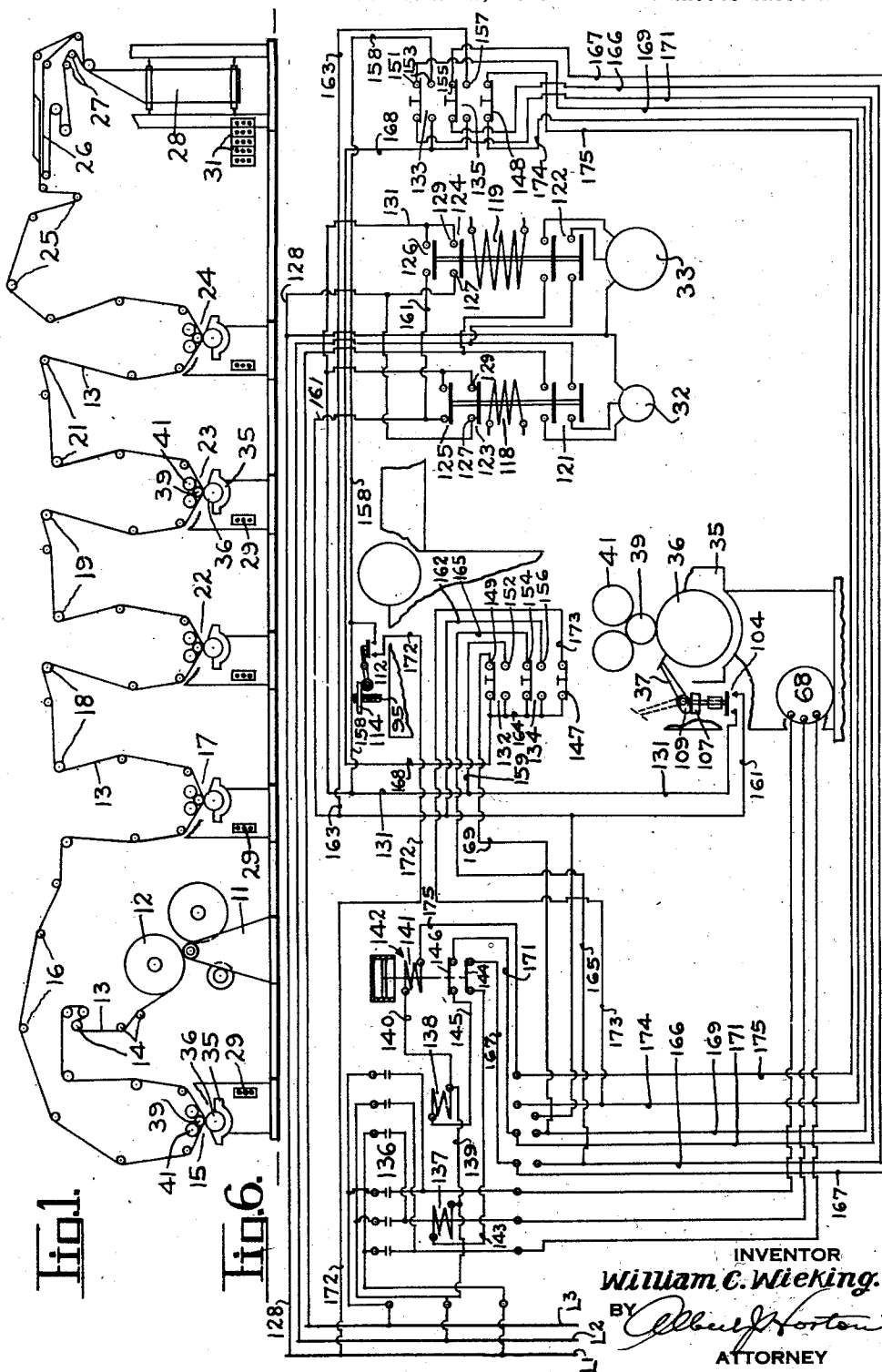
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2,281,900

CONTROL MECHANISM FOR PRINTING MACHINES

Filed Jan. 12, 1940

3 Sheets-Sheet 1



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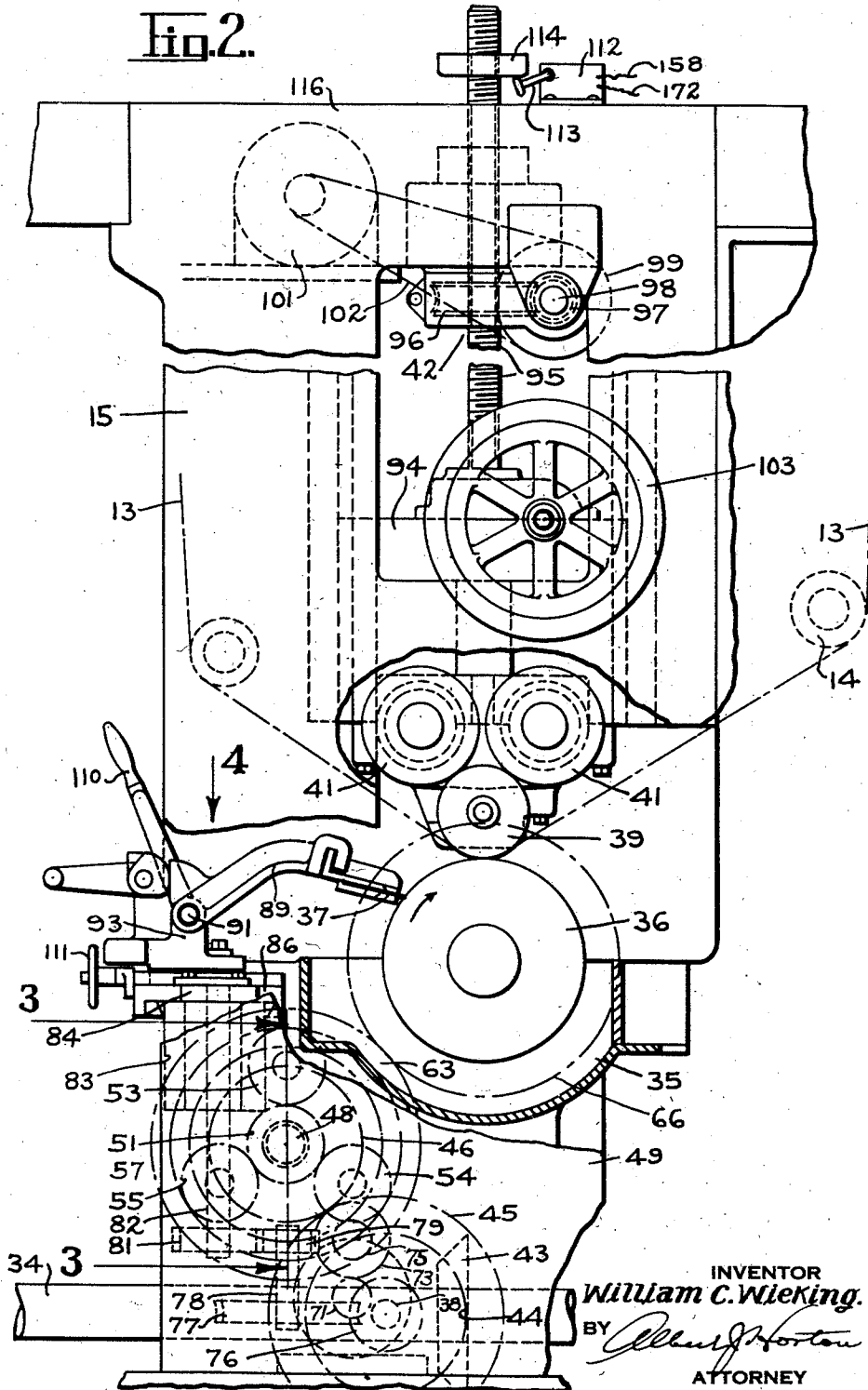
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CONTROL MECHANISM FOR PRINTING MACHINES

Filed Jan. 12, 1940

3 Sheets-Sheet 2



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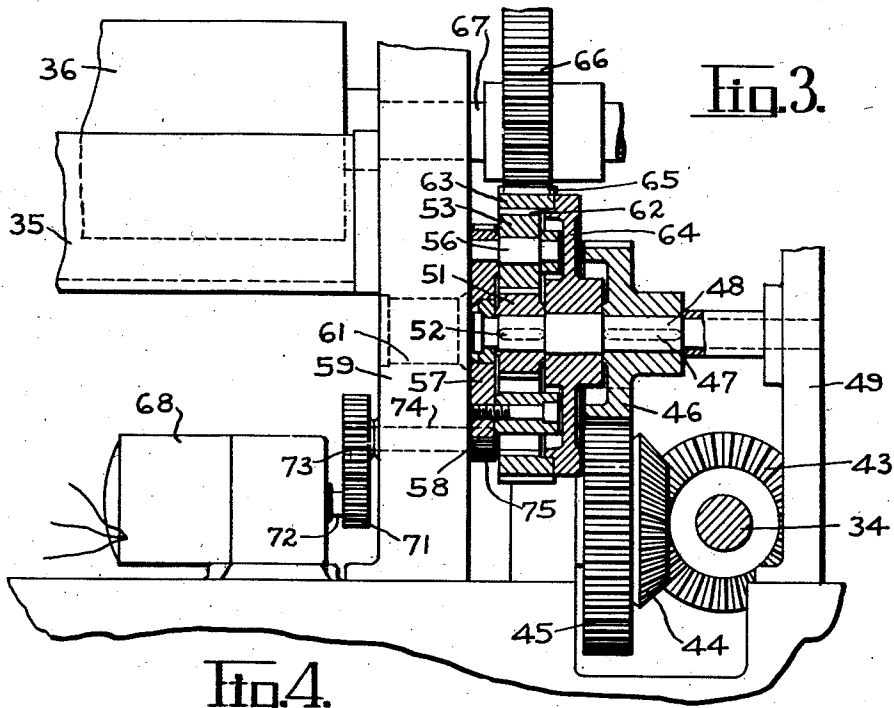
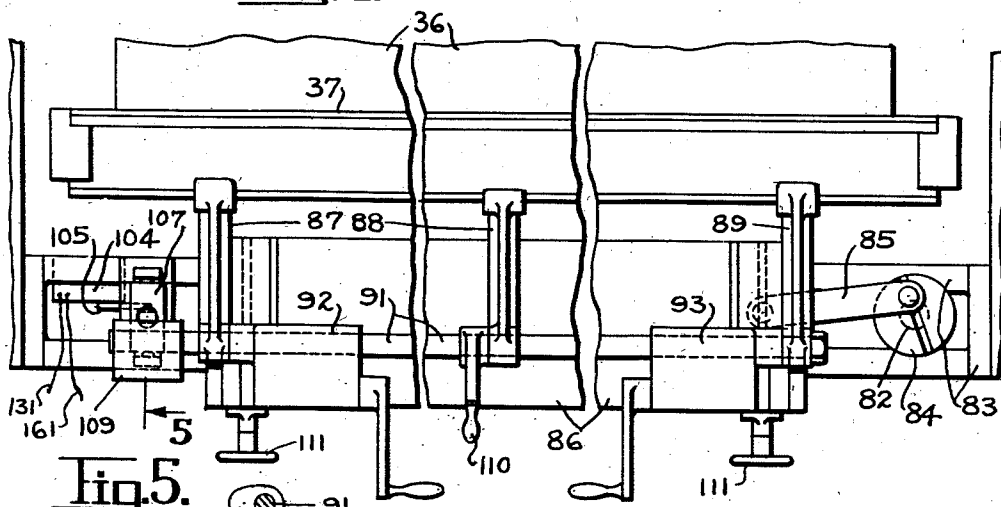
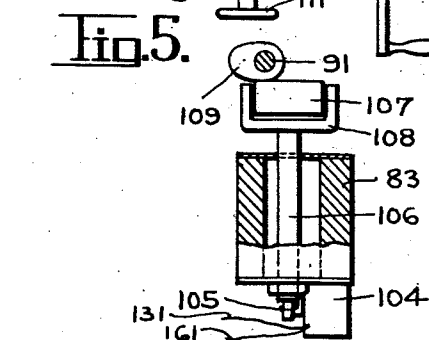
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CONTROL MECHANISM FOR PRINTING MACHINES

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,281,900

CONTROL MECHANISM FOR PRINTING
MACHINES

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Application January 12, 1940, Serial No. 313,587

23 Claims. (Cl. 270—20)

This invention relates to rotary intaglio printing machines and more particularly to machines of this nature having electric motors for registering the form cylinders, and to an improved arrangement of controls for said motors.

One object of this invention is to provide an improved control for an electric motor for registering a form cylinder of a printing machine.

Another object is to provide in a control of the above nature, means to prevent the backward rotation of the cylinder while the printing machine is stopped and a doctor blade is in contact therewith.

Still another object is to provide in a control of the above nature, means to prevent the operation of the cylinder registering motor when the impression roller is down and the printing machine is stopped.

A further object of this invention is to provide in a control of the above nature, a selector switch operative to permit either a limited or a continuous rotation of the cylinder by its registering motor when either a "forward" or a "reverse" control is operated while the machine is running.

It is also an object of this invention to provide an improved means for controlling a rotary intaglio printing machine, that is simple, durable, and inexpensive in construction, as well as convenient, practical, serviceable and efficient in use.

With the foregoing and other objects in view, which will appear as the description proceeds, the invention resides in the combination and arrangement of parts, and in the details of construction hereinafter described and claimed, it being understood that various changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

The preferred embodiment of the invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a schematic layout of a printing machine embodying the features and principles of this invention;

Figure 2 is a broken end elevational view of a printing unit of the machine;

Figure 3 is a broken sectional view taken on the line 3—3 of Figure 2;

Figure 4 is a broken plan view of the doctor blade mechanism for the printing unit as seen in the direction of arrow 4 in Figure 2;

Figure 5 is a sectional view taken on line 5—5 of Figure 4; and

Figure 6 is a circuit diagram showing the electrical controls for the cylinder registering motor and the various interlocks whereby the features, principles and objects of this invention are obtained.

Referring now to the drawings wherein like reference numerals designate like parts throughout the several views, and especially to Figure 1, the numeral 11 denotes a web roll supporting reel upon which is mounted a web roll 12 from which a web 13 is led over suitable guide rollers 14 to a first printing unit 15. From the unit 15, the web 13 is guided by guide rollers 16 to a second printing unit 17 and then by guide rollers 18, 19 and 21 to subsequent printing units 22, 23 and 24 respectively. From the unit 24, the web 13 is guided by guide rollers 25, turning bars 26 and rollers 27 to a folding mechanism 28. A cylinder registering control station 29 is provided at each of the printing units 15, 17, 22, 23 and 24, and a group of cylinder registering control stations, one for each printing unit, are provided at the folding mechanism and indicated by numerals 31.

The printing units 15, 17, 22, 23 and 24 are substantially identical in structure and they, with the folder 28, are arranged to be operated by a common starting motor 32 (shown diagrammatically in Figure 6), and a running motor 33, which are suitably connected to each unit by means of a common drive shaft 34 (Figures 2 and 3). Each printing unit includes an ink fountain 35, a form cylinder 36, mounted to run partly in a body of ink contained in said fountain 35, a doctor blade 37, with its associated mechanism, an impression roller 39, back-up rollers 41, and mechanism 42 for moving the impression roller upwardly away from the form cylinder 36.

The form cylinder 36 is adapted to be rotated from the common drive shaft 34 by means of meshing bevel gears 43 and 44 respectively secured on the common shaft 34 and to a spur gear 45 (see Figure 3). The gear 45 is secured to a shaft 38 and meshes with a gear 46, secured as by a key 47, to a short horizontal shaft 48 journaled at one end in a frame member 49. A pinion 51 is secured, as by a key 52, to the other end of the shaft 48 and is in mesh with each of a set of planetary gears 53, 54 and 55 which are freely rotatable on stud shafts 56 carried by and extending from a gear member 57, which, in this instance, has gear teeth 58 formed upon its pe-

riphery and is journaled in a machine frame 59 by means of a centrally disposed hub member 61. The planetary gears 53, 54 and 55 all mesh with internal teeth 62 of a ring gear 63 which is carried on and by a wheel 64 rotatably supported on the shaft 43 between the gear 46 and the pinion 51. External teeth 65 of the ring gear 63 are in mesh with a gear 66 secured upon the shaft 67 of the form cylinder 35.

From the above, it is obvious that the form cylinder 36 may be rotated from the shaft 34 through the bevel gears 43 and 44, the gear 45, the gear 46, the shaft 48, the pinion 51, planetary gears 53, 54 and 55, the ring gear 63, the gear 66, and the shaft 67, provided the gear member 57 is held stationary. It is also obvious that rotation of the gear member 57 in either direction will vary the register of the form cylinder of the unit with which it is associated in respect to the register of the form cylinders of the other units.

An electric motor 68 preferably of the type having an automatically operated brake that is set when the motor is stopped, is provided to hold the gear member 57 stationary and to rotate it, to change the register of the form cylinder 36. The motor 68 is drivingly connected to the gear member 57 through a pinion 71 secured on the motor shaft 72 and which meshes with a gear 73 secured to one end of a shaft 74 journaled in the frame 59. A pinion 75 secured on the other end of the shaft 74 is in mesh with the teeth 53 on the periphery of the gear member 57. When the motor 68 is stopped and its brake set, the gear member 57 is held stationary, and the form cylinders 36 of all units are rotated in unison, but when the motor 68 of one of the units is operated, the brake now being "off," the form cylinder 36 of that unit is rotated to either accelerate or decelerate its normal movement of rotation, thus changing its registration with respect to the form cylinders of the other printing units.

The actuating mechanism for the doctor blade 37, includes a worm 76 secured to the shaft 33 (see Figure 2), which is driven by the common shaft 34 through the bevel gears 43 and 44. The worm 76 meshes with a worm-wheel 77 secured on the end of a vertical shaft 78. A gear 79 on the other end of the shaft 78 meshes with a gear 81 on the lower end of another vertical shaft 82 that extends upwardly through a frame member 83 and has a disc 84 secured thereto (Figure 4). An arm 85 reciprocated by rotation of the disc 84, in turn reciprocates a slide 86. The doctor blade 37 is swingably mounted by means of arms 87, 88 and 89 secured to a shaft 91 which is journaled in bearings 92 and 93 on the slide 86.

The mechanism 42 for raising and lowering the impression roller 39 in respect to the form cylinder 36 (see Figure 2) includes a vertically slidable frame 94 having a screw threaded spindle 95 extending upwardly therefrom. A worm-wheel 96 having internal screw threads is adapted to act as a nut upon the screw threaded spindle 95 and to be rotated by a worm 97 secured on a shaft 98 having a pulley 99 thereon, which is adapted to be rotated in either direction by an electric motor 101 through a belt 102 or other suitable driving connection. Suitable limit switches (not shown) may be provided to control the motor 101 to limit the up and down movement of the roller 39. A hand-wheel 103 may be provided to rotate the spindle 95, and connected to a shaft having a worm that meshes with a worm-wheel (not shown) secured to the spindle 95, and thus permit

hand adjustment of the roller 39 for accurate setting.

In a rotogravure printing machine, the doctor blade, as shown in the drawings, is mounted angularly to a tangent drawn at its line of contact with the form cylinder, the angle being such that in operation the periphery of the cylinder turns in a direction away from the adjacent edge of the blade. If the cylinder should be rotated in the reverse direction even to a very slight extent without first raising the doctor blade, the relatively hard blade would seriously injure the surface of the cylinder. Hence, it will be understood that it is desirable to prevent such an occurrence.

In order to prevent operation of the motor 68 to rotate the cylinder 36 backwardly, while the machine is stopped unless the doctor blade 37 has been raised, an interlock switch 104 (Figure 5) is provided having an operating arm 105. The arm 105 is disposed in the path of the lower end of a vertically movable rod 106 having an axially elongated roller 107 carried by its upper end 108, which is bifurcated to provide bearings for the roller. An axially elongated cam 109 secured to the outer end of the shaft 91, to which the blade carrying arms 87, 88 and 90 are secured, is formed to engage the roller 107 and will depress the rod 106 and actuate the switch 104 when the doctor blade 37 is swung away from the cylinder. A handle 110 is secured to the shaft 91 for raising the doctor blade. The roller 107 is axially elongated to compensate for adjustment of the doctor blade 37 toward and away from the cylinder 36 by means of the hand-wheels 111, and the cam 109 is axially elongated to compensate for the reciprocating movement of the slide 86.

While it is entirely practical to advance or retard one form cylinder with respect to others while the machine is printing, it is not advisable to do so when the machine is not running, unless the impression roller is raised; for it is liable to break the web and also imposes an unnecessary overload on the registering motor.

In order to prevent operation of the motor 68 to rotate the form cylinder 36 in either direction while the machine is stopped, unless the impression roller 39 has been raised from the cylinder, an interlock switch 112 is provided having an operating arm 113 (Figure 2). The arm 113 is disposed in the path of a member 114 which is screw threaded upon the upper extended end of the screw threaded spindle 95 for vertical adjustment thereon and operation thereby. The member 114 is adjustably secured to the spindle 95 and as the spindle 95 is raised and lowered the member 114 will operate the switch 112.

The interlock switches 104 and 112 are connected into the control circuits of the machine motors, as shown in Figure 6. The control switches of the starting and full speed machine motors 32 and 33 are shown as with the motors stopped, and while the interlock switches of only one printing unit are shown, it will be understood that interlock switches of the additional printing units are connected in circuit with those shown so that all operate uniformly. The registering motor 68 is also shown stopped, the doctor blade 37 is shown down, resting upon the cylinder 36, the impression roller 39 is shown down in contact with the form cylinder 36, and the interlock switches 104 and 112 are open. Motors 32 and 33 may be started in the usual sequence to operate the printing machine by energizing the control coils 118 and 119 respectively, which close motor control switches 121 and 122 respectively.

This action of the control coils 113 and 119 also closes switches 123 and 124 which are in parallel, and switches 125 and 126 which are also in parallel. One contact 127 of each of the switches 123 and 124 is connected by a common conductor 128 to the line wire L1. The other contact 129, of the switches 123 and 124, is connected by a common conductor 131 to one terminal of each of the interlock switches 104 and 112 respectively.

Each registering motor control station 29 at each printing unit and each station of the group 31, at the folding mechanism 28, includes three push button switches. The upper ones 132 of each station 29 and 133 of each station 31, and the intermediate ones 134 of each station 29, and 135 of each station 31 are operable to cause forward or reverse actuation of the registering motor 68. The registering motor is connected as is usual to a controller device designated generally by the numeral 136, which includes forward control coil 137 and a reverse control coil 138, one terminal of each coil 137 and 138 being connected together and to the line wire L2 by a conductor 139, and by a conductor 140 to one terminal of the coil 141 of an adjustable time delay relay 142. The other terminal of the forward control coil 137 is connected by a conductor 143 to one contact of a normally closed switch 144 and the other terminal of the reverse control coil 138 is connected by a conductor 145 to one contact of a normally closed switch 146. The switches 144 and 146 are adapted to be acted upon by the time delay relay coil 141. The adjustable time delay relay 142 is of the usual type whereby its action may be delayed a predetermined amount before the switches 144 and 146 are opened by its coil 141. The lowermost or selector push button switches 147 of the unit stations 29 and 148 of the folder stations 31 are operable to maintain open the circuit through the time delay relay coil 141, and the switches 144 and 146 closed, to permit continuous operation of the motor 68 when desired, the time delay relay 142 being preferably set to provide an amount of registering correction, of say .003" to .005" regardless of how long either of the push button switches 132, 133, 134 and 135 are held down and therefore closed.

The registering motor "forward" push button switches 132 at the units and 133 at the folder 28 are double contact switches, the upper contacts 149 and 151 respectively being normally in closed position, and the lower contacts 152 and 153 respectively being normally in open position. Actuation of either of the switches 132 or 133 reverses this condition, opening the normally closed contacts 149 or 151 and closing the normally open ones 152 or 153. The reverse switches 134 at the units and 135 at the folder 28 are also double contact switches, the upper contacts 154 and 155 respectively being normally in closed position and the lower contacts 156 and 157 respectively being normally in open position so that actuation of either of the switches 134 or 135 will reverse this condition and open the contacts 154 or 155, and close the contacts 156 or 157.

As shown in Figure 6, the interlocking switch 112 controlled by the member 114 on the threaded spindle 95, which raises and lowers the impression roller 39, is open when the roller 39 is down in contact with the form cylinder 36. With the switch 112 open, and as the switches 123, 124, 125 and 126 are also open when the machine is stopped, the registering motor then cannot be operated to rotate the cylinder 36.

While the press is in operation, either the switches 123 and 125, or 124 and 126 are closed, and any one of the push buttons 132, 133, 134 or 135 may be operated to actuate the motor 68 regardless of whether the switches 112 and 104 are open or closed. Thus, while the press is running, the control circuit for operation of the contactor 137, to move the form cylinder in a forward direction is as follows: From line L1, through conductor 128, through switches 123 or 124, through conductor 131, through conductors 159 or 158, through the normally open push button switches 132 or 133 (then closed), located at the unit and folder respectively, through conductor 163, through the normally closed contact 154 of push button switch 134, through conductors 165, 166, through the normally closed contact 155 of push button switch 135, through conductor 167, through the normally closed contact 144 of relay 142, through conductor 143, through coil of contactor 137, through conductor 139 to line L2.

The form cylinder may be rotated in a reverse direction while the press is in motion regardless of whether or not either or both the interlock switches 104 or 112 are closed, (by raising the doctor blade or by raising the impression roller), the circuits closing the reverse contactor 138 being as follows: From line L1, through conductor 128, through switches 123 or 124, through conductor 131, through switches 125 or 126, through conductor 161, through conductors 162 or 163, through the normally open contacts 156 or 157 (then closed), of the push button switches 134 or 135 located at the unit and folder respectively, through the conductor 168, through the normally closed contact 149, through conductor 169, through the normally closed contact 151, through conductor 171, through the normally closed contact 146, through conductor 145, through the reverse contactor coil 138, through conductor 139 to line L2.

When the press is not in motion, motor 68 cannot be energized unless the impression roller is raised, closing the switch 112. With the switch 112 closed and the press stopped, the motor 68 can be energized to rotate the form cylinders in a forward direction only, unless the doctor blade is also raised, closing the switch 104. The control circuit to energize the forward contactor coil 137 with the switch 112 closed and the press stopped, differs from the one previously described only in the fact that switch 112 closes the circuit to line L1 instead of either of the two switches 123 and 124, which are open under these circumstances. The circuit energizing the reverse contactor coil 138, while the press is stopped, differs from the circuit previously described, by the fact that both sets of switches 123 and 124, and 125 and 126 are then paralleled by the switches 112 and 104 respectively.

As stated above, the selector switches 147 and 148 are for use in continuing the registering rotation of the cylinder 36 beyond the amount permitted by the time delay relay 142. The circuit whereby this is accomplished, starting at one side of switch 147, is made through a conductor 173 and a conductor 174 to the switch 148, then through a conductor 175 to the time delay relay coil 141, and then through the conductor 140 to the conductor 139 and to the line wire L2. The switches 147 and 148 are also in series with the open contacts at the units and at the folder by the conductor 164 which is connected to the

other side of the switch 147. In view of this arrangement, the circuit through the time delay relay control coil 141 may be opened by actuation of either the switch 147 or the switch 143, to maintain the switches 144 and 146 in closed position, and thus continue the operation of the motor 63, whenever any one of the control switches 132, 133, 134 or 135 are operated to actuate the motor 63, being of course, under the control of the interlock switches 104 and 112 for the different conditions above described.

Briefly the operation is as follows:

Assuming that the switches 123, 124, 125 and 126 are closed and the printing machine in operation, with the impression roller 39 lowered into contact with web 13 to press it against the form cylinder 36, and with the doctor blade 37 in running contact with the form cylinder; when it is desired to operate the cylinder registering motor on one of the units to correct a misregister, if the correction requires a forward rotating movement of the cylinder 36, this is accomplished by pressing either the push button switch 132 at the printing unit or the push button switch 133 at the respective station for that printing unit at the folder 28. Should more than the predetermined amount of correction to which the timed relay 142 is set be required, the operation may be repeated, or either of the switches 147 or 143 may also be pressed down to open the circuit through the coil 141 of the time relay 142, which will permit continuous operation of the motor 63, while pressure is maintained on the push button 132 or 133.

When the machine is stopped without raising the impression roller 39, the motor switches 123 and 124 will be opened and the contacts of switch 112 will also be open interrupting all paths for the supply of current to the control circuits of motor 63. Thus, the motor 63 can not be operated until the switch 112 is closed by the raising of the impression roller 39. When this roller is raised, the circuit through the "forward" coil 137 of the controller for the motor 63 can be established by pressing the button of switch 132 or 133, but it is impossible to operate the motor 63 in the reverse direction until the contacts of the switch 104 are closed by raising the doctor blade 37. When this is done, a reverse control circuit for the motor 63 is established to the push button switches 134 and 135, either of which when pressed, will operate the cylinder registering motor to cause a backward rotating movement of the cylinder 36.

From the above, it is believed to be obvious that means has been provided whereby any form cylinder 36 of a plurality of units may be selectively rotated to register it with others either from any one of the units or from the folding mechanism, and that such actuation is controlled by the disposition of the doctor blade associated with the cylinder of the selected unit, and by whether the printing machine is running or stopped, and by whether or not the impression roller is up or down. With the machine stopped, if the doctor blade is down on the cylinder 36, the cylinder cannot be rotated backwardly, but may be rotated forwardly if the impression roller is raised. With the machine running, the cylinder 36 may be rotated either forwardly or backwardly. The rotation of the cylinder may be continued beyond the amount permitted by the setting of the time de-

lay relay by opening a normally closed selector switch.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being had to the claims rather than to the foregoing description to indicate the scope of the invention.

What I claim is:

1. In a printing machine, a rotatable form cylinder, a doctor blade adapted to be raised from and lowered into contact with the cylinder, a cylinder driving means, mechanism operatively disposed between the driving means and the form cylinder to accelerate and to decelerate the normal movement of rotation of the cylinder by the driving means, and means controlled by movement of the doctor blade to control the operation of the said mechanism.

2. In a printing machine, a rotatable form cylinder, a doctor blade adapted to be raised from and lowered into contact with the cylinder, a cylinder driving means, mechanism operatively disposed between the driving means and the form cylinder to accelerate and to decelerate the normal movement of rotation of the cylinder by the driving means, and means controlled by movement of the doctor blade to control the operation of the said mechanism, and adapted to prevent retarding the cylinder when the doctor blade is lowered into contact with the cylinder, and to permit it to operate when the doctor blade is raised.

3. In a printing machine, a plurality of printing units each having a form cylinder and a doctor blade adapted to be raised from and lowered into contact with the cylinder, a folding mechanism, means to drive the printing units and the folding mechanism in unison, a registering motor at each printing unit to superimpose rotary additive and subtractive registering movements on the rotating movement of the form cylinder thereof as it normally rotates, control switches for each registering motor, one at each unit and one at the folding mechanism, and another switch at each unit in circuit with the control switches and being actuated by said doctor blade when it is raised, to close the circuit through said control switches and, when said doctor blade is lowered, to open the circuit through said control switches.

4. In a printing machine, a form cylinder, a doctor blade swingable toward and away from the said cylinder, means to rotate the cylinder normally, a registering motor adapted to superimpose rotating additive and subtractive registering movements on the cylinder apart from its normal rotating movement, a reversing controller for the registering motor, and a switch operable by movement of the doctor blade when it is swung toward the cylinder, to prevent operation of the reversing controller.

5. In a printing machine, a form cylinder, a doctor blade swingable toward and away from the said cylinder, means to rotate the cylinder normally, an electric motor adapted to superimpose rotating additive and subtractive registering movements on the cylinder apart from its normal rotating movement, a reverse switch and a forward switch for the motor, and a switch operable by movement of the doctor blade when it is swung toward the cylinder to open the circuit through the reverse switch.

6. In a printing machine, a printing unit including a form cylinder and an impression roller, means to rotate the form cylinder normally, an electric motor adapted to superimpose rotating additive and subtractive registering movements on the form cylinder apart from its normal rotating movement, forward and reverse switches for the motor, means to raise and lower the impression roller, and a switch in circuit with the forward and reverse switches and controlled by the roller raising and lowering means to open the circuit through the forward and reverse switches when the roller is in lowered position.

7. In a printing machine, a printing unit including a form cylinder and an impression roller, means to rotate said form cylinder normally, an electric motor adapted to superimpose rotating additive and subtractive registering movements on the form cylinder apart from its normal rotating movement, forward and reverse switches for the motor, means to raise and lower the impression roller, a switch in circuit with the forward and reverse switches and controlled by the roller raising and lowering means to open the circuit through the forward and reverse switches when the roller is in lowered position and the form cylinder is stopped, and additional switches adapted to be closed when the form cylinder is rotating normally to maintain the circuit closed through the forward and reverse switches when the roller is raised and also when it is lowered.

8. In a printing machine, a printing unit including a form cylinder and an impression roller, means to rotate the form cylinder normally, an electric motor adapted to superimpose rotating additive and subtractive registering movements on the form cylinder apart from its normal rotating movement, forward and reverse switches for the motor, means to raise and lower the impression roller, a switch in circuit with the forward and reverse switches and controlled by the roller raising and lowering means, to open a circuit to the forward and reverse switches when the roller is in lowered position, a doctor blade swingable toward and away from the form cylinder, and a switch operable by the doctor blade when it is swung toward the cylinder to open a circuit to the reverse switch.

9. In a printing machine, a printing unit including a form cylinder and an impression roller, means to rotate the form cylinder normally, an electric motor adapted to superimpose rotating additive and subtractive registering movements on the form cylinder apart from its normal rotating movement, forward and reverse switches for the motor, means to raise and lower the impression roller, a switch in circuit with the forward and reverse switches and controlled by the roller raising and lowering means, to open a circuit to the forward and reverse switches when the roller is in lowered position and the form cylinder is stopped, additional switches adapted to be closed while the form cylinder is rotated normally, to maintain a circuit closed to the forward and reverse switches when the roller is raised and also when it is lowered, a doctor blade swingable toward and away from the form cylinder, and a switch operable by motion of the doctor blade when it is swung toward the cylinder to open a circuit to the reverse switch.

10. In a printing machine, a form cylinder, a doctor blade swingable toward and away from the said cylinder, means to normally rotate the form cylinder, a registering motor adapted to superimpose rotating additive and subtractive

registering movements on the form cylinder apart from its normal rotating movement, a reversing switch for the motor, a time delay relay for the reversing switch to limit the operation of the motor, a switch operable by the doctor blade when it is swung toward the cylinder to open the circuit through the reversing switch, and a relay control switch in circuit with said time delay relay, to open its circuit and thereby permit the motor to operate continuously.

11. In a printing machine, a printing unit including a form cylinder and an impression roller, means to rotate the form cylinder normally, an electric motor adapted to superimpose rotating additive and subtractive registering movements on the form cylinder apart from its normal rotating movement, forward and reverse switches for the motor, means to raise and lower the impression roller, a switch in circuit with the forward and reverse switches and controlled by the roller raising and lowering means, to open the circuit through the forward and reverse switches when the roller is in lowered position, a settable time delay relay for operating the forward and reverse switches, to limit the forward and reverse operation of the motor, and a relay control switch in circuit with the time delay relay to open its circuit and thereby permit operation of the motor continuously.

12. In a printing machine, a printing unit including a form cylinder and an impression roller, means to rotate said form cylinder normally, an electric motor adapted to superimpose rotating additive and subtractive registering movements on the form cylinder apart from its normal rotating movement, forward and reverse switches for the motor, means to raise and lower the impression roller, a switch in circuit with the forward and reverse switches and controlled by the roller raising and lowering means to open the circuit through the forward and reverse switches when the roller is in lowered position and the form cylinder is stopped, additional switches adapted to be closed when the form cylinder is rotating normally, to maintain the circuit closed through the forward and reverse switches, when the roller is raised and also when it is lowered, a doctor blade swingable toward and away from the form cylinder, a switch operable by movement of the doctor blade when it is swung toward the cylinder, to open the circuit through the reverse switch, a settable time delay relay for operating the forward and reverse switches to limit the forward and reverse operation of the motor, and a relay control switch in circuit with the time delay relay to open its circuit and thereby permit longer operation of the motor.

13. In a printing machine, a form cylinder, means to rotate the form cylinder normally, an electric motor adapted to superimpose additive and subtractive rotary movements on the said cylinder apart from its normal rotating movement, forward and reverse switches for the motor, a doctor blade swingable toward and away from the cylinder, a normally open switch in circuit with the motor reverse switch, and means actuated when the doctor blade is swung away from the cylinder to close the normally open switch whereby the reverse switch can be operated to reversely actuate the motor.

14. In a printing machine, a form cylinder, means to rotate the form cylinder normally, an electric motor adapted to superimpose additive and subtractive rotary movements on the cylinder apart from its normal rotating movement,

forward and reverse switches for the motor, an impression roller movable toward and away from the cylinder, a normally open switch in circuit with the forward and reverse switches, and means actuated when the impression roller is raised to close the normally open switch, whereby the forward and reverse switches can be operated to respectively, forwardly and reversely actuate said motor.

15. In a printing unit for a multicolor rotogravure printing machine, a form cylinder, an impression roller coacting with the form cylinder to print on material, a doctor blade supported to be moved into and out of engagement with the form cylinder, a first driving means for rotating the cylinder to print, a second driving means to accelerate and decelerate the normal rotative movement of the cylinder by the first driving means for registering the printing, and means responsive to motion of the doctor blade into engagement with the form cylinder, to prevent operation of the second driving means to rotate the cylinder in one direction, while the first driving means is inactive.

16. In a printing unit for a multicolor printing machine, a form cylinder and an impression roller movable relatively thereto into coacting relation to print on material, a first driving means for rotating the cylinder to print, a second driving means to accelerate and decelerate the normal rotative movement of the cylinder by the first driving means for registering the printing, and means responsive to a relative motion of the impression roller and the form cylinder into coacting relation, to prevent operation of the second driving means while the first driving means is inactive.

17. In a printing unit for a multicolor rotogravure printing machine, a form cylinder, an impression roller coacting with the form cylinder to print material, a doctor blade supported to be moved into and out of engagement with the form cylinder, a first driving means for rotating the cylinder to print, a second driving means to accelerate and decelerate the normal rotative movement of the cylinder by the first driving means for registering the printing, and means responsive to motion of the doctor blade out of engagement with the form cylinder and to motion of the impression roller out of coaction with the form cylinder, to permit operation of the second driving means to rotate the cylinder in either direction while the first driving means is inactive.

18. In a printing machine, a rotatable form cylinder, a doctor blade adapted to be raised from and lowered into contact with the cylinder, a cylinder driving means, means in addition to the driving means to advance and to retard the cylinder relative to and while it is being driven by the driving means, means to control the operation of the cylinder advancing and retarding means, a rock shaft upon which the doctor blade is mounted to be raised and lowered by rocking movement thereof, and means on the shaft to actuate the control means when the shaft is rocked.

19. In a printing machine, a form cylinder, a doctor blade swingable toward and away from the said cylinder, means to rotate the cylinder normally, a registering motor adapted to impose a rotating registering movement on the cylinder apart from its normal rotating movement while

it is being rotated by the said means, a reversing controller for the registering motor, a rockable shaft upon which the doctor blade is mounted to be swung toward and away from the cylinder, means to prevent the operation of the reversing controller including a switch, and means on the shaft to actuate the switch when the shaft is rocked.

20. In a printing unit for a printing machine, a form cylinder, an impression roller co-acting with the form cylinder to print on material, a doctor blade adapted to engage the form cylinder, a rockable shaft upon which the doctor blade is mounted, means to rock the shaft to move the doctor blade toward and away from the form cylinder, a first driving means for rotating the form cylinder, a second driving means for rotating the form cylinder with respect to the first driving means to register the printing and while it is being driven thereby, means to control the operation of the second driving means, and means on the rockable shaft to actuate the control means when the shaft is rocked to prevent operation of the second driving means.

21. In a printing unit for a printing machine, a form cylinder, an impression roller coacting with the form cylinder to print on material, a doctor blade adapted to engage the form cylinder, a rockable shaft upon which the doctor blade is mounted, means to rock the shaft to move the doctor blade toward and away from the form cylinder, a first driving means for rotating the form cylinder, a second driving means for rotating the form cylinder with respect to the first driving means to register the printing and while it is being driven thereby, the second driving means including a reversible electric motor, a normally open switch to control the reverse operation of the motor, a cam on the rockable shaft, and means extending between the cam and the control switch and adapted to be moved by the cam to close the switch, when the shaft is rocked in one direction to move the doctor blade away from the form cylinder, to permit operation of the motor.

22. In a printing machine, a rotatable form cylinder, a doctor blade adapted to be raised from and lowered into contact with the form cylinder, a cylinder driving means, mechanism operatively disposed between the driving means and the form cylinder to accelerate and decelerate the normal movement of rotation of the cylinder by the driving means, and through which the driving means rotates the cylinder, and means controlled by movement of the doctor blade to control the operation of the mechanism.

23. In a printing machine, a rotatable form cylinder, a doctor blade adapted to be raised from and lowered into contact with the form cylinder, a driven shaft, mechanism operatively connecting the driven shaft with the form cylinder to rotate it at a predetermined speed, means to drive the mechanism to produce additive and subtractive increments of rotative movement of the cylinder in respect to the driven shaft and while being driven thereby, and means controlled by movements of the doctor blade to control the operation of the mechanism to produce the aforesaid increments of movement of the form cylinder.

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