April 24, 1951 E. W. WORTHINGTON ET AL 2,550,318

REGISTER CONTROL AND SIGNAL FOR WEB PRESSES

Filed July 10, 1947 2 Sheets-Sheet 1

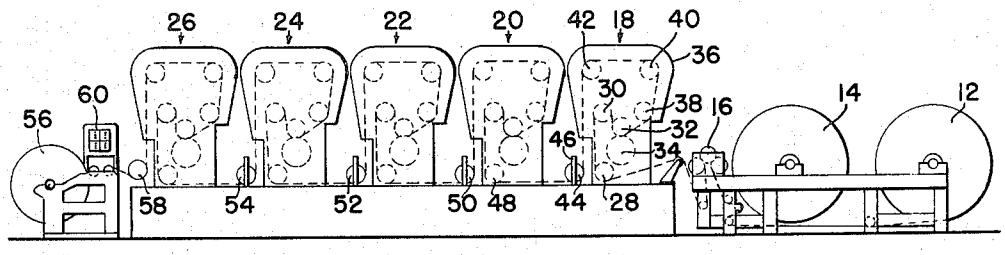


FIG. 1

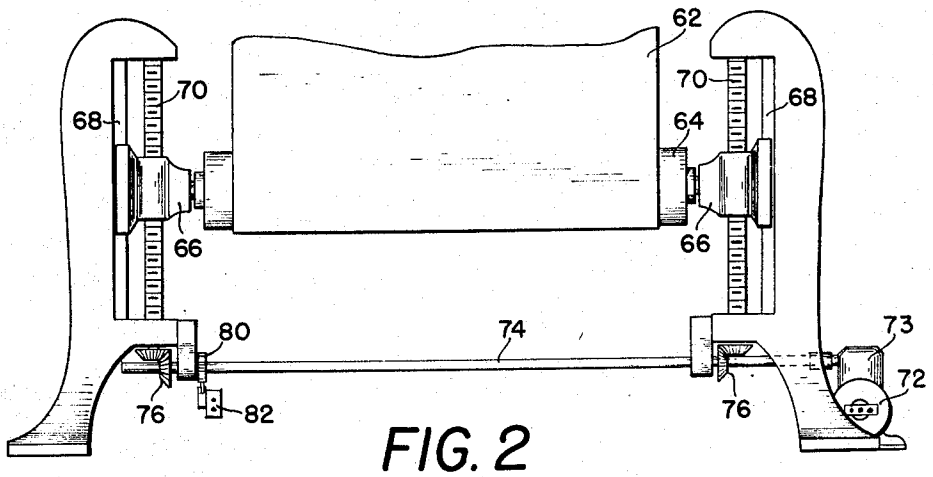


FIG. 2

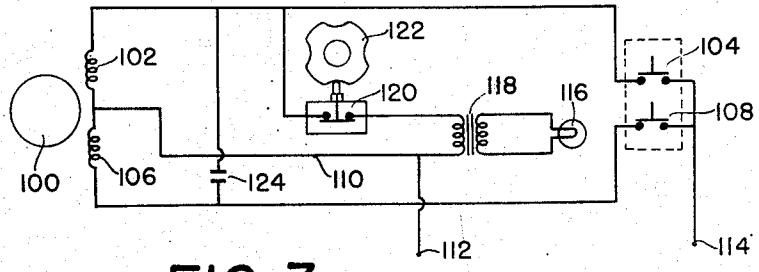


FIG. 3

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REGISTER CONTROL AND SIGNAL FOR WEB PRESSES

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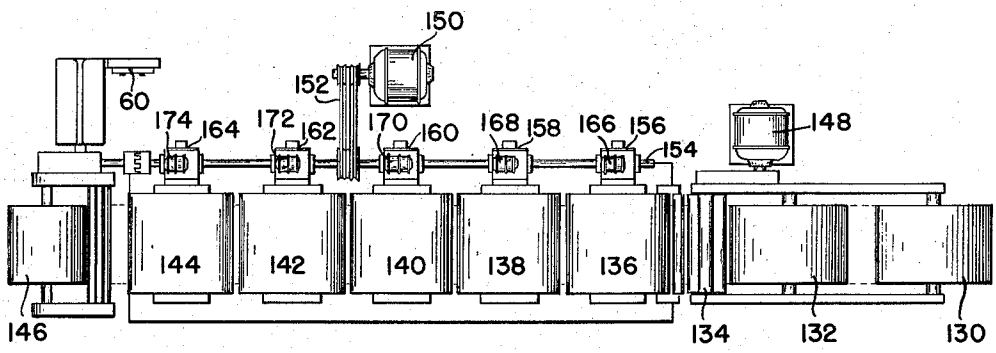


FIG. 4

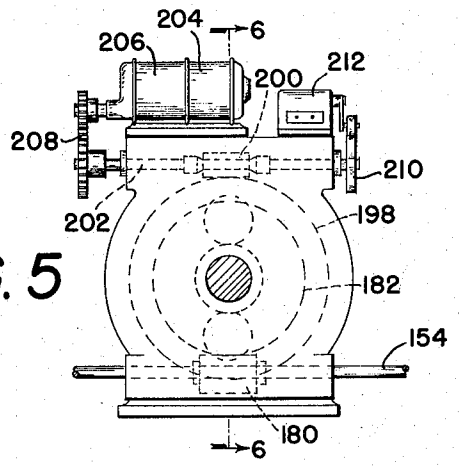


FIG. 5

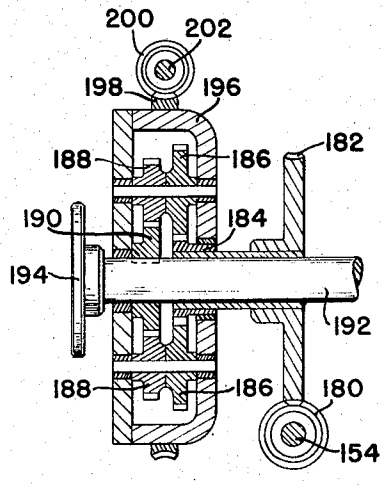


FIG. 6

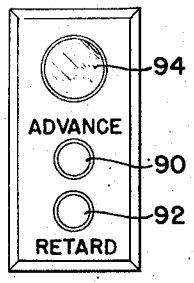


FIG. 7

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REGISTER CONTROL AND SIGNAL FOR WEB PRESSES

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2 Claims. (Cl. 177—311)

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This invention relates to mechanism for registering multiple operations on a single web. A most common example is multicolor printing.

There are many cases in which multiple operations on a single web must be properly registered. Multicolor printing is a common example, but in other cases machines for cutting, slitting, perforating, applying adhesive, or otherwise acting on a web, may be used in combination with one another or/and in combination with single-color or multicolor printing presses. In the present specification, all such units are intended to be covered by the expression "web presses and the like."

There are two well-known methods of controlling register. One is by the use of a compensator roller which increases or decreases the amount of web between the units of the complete machine, thereby making it possible to correct errors in registration. The other is by the use of gearing in the drive to the printing cylinder or other unit. Ordinarily, differential gearing is employed, and in addition to an input shaft and an output shaft, there is a third shaft which feeds a corrective movement into a part of the differential gearing, thereby modifying the position of the output shaft relative to the input shaft. Such an arrangement is commonly referred to as a running register.

While the registration may be corrected by using control devices locally at each of the units, it is far more convenient to locate all of the control devices near one another at the delivery or output end of the machine, so that the finished product may be examined for errors, and appropriate corrective movement introduced. For this purpose, manually operated mechanical means have been employed, for example, hand-wheels with appropriate shafts and gearing running back to the individual units. However, it has been difficult to estimate the necessary correction because of the lost motion or backlash between the hand-wheel and the remote mechanism controlled thereby. It is important to be able to closely estimate the amount which the incorrect unit is advanced or retarded, because each time a change is made the operator must wait for a considerable period of time until the complete series of machines settles down to a new, steady operating condition, before examining the product to ascertain the need for further correction.

In more modern equipment, the corrective movement at the units is usually accomplished by means of small, reversible electric motors. In

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such case the correction is controlled by pressing either of two switch buttons, one for advancing and the other for retarding the operation at the unit. The amount of correction being introduced is estimated by the time or duration of operation of the motor, but that is not a good indication of the amount of correction actually introduced, because of various factors such as lost motion in the gear reduction mechanism; change in speed of the motor depending on the line voltage existing at the particular moment; or for other reasons having to do with the condition of the motor. Moreover, in the case of a compensator roller which must be raised or lowered, the speed of movement in the lowering direction may be faster than that in the rising direction, because in one case gravity aids the movement of the roller, while in the other case it opposes the movement.

The primary object of the present invention is to overcome the foregoing difficulty, and to make possible a more rapid registry between colors or other operations, and to do this regardless of whether a second correction is in opposite direction to the preceding correction, with consequent lost motion, and regardless of changes in line voltage, etc.

A more specific object is to provide means for measuring or indicating the actual corrective movement at the unit being corrected, in contradistinction to the movement introduced at the control device, and independently of the correction time when using a motorized compensating means.

The invention is applicable to control devices localized at the different press units or the like, but in accordance with a further feature and object of the invention, we prefer to localize all of the controls and associated indicators at one focal point.

Still another object of the invention is to apply the same to register control mechanism of both the compensator roller type and the differential gear or running register type.

To accomplish the foregoing objects, and others which will hereinafter appear, our invention resides in the register control and indicator elements and their relation one to the other, as are hereinafter more particularly described in the following specification. The specification is accompanied by drawings in which:

Fig. 1 is a side elevation of a multicolor printing press embodying features of the present invention;

Fig. 2 is a schematic view of a compensator roller with the invention applied thereto;

Fig. 3 is a wiring diagram explanatory of one form of our invention;

Fig. 4 is a top plan view showing the invention applied to a multicolor printing press having running register mechanism;

Fig. 5 is an elevation showing one of the differential gear compensators used in the multicolor press of Fig. 4;

Fig. 6 is a section through the same, taken approximately in the plane of the line 6—6 of Fig. 5; and

Fig. 7 shows one of the control and signal panels forming a part of the invention.

Referring to the drawings, and more particularly to Fig. 1, we there show a five-color gravure cylinder printing press. The web is supplied from a reel 12. A second supply reel is shown at 14 for use in alternation with the reel 12. The web runs through a suitable feed unit 16, from which it is supplied to the color presses 18, 20, 22, 24 and 26. The units are substantially alike, and taking the unit 18 as typical, the web is fed under guide roller 28, over guide roller 30, and around pressure roll 32, where it is pressed against the gravure cylinder 34. The printed web then runs through a high-speed drier 36, it being guided through the drier by appropriate guide rolls 38, 40 and 42. Before being led to the next press the web is run under a compensator roller 44. This is arranged for vertical movement, as is schematically indicated by the vertical support track 46. The change in distance between the roller 48 and the compensating roller 44 is negligible, consequently the raising or lowering of roller 44 is substantially equal to the lengthening or shortening of the web between the units of the press. The presses 20, 22 and 24 are similarly provided with compensator rollers 50, 52 and 54, respectively. No compensator roller is needed following the press 26, when, as in the present case, the web is simply rewound, as indicated at 56. However, if the press is followed by a unit performing another operation on the web, such as blanking, perforating, severing, or the like, the last printing unit 26 should also be provided with a compensator roller mechanism, conveniently located at the roller 58.

In accordance with the present invention, the compensator rollers 44, 50, 52 and 54 are each raised or lowered under drive of a reversible electric motor, the motors being controlled by suitable push-buttons preferably located remotely from the press units, and preferably localized at the output end of the press, as is indicated by the panel board 60.

Panel board 60 has four push-button and signal units, one for each of the compensator rollers. Fig. 7 shows one of these units, and referring to that figure, it will be seen that each unit has a push-button 90 for "Advance," and a push-button 92 for "Retard," and a signal, in this case a lamp 94. The lamp may be used as an approximate measure of the amount of register correction being introduced. For this purpose, the lamp is normally occulted, but flashes briefly in response to uniform increments of movement of the compensator roller, so that the number of flashes of the lamp may be used as an approximate measure of the register correction introduced.

Fig. 2, although schematic, is sufficiently explanatory of the application of the invention to a compensator roller. The web 62 is shown passing around a compensator roller 64, the latter being carried in bearings 66 which are vertically slidable on guides or ways 68. The elevation of the roller is determined by lead-screws 70 which are threadedly received in the bearings 66. The lead-screws are rotated simultaneously by means of a suitable reversing electric motor 72 and speed reducer 73, said motor driving a shaft 74 geared by means of suitable bevel gearing 76 to the lead-screws 70. As so far described, the compensating mechanism may be wholly conventional.

Now in accordance with the present invention, a movable component causing the compensation is employed to also cause a signal, which acts as a measure of the amount of correction being introduced. In the present case the theoretically ideal movable component would be the bearings 66, but for reasons which will appear later, it is not very convenient to employ the bearings. The next best component would be the lead-screw 70, and in many cases that may be used, but in the particular apparatus here shown we have employed the shaft 74. In other words, the shaft 74 is the movable component nearest to the compensator roller to which the invention may be most conveniently applied. A cam 80 is mounted on shaft 74 and actuates a switch 82 which causes a signal, which in turn may be used as a measure of the amount of register correction being introduced.

The speed at which the lamp flashes is preferably made slow enough to be easy to watch, but rapid enough to accommodate small adjustments. We have found that a speed of say 120 flashes a minute is satisfactory. Thus, if the shaft 74 has a speed of say thirty revolutions per minute, the cam 80 is provided with four lifts, in order to produce four flashes per revolution of the shaft. The motor 72 may operate at a much higher speed of say 1800 R. P. M., but the speed reducer 73 brings that down to 30 R. P. M. For ordinary commercial printing, a correction to an accuracy of say three or four thousandths of an inch, is entirely acceptable.

The flashes of the lamp may be made to correspond to the desired accuracy of registration, or to a multiple thereof, and the operator, on seeing a departure from registration, estimates the amount of departure, and simply presses the proper corrective switch button and watches the flashes of the lamp until the desired number of flashes are seen. With this arrangement, any error caused by backlash in the speed reducer 73 is eliminated. Errors which may result from changes in line voltage, or from a difference in speed when raising or lowering the compensator roller, are also eliminated.

In many cases the compensator motors may be three-phase motors operated from a conventional three-phase line, and we have applied our invention to such an arrangement. However, a simpler, single-phase circuit is shown in Fig. 3, for purposes of illustration, and referring to that figure, it will be seen that the motor 100 is a three-wire, single-phase capacitor type of motor having a field winding 102 which is energized when switch button 104 is pressed, and a field winding 106 which is energized when switch button 108 is pressed. The fields have a common connection 110, and power is supplied on lines 112 and 114.

The signal switch and signal lamp may be energized through a separate supply circuit, but we

prefer to connect the same into the main push-button control circuit, because we prefer to avoid the possibility of the signal lamp remaining lit. True, the cam will usually have shorter rises than are shown in Fig. 3, and there is not much likelihood of the corrective movement being terminated at the particular instant when the lamp is lighted, and even if that were to occur, it would be necessary merely to press the switch button momentarily to cause such slight additional movement as might be needed to extinguish the lamp. However, in accordance with the preferred form of our invention, the signal lamp 116 is energized from the compensator motor circuit at a point between the motor and the control switches 104 and 108, so that the lamp can be lighted only while a control switch is closed. In the present case, the lamp is energized through a transformer 118, the primary of which is connected in series with a microswitch 120 operated by cam 122. The switch and transformer are connected across one field of the motor, but the lamp is lighted regardless of which field is energized, because some energy is transferred through the capacitor 124.

A preferred form of the invention is schematically shown in Fig. 4. In this case the invention is applied to a running register. Paper is fed from either reel 130 or 132 through a feed unit 134 and thence to printing press units 136, 138, 140, 142 and 144, from which the printed web is rewound at a reel 146. The feed unit 134 is driven by motor 148. The presses are driven by a motor 150 operating through a suitable multigroove pulley drive 152 to a line shaft 154. This shaft is common to all of the printing units, and drives the same in synchronism. However, the connection between the shaft 154 and each of the printing units includes differential gear units 156, 158, 160, 162 and 164 respectively. A corrective movement may be fed into the differential gearing manually, but we prefer to employ small reversing motors schematically indicated at 166, 168, 170, 172 and 174, respectively.

One form of differential gearing for a running register of the character set forth, is shown in Figs. 5 and 6 of the drawing, but the showing is schematic, and it will be understood that any of the known forms of running register may be employed. In said figures, the line shaft is shown at 154, and through a worm 180 drives a worm gear 182 which in turn causes a sun gear 184 to rotate. This drives planet gears 186, which in turn drive planet gears 188, the gears 186 and 188 being at least slightly different in diameter. The gears 188 mesh with a sun gear 190 which in turn drives shaft 192 and flange 194 for connection to the printing cylinder. The planet gears 186 and 188 are carried by a housing 196 which is itself rotatable, said housing having a ring of gear teeth 198 meshing with a worm 200 turned by a shaft 202. It will be understood that by feeding corrective motion into the differential gearing by rotation of shaft 202, the position of the printing cylinder driven by flange 194 will be changed relative to the position of the line shaft 154, so that any one of the printing cylinders may be varied in registration relative to the others, even though all of them are driven synchronously by a common line shaft 154. In Fig. 5, it will be seen that the compensator shaft 202 is driven by a reversing motor 204 through a speed reducer 206.

As so far described, the running register compensator mechanism is conventional, but in accordance with the present invention a cam 210 (Fig. 5) is mounted on shaft 202 and operates a microswitch 212. The latter in turn operates a suitable signal, typically a lamp as previously described. It will be understood that in the present case, the shaft 202 is the movable component, closest to the ring gear 198 causing the correction, which is conveniently available and which has adequate speed for best operation of the signal lamp. By locating the cam on shaft 202, all backlash or lost motion in the speed reducer 206 and in the gearing 208 is eliminated, as well as any problems attendant upon changes in line voltage, etc.

It will be understood that the motors 166 through 174 shown in Fig. 4 correspond to the motor 204 shown in Fig. 5, and that the said motors are controlled by advance and retard push-buttons associated with signal lamps, just as was described in connection with Figs. 1, 3 and 7, except that in the present case there would be five sets of push-buttons and signal lamps.

The microswitch used is preferably a sealed or explosion-proof microswitch, because of the highly volatile nature of the ink sometimes used in multi-color gravure printing.

If the compensator motor is a D.-C. motor, and if it be desired to make the operation of the signal lamp dependent upon energization of the motor, the lamp may be connected to both sides of the motor circuit through a relatively high resistance, so that operation of either side of the motor circuit (advance or retard) will energize the lamp circuit. There then will be no possibility of the lamp remaining lighted when the motor is not in use, regardless of the position at which the cam happens to stop at the end of the corrective movement.

It is believed that the construction and operation, as well as the advantages of our improved register control for web presses and the like, will be apparent from the foregoing detailed description. Signal pulses, which may be audible, but which we prefer to make visual because of the noise in a press room, correspond to the amount of correction actually introduced, measured at a point as near as possible to the component being moved for the correction. Uniform increments of movement of the selected movable component cause flashes of the lamp, so that the number of flashes may be used as a fairly accurate measure of the amount of register correction being introduced. Thus, on each correction the operator comes as closely as possible to the proper amount, so that the number of trial and error corrections needed is minimized. This is important because the operator must wait a substantial time after each correction, for the apparatus to settle down into a uniform state of operation which will propertly reflect the condition of registration resulting from the last correction introduced.

It will be understood that while we have shown and described our invention in several preferred forms, changes may be made in the structures disclosed, without departing from the spirit of the invention as sought to be defined in the following claims.

We claim:

1. Register control mechanism for web presses and the like driven through differential gearing including a shaft which introduces corrective movement into the differential gearing for running register, said shaft serving to correct the

register of two presses or the like operating on a moving single continuous web, a control device for causing rotation of said shaft when desired, and means responsive to the actual resulting rotation of said shaft for causing a signal which may be used as an approximate measure of the amount of register correction being introduced by the control device.

2. Register control mechanism for web presses and the like driven through differential gearing including a shaft which introduces corrective movement into the differential gearing for running register, said shaft serving to correct the register of two presses or the like operating on a moving single continuous web, an intermittently usable control device for causing rotation of said shaft when desired in order to correct the register, a signal lamp circuit, and a cam-operated switch responsive to uniform increments of the

actual resulting rotation of said shaft for causing flashes of the lamp the number of which flashes may be used as an approximate measure of the amount of register correction being introduced.

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