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2,628,556

REGISTERING DEVICE

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Fig. 1

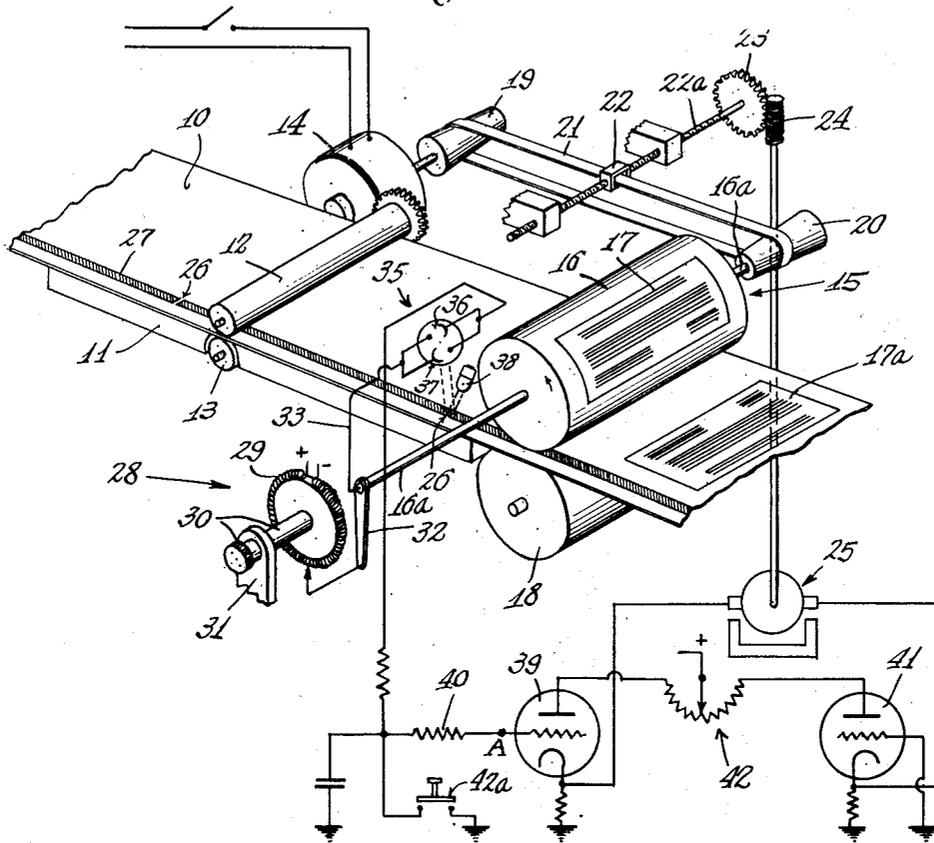


Fig. 2

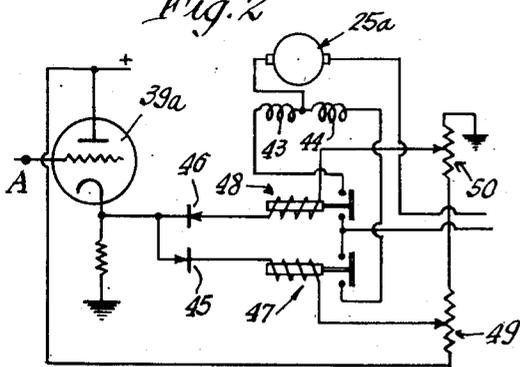
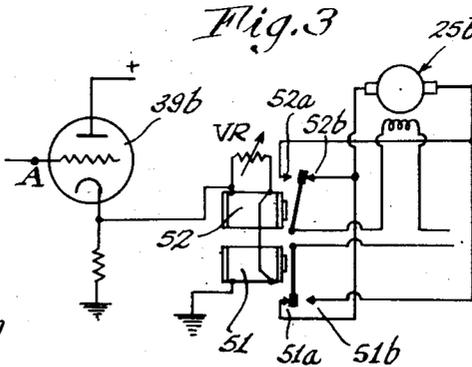


Fig. 3



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REGISTERING DEVICE

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12 Claims. (Cl. 101—248)

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The present invention relates to means for registering a web processing means with register control means on a traveling web and for thereafter automatically maintaining said web processing means in register with said register control means.

Heretofore efforts have been made to maintain web processing means in proper registration with a traveling web but these have resulted in extremely complicated systems which have not been entirely satisfactory because they have been adversely affected by the ordinary variations incident to the normal operation of the machine, such as changes in velocity of the web and voltage changes on the control system. They have also been unsatisfactory because of the high maintenance required of the complicated systems. Further, where photocells have been employed in the control circuit to provide the actuating voltage, dust, ink or other foreign matter have interfered with and varied the illumination thereof to render the control ineffective or inoperative.

The present invention overcomes these difficulties by providing a register device which is simple in construction and accurate in operation and which is easy to maintain and is not affected by variations in the velocity of the web or voltage changes on the control system.

This is accomplished by providing a web processing machine with a circuit upon which is impressed predetermined instantaneous voltages dependent upon the position of the web processing means and controlling a control circuit, when a sensing means senses the presence of a register control means, by the instantaneous voltage then impressed on the first-mentioned circuit to adjust the position of the web processing means in accordance therewith.

In the preferred form of the invention the predetermined instantaneous voltage is provided by a voltage divider or a potentiometer which is connected to the web processing means to be actuated thereby. It is so adjusted that when the web processing means is in proper position with respect to the register control means, as determined by a sensing means sensing said register control means, a predetermined voltage is produced which normally maintains a balanced condition and if the web processing means is in any other position the voltage as determined by the position of the web processing means will be impressed on the circuit to unbalance the circuit and return the web processing means to the proper position.

The present invention is applicable for use with

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various types of web processing means such as printing, coating, cutting, punching, embossing or perforating devices. For the purpose of illustrating the invention, it is shown as applied to a printing press.

In the present preferred form of the invention, the sensing means merely renders the circuit conductive so that the instantaneous voltage then impressed on the circuit is applied to a control circuit for a position adjusting means for the web processing means to actuate said position adjusting means to maintain or return the web processing means quickly to proper register in accordance with the polarity and quantity of the voltage without hunting.

The sensing means, since it merely controls the conductivity of the circuit, may be any mechanical or electrical switching device which is actuated by the register control means on the web. In the preferred form of the invention, light-sensitive means is employed to render the circuit conductive in response to change in illumination thereof caused by the register control means. Inasmuch as the sensing means is not relied upon to provide the power for actuating the circuit, as has heretofore been the practice, ink smudges, dust and the like which may accidentally get on the light-sensitive means so as to alter its illumination will not affect its operation so long as there is sufficient light to render it conductive.

Because balanced circuits and instantaneous voltages dependent upon the position of the web processing means are employed, the velocity of the web or voltage changes in such circuits will not affect the operation and accuracy of the device.

A feature of the invention resides in the fact that the register device comprises a simple circuit employing a minimum of elements which can be built in originally as part of a machine or which may be attached to existing machines to control the same.

Other features and advantages of the invention will be apparent from the specification and claims when considered in connection with the drawings in which:

Figure 1 shows a diagrammatic view of the present invention showing one form of motor control means.

Fig. 2 shows another form of motor control means.

Fig. 3 shows a still further form of motor control means.

As shown in the drawings a traveling web 10 is fed from a supply (not shown) over a table

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11 by a pair of feed rolls 12, 13 driven by a suitable motor 14 which advances the web to the web processing unit 15 having a web processing means therein. The web processing means may be any means for performing an operation on the web and is herein illustrated as a rotary printing cylinder 16 having a printing plate 17 thereon cooperating with an impression cylinder 18 to provide a suitable impression on the traveling web.

The printing cylinder is driven by a variable or differential drive of any type whereby its speed and hence its position may be varied with respect to the feed rolls to the web driven thereby. Such a device, for example, comprises a pair of conical pulleys 19, 20. Pulley 19 is mounted on the shaft of motor 14 to be driven thereby and pulley 20 is mounted on the shaft 16a of the printing cylinder to be driven from the pulley 19 by a belt 21. The belt is moved along the pulleys by a belt shifter 22 mounted on an adjusting screw 22a driven by a worm gear 23 and worm 24 from a position adjusting means or motor 25. The motor is controlled by a register device or system so as to alter the speed and position of the printing cylinder with respect to the web in order to secure and maintain proper registration therebetween.

According to the present invention means are provided for maintaining the impression 17a formed on the traveling web 10 in register with register control means formed on the web. The register control means may take many forms such as apertures in the web or black dots on the web but, in the illustrated form of the invention, it comprises uniformly spaced breaks 26 in a longitudinally extending non-reflecting band 27 printed on the web.

The register device of the present invention for adjusting the position of the printing cylinder with respect to the web to maintain the printing plate in register with the register control means or to return it to register should the printing cylinder be ahead or behind the predetermined registered position comprises a register control or first circuit including a voltage divider, or more specifically a potentiometer, 28 for producing predetermined instantaneous voltages in accordance with the rotative position of the printing cylinder, said potentiometer having one part adjustably mounted on the frame and the other part connected to the shaft of the printing cylinder.

In the illustrated form of the invention the potentiometer comprises a substantially circular resistor 29 adjustably mounted by shaft 30 on a part 31 of the frame of the machine and a cooperating wiping contact 32 which is connected to the end of the printing cylinder shaft 16a to be moved thereby over the resistor. The potentiometer has a predetermined positive voltage and a predetermined negative voltage, as compared to its midpoint, connected to the ends of the resistor as indicated by the "+" and "-" signs in Fig. 1 and is normally adjusted on the frame so that there will be a balance and no voltage on the wiping contact when the printing cylinder is in proper registration with the register control means. The wiping contact 32 is connected in the first circuit by lead 33 to a sensing means 35 which in the present circuit functions to render the circuit conductive when a register control means is sensed thereby.

The sensing means 35 may be a mechanically operated circuit closer or a wiping contact but

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in the preferred form of the invention it comprises a light sensitive means in which a pair of photocells 36, 37 are connected in back to back relation and are adapted to be rendered conductive upon a change of illumination thereof as when light from the lamp 38 impinges upon a break 26 in the band and causes the light to be reflected and illuminate the cell. The sensing means is connected to an integrating resistor-condenser circuit RC which smooths out the voltage pulses, produced by the periodic operation of the sensing means, which integrated voltage is impressed on the grid circuit of an electron discharge device or tube 39 through a protective resistor 40. The tube 39 is connected in a second or control circuit for motor 25 to control the motor for altering the position of the printing cylinder when it is out of register with the register control means.

In the form of the invention shown in Fig. 1, motor 25 is a permanent magnet motor having its armature electrically connected in the motor control circuit which includes the tube 39 and a tube 41. The tubes 39 and 41 are connected together through an adjustable rheostat 42 to a source of energy as indicated by the + sign. The control circuit is normally balanced so that the motor does not rotate when the printing cylinder is in proper registration and no potential is impressed on the grid. This is done by closing the normally open switch 42a to connect the grid of the electron device 39 to ground and adjusting the rheostat until there is no current flow in the armature of the motor. However, the grid of the tube 39 will have impressed thereon a voltage from the register control circuit which voltage will be positive or negative with respect to the normal voltage thereon depending upon the amount and direction the printing cylinder is out of register. This voltage on the grid would unbalance the motor circuit and cause a current to flow in the armature of motor 25 in accordance with the amount and direction of unbalance of the control circuit to energize the motor to drive the worm 24 and worm gear 23 and shift the belt on the variable drive in the proper direction in order to produce the necessary advance or retardation of the printing cylinder with respect to the traveling web so as to change the position thereof in the proper direction and in the proper amount to restore registration of the impression with respect to the register control means whereupon balance is restored to the control circuit and the motor stopped. Since the motor 25 is operated in accordance with the direction and quantity of unbalance, as represented by the polarity and quantity of the instantaneous voltage produced by the potentiometer when the sensing device senses a register control means, the printing cylinder will be brought back to proper registration without any hunting.

A modified form of position adjusting means and second circuit controlling the same is shown in Fig. 2, said circuit being substituted for the motor control circuit of Fig. 1 to be connected to said register control circuit. Here a reversible differential motor 25a having controlling fields 43 and 44 is employed in place of the permanent magnet motor 25. The control circuit for this motor includes an electron discharge means or tube 39a having its grid connected to the register control circuit at A to have the voltage of said circuit, when the circuit is conductive, impressed

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thereon to control the current flow in the tube 39a in accordance therewith. Connected to the tube as shown by means of rectifiers 45 and 46 are a pair of relays 47 and 48 which are connected through variable resistors 49 and 50 to ground. The relays are adjusted so that they are normally open so that the motor fields are open and the motor does not rotate when no voltage is impressed on the grid. However, when a positive or negative voltage is impressed upon the grid, the flow of current in the device 39a is varied and depending upon the direction of flow of current in the circuit will cause either relay to be closed and complete the circuit to the proper field winding for the motor 25a to drive it in the proper direction to cause it to shift the belt through the worm and worm gear drive of Fig. 1 to cause the printing cylinder to be advanced or retarded with respect to the traveling web so as to return it into proper register. As soon as the cylinder is in register the current flow in the electron discharge device will return to normal and the motor control circuit will be opened and the motor stopped.

Another circuit for controlling the position adjusting means is shown in Fig. 3 wherein a series motor 25b connected across a suitable source of power is employed for driving the belt shifter to alter the position of the printing cylinder. In this circuit the electron discharge device or tube 39b has its grid connected at point A of the register control circuit and the tube is adjusted so that a predetermined current flows in the tube circuit when the device is in register. A pair of series connected relays 51, 52 are connected to the variable adjusting resistor VR to the tube 39b as shown in Fig. 3. Relay 51 is adjusted so that it is normally closed through its front contact 51a while relay 52 is normally open to its front contact 52a but is closed to its back contact 52b and thus the armature circuit is open. The relays are so adjusted that if the current in the tube circuit falls below the predetermined value, relay 51 will drop out and open the circuit to contact 51a and close the circuit through its back contact 51b and contact 52b to rotate the motor in one direction. If the current is above said predetermined normal value, it will close the relay 52 causing the circuit to be extended through the contact 52a and contact 51a to rotate the motor in the opposite direction.

In operation the web is provided with register control means 26 and is led from a suitable source through the feed rolls 12, 13 and fed to the web processing unit 15. The motor control circuit is then adjusted by depressing push button switch 42a and adjusting rheostat 42 in the motor control circuit so that there is normally no current flow in the armature circuit. The sensing means 35 is adjusted so that it will be actuated by the register control means on the web to cause the circuit to become conductive. The printing cylinder of the web processing unit is then adjusted so that the impression formed thereby is in predetermined registration with the register control means on the web. With the printing cylinder in this position the resistor 23 of the potentiometer is adjusted on the frame so that the potential on the wiping contact carried by the cylinder shaft in predetermined relation with the printing plate is a predetermined value, normally zero. The printing press is started and whenever the sensing means senses a register control means on the traveling web it renders the circuit conductive and the potential on the wiping contact is impressed on the circuit. If the web processing

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means is in proper register, zero potential is impressed on the circuit and no change is effected in the motor control circuit. However, should the web processing means be out of register in either direction, the instantaneous voltage impressed on the circuit will be plus or negative depending upon the direction of out-of-register and will be of a quantity depending upon the amount of out-of-register. This instantaneous voltage, after being integrated by the RC circuit, is impressed on the grid of tube 39 so as to unbalance the armature circuit of motor 25 and cause a current to flow in the armature in proportion to the unbalance and in the direction which will rotate the motor to adjust the position of the cylinder with respect to the web and restore registration. Since the potential impressed on the circuit is dependent upon the instantaneous position of the wiping contact when the circuit is rendered conductive, it will be seen that as the web processing means is brought back into registration the out of register potential will gradually decrease so that the web processing unit is brought back into register without any hunting.

Further changes in velocity of the traveling web as may be encountered in the starting and stopping of the press will not in any way affect the operation of the register device or system so long as the position and relation of the sensing means and processing unit are not altered since no timing factor is employed in the operation of the device.

The circuits, as will be seen from the foregoing, are simple and can easily be installed on new machines or as attachments for existing machines and can be maintained at a relatively low cost, and also they are unaffected by the usual variations in voltage and dust as were machines heretofore employed.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

I claim:

1. In a web processing machine provided with a web processing unit having movable web processing means, and means for feeding a web having register control means thereon to said web processing unit; the combination of means for adjusting and maintaining the web processing means in predetermined relation to the web and the register control means thereon, including position adjusting means for altering the relative position of the web processing means with respect to the web and an electrical control circuit for said position adjusting means comprising a resistor having a predetermined voltage applied thereto and a wiping contact movable thereover in response to movement of the web processing means to produce a predetermined voltage on the contact in accordance with the position of the web processing means; sensing means located in predetermined relation to the web processing means and having means for controlling the conductivity of said circuit upon sensing the presence of the register control means; and means controlled by the voltage on the wiping contact at the time the sensing means senses a register control means for actuating the position adjusting means to correct or maintain the web processing means in said predetermined relation with the web and the register control means thereon.

2. In a web processing machine provided with a web processing unit having rotary web processing means, and means for feeding a web hav-

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ing register control means thereon to said web processing unit; the combination of means for adjusting and maintaining the web processing means in register with the register control means on the web, including position adjusting means for altering the position of the web processing means with respect to the web and an electrical control circuit for said position adjusting means comprising a potentiometer connected to the web processing means and so adjusted as to impress a predetermined voltage on the circuit when the web processing means is in registration and to impress a predetermined different voltage on the circuit when the web processing means is out of registration, said voltage being determined by the amount of out-of-register; sensing means located in predetermined relation to the web processing means and rendering said circuit conductive upon sensing the register control means; and means controlled by the voltage on the potentiometer at the time the circuit is conductive to control the position adjusting means to maintain or return the web processing means to proper register.

3. In a web processing machine provided with a web processing unit having movable web processing means, and means for feeding a web having register control means thereon to said web processing unit; the combination of means for adjusting and maintaining the position of the web processing means in predetermined relation to the register control means thereon, including position adjusting means for altering the position of the web processing means with respect to the web and an electrical circuit comprising a resistor adjustably mounted on the machine and having a predetermined positive and negative voltage applied to the terminals thereof and a wiping contact movable thereover in response to movement of the web processing means, said resistor being adjusted to produce no voltage on the contact when the web processing means is in proper registration with the web; sensing means located in predetermined relation to the web processing means for sensing the presence of the register control means and rendering said circuit conductive; and means controlled by the polarity and quantity of the voltage on the wiping contact at the time the circuit is conductive for actuating the position adjusting means to correct or maintain the web processing means in predetermined relation with the web.

4. In a web processing machine provided with a web processing unit having movable web processing means, and means for feeding a web having register control means thereon to said web processing unit; the combination of means for adjusting and maintaining the position of the web processing means in predetermined relation to the register control means thereon, including position adjusting means for altering the position of the web processing means with respect to the web and an electrical circuit comprising a resistor adjustably mounted on the machine and having a predetermined positive and negative voltage applied to the terminals thereof and a wiping contact movable thereover in response to movement of the web processing means, said resistor being adjusted to produce a zero voltage on the contact when the web processing means is in proper registration with the web; sensing means located in predetermined relation to the web processing means for sensing the presence of the register control means and rendering said circuit conductive; and means including an elec-

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tron discharge means and a power operator controlled thereby for actuating the position adjusting means to correct or maintain the web processing means in predetermined relation with the web, said electron discharge means having means connected in the said circuit and upon which the contact voltage is impressed to control the operation of said electron discharge means in accordance therewith.

5. In a web processing machine provided with a web processing unit having movable web processing means, and means for feeding a web having register control means thereon to said web processing unit; the combination of means for adjusting and maintaining the web processing means in predetermined relation to the web and register control means thereon, including position adjusting means for altering the relative position of the web processing means with respect to the web and an electrical control circuit for said position adjusting means comprising a resistor having a predetermined voltage applied thereto and a wiping contact movable thereover in response to movement of the web processing means to produce a predetermined voltage on the contact when the web processing means is in proper registration with the web; light sensitive means connected in said circuit and located in predetermined relation to the web processing means for cooperation with the register control means, said light sensitive means rendering the circuit conductive upon a change in illumination thereof caused by the register control means; and means controlled by the voltage on the wiping contact at the time the circuit is conductive for actuating the position adjusting means to correct or maintain the web processing means in said predetermined relation with the register control means.

6. In a web processing machine provided with a web processing unit having movable web processing means, and means for feeding a web having register control means thereon to said web processing unit; the combination of means for adjusting and maintaining the web processing means in predetermined relation to the web and register control means thereon, including position adjusting means for altering the relative position of the web processing means with respect to the web and an electrical control circuit for said position adjusting means comprising a resistor having a predetermined positive and negative voltage applied to the terminals thereof and a wiping contact movable thereover in response to movement of the web processing means to produce a predetermined voltage on the contact when the web processing means is in proper registration with the web; light sensitive means connected in said circuit and located in predetermined relation to the web processing means for cooperation with the register control means, said light sensitive means comprising a pair of photocells connected back to back for rendering the circuit conductive upon a change in illumination thereof caused by the register control means; and means controlled by the polarity and quantity of the voltage on the wiping contact at the time the circuit is conductive for actuating the position adjusting means to correct or maintain the web processing means in said predetermined relation with the register control means.

7. In a web processing machine provided with a web processing unit having rotary web processing means including a variable drive therefor,

and means for feeding a web having register control means thereon to said web processing unit; the combination of means for adjusting the variable drive to maintain the web processing means in predetermined register with the register control means on the web, comprising a first circuit including a resistor adjustably mounted on the machine and having a predetermined positive and negative voltage applied to the terminals thereof and a wiping contact connected to the web processing means to rotate therewith and move over the resistor in response to movement of the web processing means, said resistor being adjusted to produce a predetermined voltage on the contact when the web processing means is in proper registration with the web; sensing means located in predetermined relation to the web processing means for sensing the presence of the register control means and rendering said first circuit conductive; and a second circuit for controlling said variable drive including at least one electron discharge means and a motor controlled thereby for adjusting the variable drive to correct or maintain the web processing means in predetermined relation with the web, said electron discharge means having a grid connected in the said first circuit to receive the contact voltage when the first circuit is conductive to control the operation of said electron discharge means and motor in accordance with the polarity and value of said contact voltage.

8. In a web processing machine provided with a web processing unit having rotary web processing means including a variable drive therefor, and means for feeding a web having register control means thereon to said web processing unit; the combination of means for adjusting the variable drive to maintain the web processing means in predetermined register with the register control means on the web, comprising a first circuit including a resistor adjustably mounted on the machine and having a predetermined positive and negative voltage applied to the terminals thereof and a wiping contact connected to the web processing means to rotate therewith and move over the resistor in response to movement of the web processing means, said resistor being adjusted to produce a predetermined voltage on the contact when the web processing means is in proper registration with the web; sensing means located in predetermined relation to the web processing means for sensing the presence of the register control means and rendering said first circuit conductive; and a second circuit for controlling said variable drive including at least one electron discharge means and a permanent magnet motor controlled thereby, said electron discharge means providing a predetermined balancing current to the motor when the web processing means is in predetermined relation with the web, said electron discharge means having grid connections in the said first circuit to receive the contact voltage when the first circuit is conductive and being operative in response to voltages other than said predetermined voltage to vary the current in said electron discharge means and unbalance the motor in accordance with the polarity and value of said contact voltage.

9. In a printing press provided with a rotary printing cylinder, and means for feeding a web having register control means thereon to said printing cylinder to cause said web to be printed thereby in predetermined relation to said register

control means; the combination of means for adjusting and maintaining the printing cylinder in register with the register control means on the web, including position adjusting means for altering the position of the printing cylinder with respect to the web and an electrical control circuit for said position adjusting means comprising a potentiometer connected to the printing cylinder and so adjusted as to impress no voltage on the circuit when the printing cylinder is in registration and to impress a predetermined voltage on the circuit when the printing cylinder is out of registration, said voltage being determined by the amount of out-of-registration; sensing means located in predetermined relation to the printing cylinder and rendering said circuit conductive upon sensing the register control means; and means controlled by the voltage on the potentiometer at the time the circuit is conductive to control the position adjusting means to maintain or return the printing cylinder to proper register.

10. A register device for registering a movable web processing means having position adjusting means with register control means on a web comprising a circuit including a potentiometer having a predetermined positive and negative voltage applied to the terminals and adapted to be connected to said movable web processing means to provide a predetermined voltage for all positions of said web processing means, said potentiometer being adjusted to normally impress a predetermined voltage on the circuit when the web processing means is in register; sensing means connected in said circuit to render said circuit conductive upon sensing a register control means; and means adapted to be connected to the position adjusting means to control the same and having means connected in said circuit and responsive to the polarity and quantity of the voltage impressed on the circuit by the potentiometer when the circuit is rendered conductive to cause said position adjusting means to maintain or return the web processing means to proper register.

11. A register device for registering a rotary web processing means having position adjusting means with register control means on a web comprising a circuit including a potentiometer having a predetermined positive and negative voltage applied to the terminals, said potentiometer adapted to be connected to said rotary web processing means to provide a predetermined voltage for all rotative positions of said web processing means and being adjusted to normally impress no voltage on the circuit when the web processing means is in register; sensing means connected in said circuit to render said circuit conductive upon sensing a register control means; and means, including an electron discharge means, adapted to be connected to the position adjusting means to control the position adjusting means and having means connected in said circuit and responsive to the polarity and quantity of the voltage impressed on the circuit by the potentiometer when the circuit is rendered conductive to cause said position adjusting means to maintain or return the web processing means to proper register.

12. A register device for registering a rotary web processing means having position adjusting means with register control means on a web comprising a first circuit including a potentiometer having a predetermined positive and negative

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voltage applied to the terminals and adapted to be connected to said rotary web processing means to provide a predetermined voltage for all rotative positions of said web processing means, said potentiometer being adjusted to normally impress a predetermined voltage on the first circuit when the web processing means is in register; sensing means connected in said circuit to render said circuit conductive upon sensing a register control means; and a second circuit having means adapted to be connected to the position adjusting means for controlling the position adjusting means, said second circuit having at least one electron discharge means therein provided with a grid connected in said first circuit and responsive to the voltage impressed on the first circuit by

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the potentiometer when the first circuit is rendered conductive to control the current flow in the second circuit and thereby control said position adjusting means to maintain or return the web processing means to proper register.

JAMES P. FAY.

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