

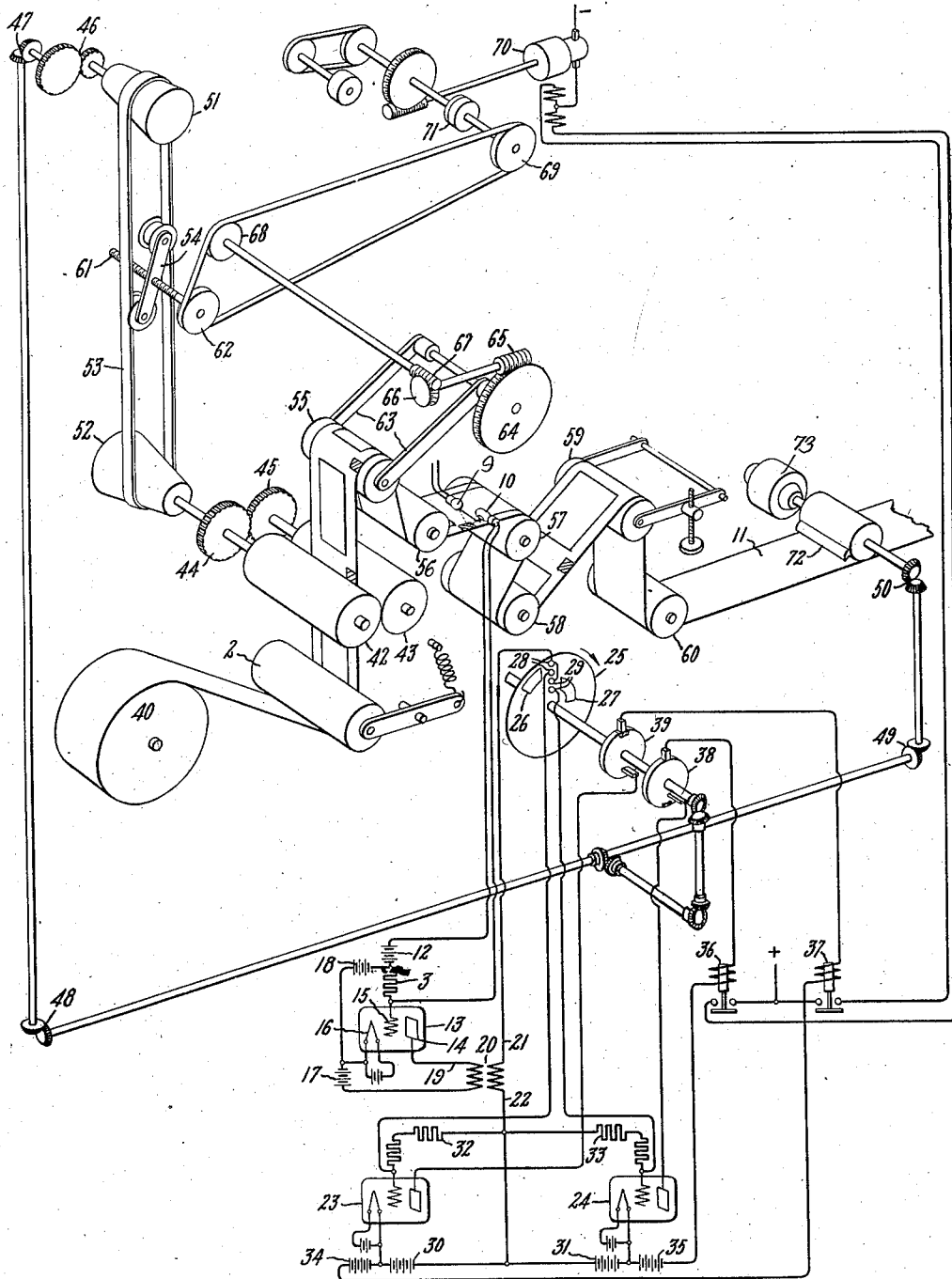
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CONTROL SYSTEM

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CONTROL SYSTEM

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5 Claims. (Cl. 164—68)

This invention relates to control systems, more particularly to systems for controlling the operation of machines operating upon a length of material such for example as a web of paper or cloth, and it has for an object the provision of a simple, reliable, and improved system of this character.

More specifically the invention relates to systems for controlling the machine to operate in predetermined relationship with designs or printed matter on the web.

Still more specifically this invention relates to a device for use in conjunction with printing presses, and more particularly to presses of the high speed rotary type.

A further object of this invention is to provide a continuous and automatic adjustment of the feed of a design impressed web of paper to a printing press cutting machine, or the like so as to cause the cutter knife to sever the web in predetermined relationship with the designs or printed matter on the web. Another object of the invention is to provide an automatic adjustment of the feed of a web to a printing press when this web is not being printed simultaneously and continuously with other webs of paper with which the aforementioned web of paper must synchronize to give a final association of prints or designs in a newspaper or journal in satisfactory register. In carrying the invention into effect in one form thereof, it is illustrated as embodied in an application to a high speed printing press, but it will of course be understood that this particular embodiment is merely illustrative and that the invention has other applications.

This invention utilizes the action of a light sensitive device, such as a selenium cell, photo-electric cell, or any photo-electric device of similar nature, which is so situated relative to the pre-printed web or inset during its transmission to the main press where other webs are being completely printed, as to give an instantaneous response to certain changes in the optical properties of the inset web. Accordingly, there are to be provided a series of regularly spaced holes, displaced along the length of the inset web, each in a position which is fixed relative to the pre-printed matter. Alternatively, a series of marks may be printed on the inset web at regular intervals, giving the inset web a change in opacity which is sufficient to operate the photo-electric device. In the following description, it is assumed that a hole or mark appears in register with each design; alternate, or fewer, designs may be punched or overprinted without materially affect-

ing the operation of the device. The photo-electric device is fixed on the press in such a position that the holes or marks traverse the field of vision of the device. To obtain a response of sufficient amplitude from the photo-electric device, a suitable source of light may be provided on the side of the web opposite to that occupied by the photo-electric device. As a further alternative, the light source and photo-electric device may be arranged on the same side of the web so that the photo-electric device receives light which is reflected from the surface of the inset web, the difference in the reflecting powers of the plain and printed surface being used to operate the device.

It is apparent, since the photo-electric device occupies a fixed position on the press, that when the inset web is in satisfactory register with the simultaneously printed matter, each punched hole or mark must pass the photo-electric device when the printing rolls, folding cylinder, or cutting knife operating on the simultaneously printed matter, occupy a predetermined position with respect to the design or printed matter on the web. If the holes or marks pass the photo-sensitive device when the printing rolls are in this one position, means are provided, as hereafter described, for rendering the register adjusting device inoperative. If a hole or mark traverses the field of vision of the photo-electric device at some instant after the main printing rolls or other corresponding machine elements have occupied the above mentioned position, means are provided whereby the inset web is given an increased forward movement. Conversely, if a hole or mark passes the photo-electric device before the printing rolls have reached the correct position, the movement of the web is retarded.

The action of the registering marks, or punched holes, on the photo-electric cell may be utilized in various ways, to correct the motion of the pre-printed web. It is preferred, however, to cause the impulses received from the photo-electric device to control thermionic devices, since rapidity of response to the photo-electric device is essential if accurate registration is to be secured; further, the impulses received from the photo-electric cell are of too short duration to operate satisfactorily the more conventional types of control gear directly. The thermionic devices may operate any suitable form of control gear. The latter serve to energize a motor or other suitable device adapted to advance or retard the web when it is out of register.

For a better and more complete understanding of the invention, reference should now be

had to the following specification and to the accompanying drawing, the single figure of which is a simple diagrammatic representation of an embodiment of the invention.

5 Referring now to the drawing, a photo-sensitive device 10 is placed near the inset web 11, and has a suitable source of potential 12. Both the photo-electric device 10 and the source 12 are connected to the grid circuit of a thermionic valve 13. The thermionic valve 13 is provided with an anode 14, grid 15 and cathode 16, and has suitable sources of anode and grid potential 17 and 18 respectively. The anode circuit 19 of the thermionic valve 13 is coupled to the electrical conductors 21 and 22 by means of a transformer 20, or any other suitable means well known in the art and capable of transmitting electrical impulses.

The circuit comprising the electrical conductors 21 and 22 is connected to the grid or controlling circuits of two electric valves 23 and 24 through the medium of the contact making device 25. This contact making device is shown diagrammatically as a disc or drum carrying conducting segments 26 and 27 which cooperate with the fixed contacts 28 and 29, respectively. This device rotates synchronously with the collating cylinder, or other part of the main press, or cutter knife. The operation of the device 30 can be most conveniently explained by assuming that the contact making device 25 makes one revolution during the passage of one complete copy of printed matter of the inset web when the latter is being fed into the main press at the correct speed.

The electric valves 23 and 24 are preferably of the three electrode vapour discharge type, in which the starting of the current through the valve is dependent upon the potential of the control grid with respect to the cathode, but in which the anode or output current may only be interrupted by reducing the anode potential below a certain critical value.

Normally, the grids of both electric valves 23 and 24 are held at a negative potential by the biasing potential sources 30 and 31, applied through high resistances 32 and 33 respectively. The anode current of the valves 23 and 24, derived from the sources 34 and 35 serves to energize the electro-responsive devices 36 and 37. As shown, the devices 36 and 37 are the operating coils of a suitable form of reversing contactor which controls a pilot motor, which in turn serves to raise or lower the speed of the inset web, according to its direction of rotation. It will of course be understood that the devices 36 and 37 may take other forms of well known control means, the essential feature being that when one of the devices is energized, the inset web is given an increased forward movement, and when the other is energized, the movement of the web is retarded.

Means are provided for reducing the potential of the anode of either valve, this means being shown diagrammatically as the interrupter switches 38 and 39. Any other of the various known methods of open circuiting the two anode circuits or otherwise reducing the anode potentials of the valves 23 and 24 when it is required to deenergize either of the devices 36 and 37 may be utilized.

One form of apparatus for providing the control of the movement of the pre-printed web in accordance with the impulses received from a

photo-electric cell and contact maker as previously described, is illustrated in the drawing.

The pre-printed web 11 in the form of a roll 40 is passed round a spring loaded floating roll 2 and then between feeding rolls 42 and 43. These feeding rolls may conveniently be geared together by spur wheels 44 and 45, and may be pressed together by springs, not shown. The feeding rolls are driven from some part of the press positively geared to the folder or cutter through gear train 46, 47, 48, 49, and 50, and variable speed gear consisting of cone pulleys 51 and 52 connected by belt 53, which can be traversed by belt guide 54. The spur wheels 46 are so mounted as to permit of cone pulley 51 being raised or lowered without interfering with the mesh of the spur gears for purposes of belt adjustment. After leaving feeding rolls 42 and 43 the web passes over automatic compensator roll 55, round fixed roll 56, fixed rolls 57 and 58, hand compensator roll 59, fixed roll 60, and thence to the draw rolls on the press folder. The photo-electric cell and exciting lamp 9 operate on the paper between rolls 56 and 57. The belt guide 54 can be traversed by screw 61 carrying chain sprocket 62, and automatic compensator roll 55 is raised and lowered by the arms 63 through worm sector 64, worm 65, worm wheel 66, worm 67, and chain sprocket 68. Chain sprockets 62 and 68 are driven by means of a chain from sprocket 69, which is in turn driven from pilot motor 70. A slipping clutch 71 is interposed between the pilot motor 70 and chain sprocket 69 to prevent damage in the event of either movement being driven up against stops, due to accidental circumstances. A cutting element 72 for severing the web 11 is driven by any suitable means, such for example as the electric motor 73 which is preferably the main driving motor for the press. The pilot motor is caused to rotate in one direction or the other when an error occurs in the position of the web. As previously described, the interrupter contact disks 38 and 39 make approximately one revolution before cutting off power from the pilot motor 70. The use of chain drive between the pilot motor and the automatic compensating mechanism operating the compensating roll 55 and belt traversing mechanism 54, makes it easy to alter the ratio of the movements of these two parts to each other, in order to suit any particular application, and also makes it possible to disconnect entirely one or other movement, if this is found desirable.

It is desirable when feeding the inset web into the machine prior to starting up the printing press that the web should be as near as possible in correct relationship with the printing rolls of the main press.

The function of hand operated compensator 59 is to vary the length of web between the photo-electric cell and the folder, by which means the actual position in which the special printed mark (or punched hole) will appear on the finished magazine, can be adjusted at will.

With the above understanding of the elements and apparatus and their organization in the completed system, the operation of the system itself will readily be understood from the following detailed description.

The operation of electrical circuit is as follows: Passage of the punched hole or printed registering mark beneath the photo-electric device 10 alters the conductivity of the device, due to the

change in light on its active electrode. The photo-electric current traverses the high resistance 3, and as is well known the grid potential of the thermionic valve 13 is thereby changed.

The transient photo-electric current change caused by the registering hole or mark is amplified by the thermionic valve and the associated circuits. It will be understood that the potential sources 12 and 18 must be given a suitable polarity and voltage according as to whether a hole or mark is used for obtaining the momentary impulse.

This momentary impulse from the amplifying circuit is transmitted to the grid circuit of either of the electric valves 23 and 24. As previously stated, the contact making device 25 makes one revolution during the passage of one copy of the pre-printed inset web. The position of the photo-electric cell relative to the orientation of the device 25 is such that when the inset web is in correct register, the impulse is transmitted to neither of the control circuits of the electric valves 23 and 24, both circuits being broken at the moving contact. Hence, neither of the speed changing devices 36 and 37 are energized and thus the speed of transmission of the inset web remains unaltered.

The sequence of operations if the inset web is lagging behind the mean position which gives satisfactory register is as follows. If the inset web is beyond the permissible margin out of register, the contact disk, having a direction of rotation as indicated by the arrow, has rotated to such a position that the fixed contacts 28 are traversing the conducting segment 26 when the registering hole or mark passes the photo-electric device. The impulse resulting therefrom is therefore communicated to the grid circuit of the electric valve 23. The impulse on the grid of this valve raises its potential so that the valve becomes conducting. The anode circuit is thus completed, the interrupter switch 39 being in contacting or closed position. The device 37 is thus energized, causing the pilot motor 70 to actuate the belt shifter 54 and the compensator roll 55 to raise the speed and change the position respectively of the inset web with respect to the cutter knife 72 so as to cause the latter to sever the web in predetermined relationship with designs or printed matter thereon. After a predetermined interval the interrupter switch is opened, thus allowing the grid of the valve 23 to regain control. The interrupter switch immediately recloses the circuit but the grid of valve 23 retains control of the anode circuit until the next impulse is received.

A similar sequence of operations occurs when the inset web is in advance of its correct position. In this case the hole or mark passes the photo-sensitive device too early, and the electrical impulse from the circuits 21—22 occurs before the fixed contacts 29 have left the segment 27. The impulse is thus communicated to the grid of the electric valve 24 which becomes conducting and energizes the electro-responsive device 36 for a certain interval in a manner similar to that described for the valve 23. The pilot motor 70 is thereupon energized for rotation in the opposite direction to actuate the belt shifter 54 and the compensator roll 55 so that the movement of the inset web is thereby retarded and the position of the web changed with respect to the cutter 72.

Although, in accordance with the provisions of the patent statutes, I have described this inven-

tion as embodied in concrete form, I would have it understood that the invention is not limited to the specific apparatus and connections described, which are merely illustrative, and alterations and modifications will readily suggest themselves to persons skilled in the art without departing from the true spirit of the invention and the scope of the annexed claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a control system for apparatus operating on a web, and apparatus including supply means and operating means, a localizer for changing the relative position of the supply means and operating means, a speed changer for changing the relative speeds of the supply means and operating means, a source of light and light sensitive means operatively associated with the web, and thermionic control means cooperating with said light sensitive means, to control the operation of the localizer and speed changer.

2. Apparatus for maintaining the relative position of a strip of material fed to a machine having an element operating on the strip comprising means for effecting a change in the relative positions of said strip and said element, means for effecting a change in the relative speeds of said strip and said element, an electric motor connected to actuate both said means, means for energizing said motor comprising electric valve apparatus provided with a control grid, means for actuating said valve apparatus comprising a light sensitive device connected to said grid and arranged to be responsive to a departure of said strip from register with said element, and means for deenergizing said valve apparatus after a predetermined interval of time.

3. Apparatus for maintaining the relative position of a strip of material fed to a machine having an element operating on the strip comprising means for feeding said strip to said element, driving means for said feeding means, means for varying the relative speeds of said strip and said element comprising a variable speed transmission connected between said driving means and said feeding means, said transmission comprising a pair of cone pulleys and a connecting belt, a belt shifter, means for varying the relative positions of said web and said element, an electric motor for actuating said belt shifter and said position varying means, means for controlling the energization of said motor comprising electric valve apparatus provided with a control grid, and means responsive to a departure of said strip from register with said element for actuating said valve apparatus comprising a light sensitive device connected to said grid and controlled by said strip and a switching device included in the connections between said light sensitive device and said grid for preventing actuation of said valve apparatus when said strip and said element are in register.

4. Apparatus for maintaining the relative position of a strip of material fed to a machine having an element operating on said strip comprising, means for feeding said strip to said element, driving means for said feeding means, means for varying the relative speeds of said strip and element comprising a variable speed transmission between said driving means and said feeding means, means for varying the relative positions of said strip and said element, an electric motor for actuating said transmission and said position varying means, means for controlling the ener-

gization of said motor comprising electric valve apparatus provided with a control grid, and means responsive to a departure of said strip from register with said element for actuating said valve
5 apparatus comprising a light sensitive device controlled by indicia on the strip and connected to said grid, amplifying means included in the connections to said grid, and a switching device included in said grid connections and driven by
10 said element for preventing actuation of said valve apparatus when said strip and element are in register.

5. Apparatus for maintaining the relative position of a strip of material fed to a machine having an element operating on said strip comprising
15 means for feeding said strip to said element, driving means for said feeding means, means for varying the relative speeds of said strip and said element comprising a pair of cone pulleys, a belt
20 connecting said pulleys and a belt shifter included in the driving connections between said driving

means and feeding means, means for varying the relative positions of said strip and element comprising a roll over which said strip passes, a pivoted lever mounting said roll for pivotal movement, an electric motor for actuating said belt
5 shifter and said pivoted lever, means for energizing said motor for operation in either direction comprising a pair of electric valves each provided with a control grid, means responsive to a departure of said strip from register with said element for selectively actuating said valves comprising a light sensitive device controlled by said
10 strip and connected to said grids and a selector switch driven in accordance with the speed of said element and included in the connections between said light sensitive device and said grids,
15 an amplifier connected in said grid connections, and switching means for preventing actuation of said valves when said element and said strip are in register.

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