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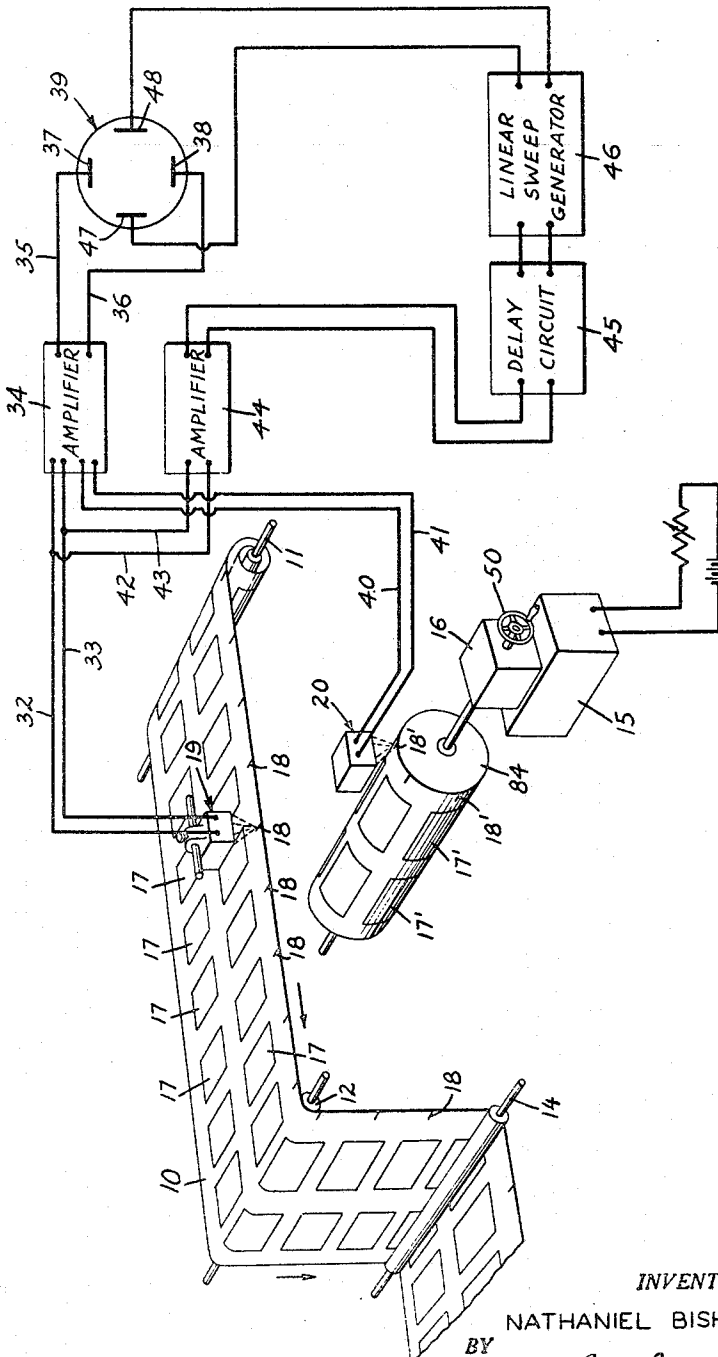
2,536,153

ELECTRONIC REGISTER CONTROL FOR WEB PASTING

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2 Sheets-Sheet 1

FIG. 1.



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FIG. 2.

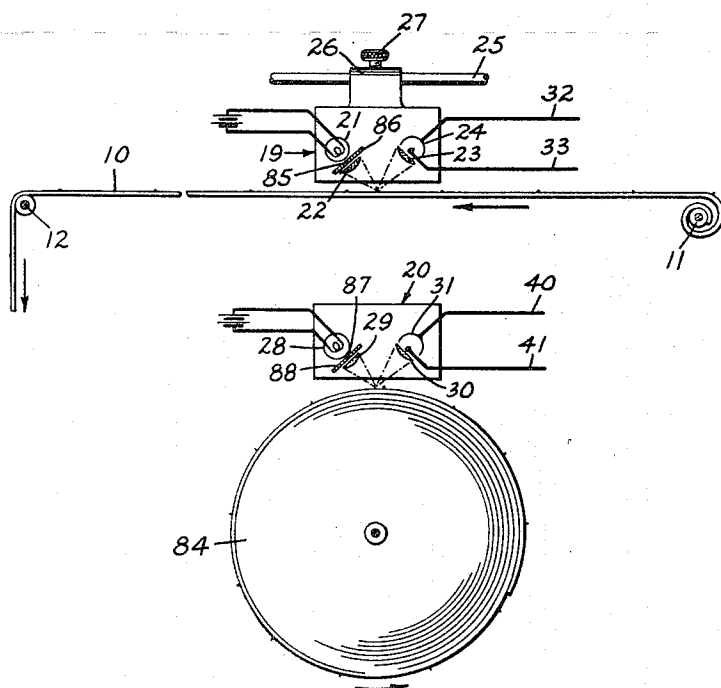
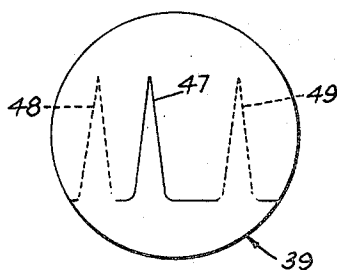


FIG. 3.



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3 Claims. (Cl. 242—58)

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The present invention relates to electronic register control mechanisms and more particularly to new and improved mechanisms of this character for determining the condition of registry of indicia on a moving web with respect to corresponding indicia on another moving object such as a moving roll of web material, for example, the free end of which is to be pasted to the moving web.

In order to conserve time, it is customary in the printing industry to replenish a nearly exhausted supply of paper by pasting the start of a new roll to the moving web without stopping or slowing down the press. When neither the moving web nor the new roll have printed matter thereon, this may be readily accomplished without tearing the web by adjusting the speed of the new roll until the peripheral speed is substantially equal to the linear speed of the web and then operating the cutting and pasting apparatus. If, however, both the moving web and the new roll have successive areas carrying printed matter thereon, the printed matter on the roll must also be brought into proper relationship with respect to the corresponding printed matter on the web before the cutting and pasting apparatus is operated. Heretofore, it has not been possible to do this effectively, so that it was necessary to shut down the press in order to perform the cutting and pasting operations properly.

The principal object of the invention, accordingly, is to provide new and improved register control mechanism for determining the condition of registry of a moving web carrying printed matter with respect to a moving roll of web material also carrying printed matter.

Another object of the invention is to provide new and improved register control mechanism of the above character which includes means for adjusting the speed and displacement of the roll relatively to the web to bring the web and the roll into registry so that subsequent operations, such as pasting and cutting, for example, may be carried out while the web and the roll are in motion.

The objects of the invention are attained by providing indicia on both the moving web and the roll of web material in known relation to the successive areas of printed matter carried thereon. The indicia on the web and on the roll are adapted to be scanned by suitable scanning means which produce signals corresponding thereto. The locations of the scanning means are suitably chosen so that, when the indicia on the mov-

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ing web and the indicia on the moving roll are in registry, a predetermined phase relation exists between web indicia signals and corresponding roll indicia signals.

The phase difference between the corresponding signals may be determined in any suitable manner, as, for example, by means of a cathode ray oscilloscope. In a preferred embodiment, signals produced by indicia on the moving web are delayed and are utilized to pulse a linear sweep generator which provides a time base for the cathode ray oscilloscope. This time base is of such character that web indicia signals are maintained in substantially fixed relation on the oscilloscope screen regardless of the linear speed of the web.

Additional objects and advantages of the invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

Figure 1 is a schematic diagram of web register control apparatus constructed according to the present invention;

Figure 2 is a side view of the apparatus shown in Figure 1 illustrating the scanning means; and

Figure 3 is a diagram illustrating a representative trace appearing on the screen of the cathode ray oscilloscope used in the system of Figure 1.

Referring now to Figure 1, conventional web delivery apparatus is shown, including a web 10 which is unrolled from a roll 11 and passes over a roller 12 and under a roller 14 from which it is fed to suitable folding or other apparatus. Disposed beneath the web 10 is a second roll 84 of web material which is adapted to be rotated by a motor 15 through a differential or planetary gear box 16. The differential or planetary gear box 16 may be of any conventional type which permits the roll 84 while it is being rotated by the motor 15, to be advanced or retarded in displacement by turning a handwheel 50 in one direction or the other. The web roll 11 is shown as being almost completely unwound and it is desired to paste the start of the web material on the roll 84 to the web 10 before the latter has become completely unwound and while the web 10 is in motion. The web pasting and cutting apparatus may be a conventional type of roll change device and forms no part of the invention. It is not essential for an understanding of the invention and therefore has not been shown in detail.

The web 10 carries thereon a plurality of successive areas having certain printed matter 17

thereon, and the web material on the roll 84 has exactly the same printed matter 17' thereon as shown. It will be understood that before the web material on the roll 84 can be pasted to the web 10, the speed of the roll 84 must be increased until its peripheral speed is substantially the same as the linear speed of the moving web 10. Further, the printed matter 17' on the web material of the roll 84 must be in registry with the corresponding printed matter 17 on the web 10 before the cutting and pasting operation is performed. Otherwise, the web 10 may be torn or subsequent operations on the web 10 may be out of register.

In accordance with the invention, a plurality of indicia 18 are printed on the web 10 in predetermined relation to the printed matter 17 and corresponding indicia 18' are printed on the web material on the roll 84. It will be understood that there will be one register mark or indicia 18 or 18' for each printed impression on the respective webs. That is, where the printed matter 17 and 17' are printed by rotary machines, they are respectively the impressions made by one rotation of the printing cylinder, the reference characters 17 and 17' respectively including all printed matter across the web. These indicia 18 and 18' are adapted to be scanned by scanning means 19 and 20, respectively, to provide periodic signals corresponding thereto, as described in greater detail below.

Referring now to Figure 2, the scanning means 19 for the indicia 18 on the web 10 may comprise, for example, a source of light 21 which is adapted to be directed through a narrow slot 85 in a mask 86 and through an optical system 22 to the web 10 in the path of the indicia 18. This serves to provide a narrow reflected beam of radiation which is adapted to be directed through an optical system 23 to a photosensitive device 24 such as a photoelectric cell, for example. The scanning means 19 is removably mounted on a rod member 25 in any suitable fashion, as by a clamp 26 and setscrew 27, for example, so that its longitudinal position with respect to the web 10 may be adjusted.

Similarly, the scanning means 20 for the indicia 18' on the roll 84 may comprise, for example, a source of light 28 which is adapted to be directed through a narrow slot 87 in a mask 88 and through an optical system 29 to the surface of the web material forming the roll 84 in the path of the indicia 18'. The light reflected by the surface of the web material on the roll 84 is adapted to be transmitted through an optical system 30 to a photosensitive device 31 which may be a photoelectric cell, for example.

The output of the photoelectric cell 24 in the scanning means 19 is adapted to be transmitted through the conductors 32 and 33 (Fig. 1) to a conventional pulse amplifier 34, the output of which is fed by the conductors 35 and 36 to the vertical deflecting plates 37 and 38 of a conventional type cathode ray oscilloscope 39. In similar fashion, the output of the photoelectric cell 31 in the scanning means 20 is adapted to be supplied through the conductors 40 and 41 to the amplifier 34, the output of which is impressed upon the vertical deflecting plates of the oscilloscope 39 in the manner described above.

The time base for the oscilloscope 39 is preferably pulsed by means of the signals received from the photoelectric cell 24. To this end, the output of photoelectric cell 24 is also supplied

through the conductors 32 and 33 and 42 and 43 to a second conventional pulse amplifier 44, the output of which is fed to a delay circuit 45. The delay circuit 45 provides pulses of the same frequency as the input pulses, but introduces a definite time delay between the input pulses and the output pulses. The pulse output of the delay circuit 45 is used to pulse a conventional type linear sweep generator 46 which provides a "saw-tooth" or other suitable output at the horizontal deflecting plates 47 and 48 of the cathode ray oscilloscope 39, forming a time base on the screen of the oscilloscope 39.

The delay circuit 45 may be of any suitable type which is capable of introducing a time delay between the creation of the pulses at the photoelectric cell 24 and their impression upon the input terminals of the linear sweep generator 46. Any conventional type multivibrator circuit with an adjustable duty cycle may be used for this purpose. The linear sweep generator 46 may be of the usual type, having preferably a "saw-tooth" output. The time delay interposed by the delay circuit 45 should be sufficient to insure that each pulse provided by the photoelectric cell 24 in response to indicia on the web 10 provides a time base for the next pulse therefrom. With this construction, it will be apparent that the relative position of the signals produced by indicia on the web 10 can be maintained in fixed position on the screen of the cathode ray oscilloscope 39 regardless of variations in the speed of the web 10.

Initially, the system described above should be adjusted so that a predetermined phase relationship exists between the signals produced upon the screen of the cathode ray oscilloscope 39 when the web 10 is in a known condition of registry with respect to the roll 84. This adjustment is preferably made with the web 10 stationary. The roll 84 is turned by hand until the indicia 18 on the web 10 are in registry with the indicia 18' on the roll 84 and one of the indicia 18' on the roll 84 is in the proper position to be viewed by the scanning means 20. The location of the scanning means 19 is then adjusted, if necessary, to bring it into viewing position over one of the indicia 18 on the web 10.

In operation, with the apparatus adjusted as indicated above, the passage of successive indicia 18 beneath the scanning means 19 will produce a succession of pulses which will be transmitted to the amplifier 34 and impressed upon the vertical deflecting plates 37 and 38 of the cathode ray oscilloscope 39. Similar pulses will be produced by the passage of the indicia 18' on the roll 84 beneath the scanning means 20. The pulses produced by the scanning means 19 are also supplied to the amplifier 44 and to the delay circuit 45 which pulses the linear sweep generator 46 and provides a linear time base for the oscilloscope 39.

Under these conditions, pulses produced by the scanning head 19 will appear as a stationary "pip" 47 (Fig. 3) on the screen of the cathode ray oscilloscope 39. Assuming that the start of the sweep is at the left of the screen, if the pulses received from the scanning head 20 lead the pulses received from the scanning head 19, then the former will appear on the screen of the cathode ray oscilloscope 39 as a "pip" 48 (shown in dotted lines in Figure 3) which leads the "pip" 47. If, on the other hand, the pulses received from the scanning means 20 lag behind the pulses from the scanning means 19, the former will appear on the

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screen of the cathode ray oscilloscope 39 as a "pip" 49 which lags behind the "pip" 47. When the web 10 and the roll 84 are in registry, the "pip" produced by the pulses from the scanning means 20 will be superimposed on the "pip" 47.

In order to bring the indicia 18' on the roll 84 into registry with the indicia 18 on the web 10, the speed of the motor 15 is adjusted until the peripheral speed of the roll 84 is the same as the linear speed of the web 10. If, at that time, the web 10 and the roll 84 are out of registry, as indicated by the cathode ray oscilloscope 39, the handwheel 50 is turned in the proper direction until registry between the web 10 and the roll 84 has been achieved.

By proper adjustment of the handwheel 50, the phase displacement between the indicia 18' on the roll 84 and the indicia 18 on the web 10 can be reduced. This will be indicated by a lessening of the distance between the "pips" 48 or 49 and the "pip" 47 on the cathode ray oscilloscope 39. When the roll 84 and the web 10 are in registry, the "pip" 48 or the "pip" 49, as the case may be, will be superimposed upon the "pip" 47. When the web 10 and the roll 84 have been brought into registry, conventional pasting and cutting apparatus (not shown) may be operated while the web 10 is moving without tearing it.

Instead of utilizing the pulses from the scanning heads 19 and 20 to produce "pips" of the type shown in Figure 3, it will be understood that these pulses might be impressed upon the control grid of the cathode ray oscilloscope 39. When this is done, an instantaneous brightening of the spot will be produced along the time base at about the positions of the pulses 47, 48 or 49. Aside from this modification, the operation of the system would be exactly as described above.

It will be understood, of course, that the indicia 18 or 18' need not lie directly beneath the corresponding scanning means 19 and 20 when the web 10 is in registry with the roll 84, provided that the phase displacement between the "pips" 47 and 48 or 49 when the web 10 and the roll 84 are in registry is known.

From the foregoing description, it will be apparent that the invention provides highly effective means for bringing printed matter on a moving roll of web material into registry with corresponding printed matter on a moving web. As a result, operations like cutting and pasting the start of a roll to a moving web that is about depleted may be carried out without stopping or slowing down the press.

While several representative embodiments have been described herein, the invention is not intended to be limited thereto but is susceptible of numerous changes in form and detail within the scope of the following claims.

I claim:

1. Web register control apparatus comprising a moving web having longitudinally spaced apart indicia thereon, a moving roll of web material having longitudinally spaced apart indicia thereon, means for scanning the indicia on the web

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and on the roll and providing signal corresponding thereto, a cathode ray oscilloscope having a pair of deflection plates responsive to said signals, and electrical means connected to another pair of deflection plates on said oscilloscope for providing a time base therefor.

2. Web register control apparatus comprising a web having longitudinally spaced apart indicia thereon, a roll of web material having longitudinally spaced apart indicia thereon, means for scanning the indicia on the web and on the roll and providing signals corresponding thereto, a cathode ray oscilloscope having a pair of deflection plates responsive to said signals, means for delaying signals produced by indicia on said web, and electrical means connected to another pair of deflection plates on said oscilloscope and responsive to said delayed signals for providing a time base for said oscilloscope.

3. In apparatus for producing printed matter, the combination of a moving web having successive areas of printed matter thereon, a plurality of longitudinally spaced apart indicia on the web, each located in predetermined relation to an area containing printed matter, a roll of web material having successive areas of printed matter thereon, a plurality of longitudinally spaced apart indicia on the roll, each located in predetermined relation to an area containing printed matter, power means for rotating said roll of web material, first scanning means adapted to produce a signal each time one of said indicia on the web passes a predetermined point, second scanning means adapted to produce a signal each time one of said indicia on the roll passes a predetermined point, a cathode ray oscilloscope having pairs of horizontal and vertical deflection plates, signal amplifying means connected between said first and second scanning means and one of said pairs of deflection plates, electrical means connected to another pair of said deflection plates for providing a time base for said oscilloscope, second signal amplifying means connected to receive signals from said first scanning means, electrical time delay means interposed between said second amplifying means and said electrical means and mechanical means associated with said power means for advancing or retarding said roll during the rotation thereof to change the phase difference between signals corresponding to indicia on the moving web and signals corresponding to indicia on the roll.

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