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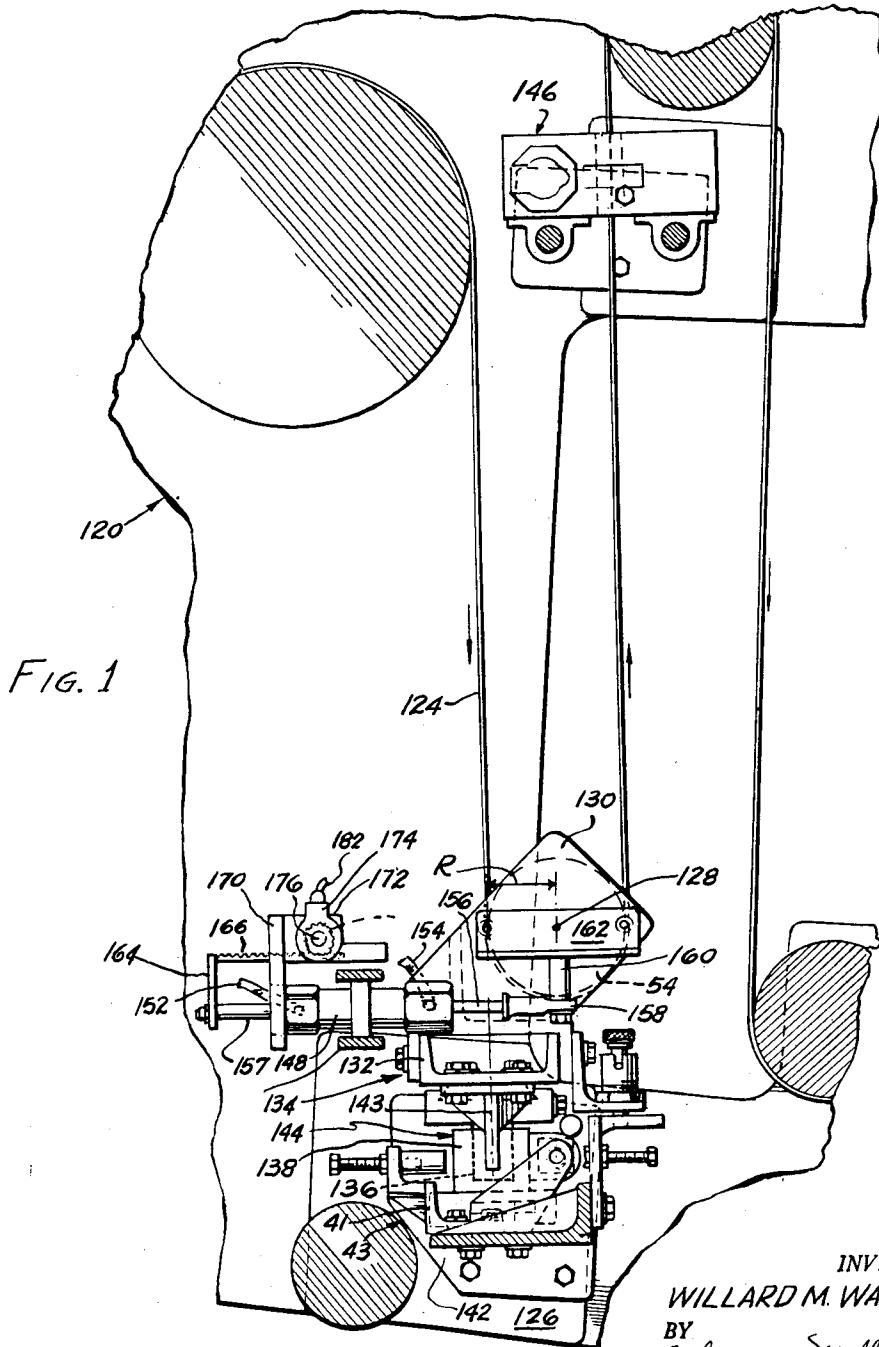
W. M. WALTHALL

3,019,955

STEERING ROLL INDICATING AND ADJUSTING APPARATUS

Filed Dec. 10, 1959

3 Sheets-Sheet 1



INVENTOR.
WILLARD M. WALTHALL
BY
Silverman, Mullin + Cass
ATT'YS

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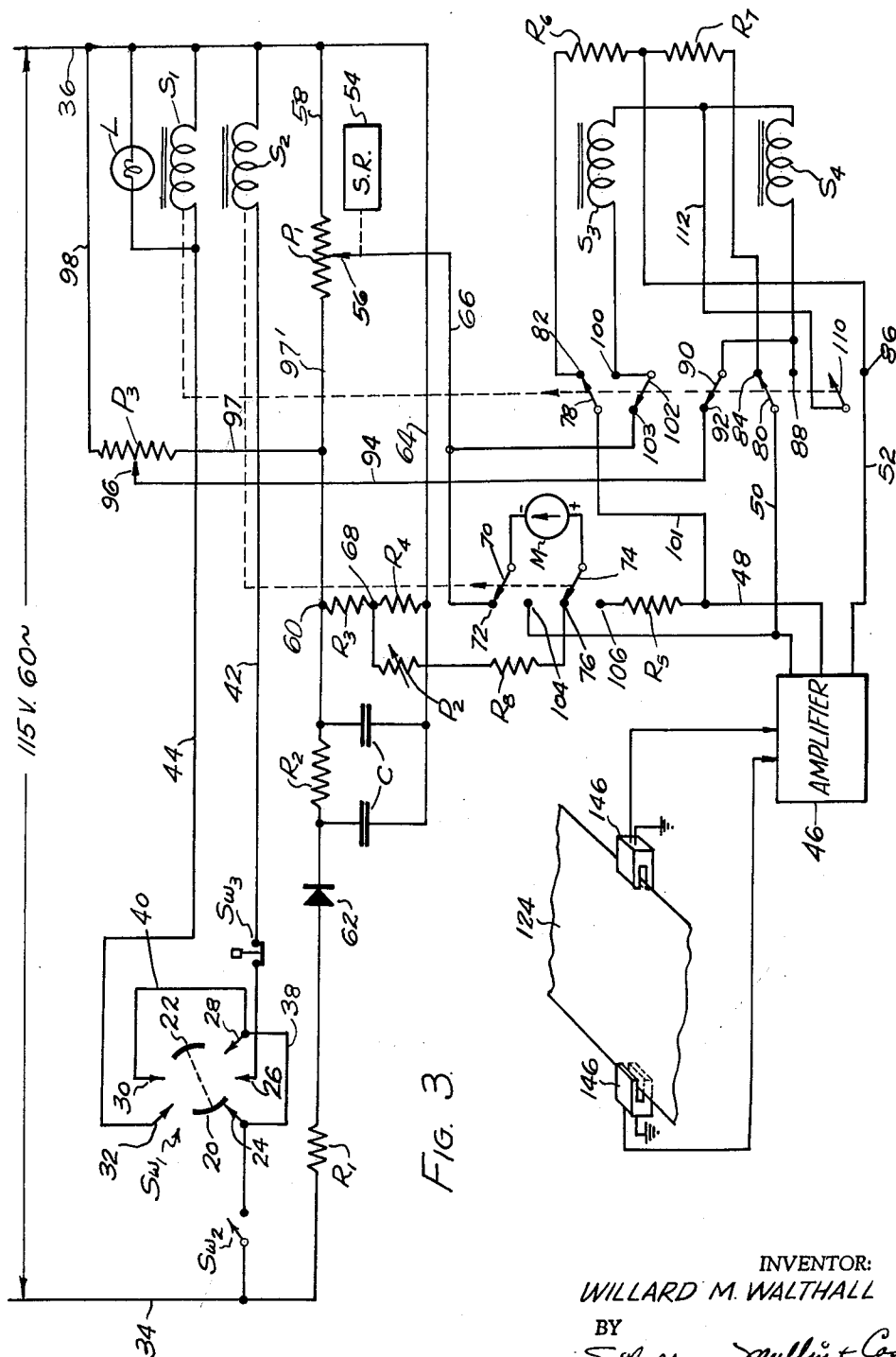
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STEERING ROLL INDICATING AND ADJUSTING APPARATUS

Willard M. Walthall, Danville, Ill., assignor to Hurlstrom Incorporated, Danville, Ill., a corporation of Delaware
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23 Claims. (Cl. 226—21)

This invention relates generally to the art of guiding a web through a machine which operates on the web, such as for example a web of paper being guided through a high-speed, multi-color printing press, and more particularly is concerned with the steering roll which is one of the guiding components which control the lateral position of the web.

For details of construction of steering rolls and control systems in which the same are used, reference may be had to the following U.S. applications for patent: Serial No. 718,057, filed Feb. 27, 1958, now Pat. No. 2,940,752 in the name of Carl L. Deeken, entitled "Steering Roll Construction"; Serial No. 801,503, filed March 24, 1959 in the names of Joseph C. Frommer and Ulrich R. Furst, entitled "Web Guide Control"; and Serial No. 853,615 filed Nov. 17, 1959 in the name of Robert E. Watt and Carl L. Deeken, entitled "Steering Roll Construction with Slidable Pivot." All of these applications are assigned to the same assignee as the application herein.

It has been found that a steering roll is effective to change the lateral position of the outgoing reach of a web passing over the steering roll without affecting the oncoming reach if the steering roll is pivoted for swinging motion on an axis which is spaced rearwardly from the axis of rotation of the roll itself. In other words, if the axis of swivelling of the steering roll is located substantially in the plane of the oncoming reach of the web, swivelling of the steering roll will have little or no effect upon the lateral position of the oncoming reach of the web but will readily shift the lateral position of the outgoing reach.

The preferred structure of steering roll comprises a yoke having the trunnions of the steering roll journaled in the ends thereof, the yoke having a relatively sturdy elongate beam extending transversely of the direction of movement of the web and the yoke being pivoted to a pivot structure which is mounted on a base. The entire structure is mounted in the printing press between the side framing supports and structure of the press, and is not readily accessible for observation because of the presence of other components of the press, including idling and guiding rolls, other structural members, etc.

In order to maintain proper centering of the web as it passes through the press, scanning devices are located adjacent the web after it leaves the steering roll, and each scanning device provides a signal which represents the location of the edge of the web as it passes through a throat of the scanner. In the structure described in the co-pending application Serial No. 801,503, the scanners are energized by directing beams of light against photo-sensitive devices so that the devices will produce signals related to the amount of light that they see. Each scanner has an edge intercepting the light impinging upon its photo-sensitive device. The signals from the scanners are amplified and converted into currents which flow in the differential windings of an electro-hydraulic servo valve controlling the flow of fluid into a cylinder from one end or the other thereof. If the currents in the windings are equal, as would be the case where equal signals are produced in the respective scanners, the spool of the valve would be centered and the piston of the cylinder is located in substantially the center of its stroke,

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considered neutral position. If one or the other of the windings has a larger current in it, the spool moves one way and the piston of the cylinder follows suit.

The cylinder is secured to the framework or base of the press, and its piston rod is coupled with the yoke, so that movement of the piston will swing the steering roll. Swinging of the steering roll will shift the web laterally to change the locations of the edges. The system is arranged so that the web is shifted in a direction tending to reduce the differential between the currents flowing in the windings of the electro-hydraulic servo valve.

The invention herein solves several problems which have arisen in connection with apparatus of the character described above.

Probably the most important problem which is solved by the invention is the problem of indicating to the pressman or operator the angle of the steering roll during the time that the press is being set up and also during the period of operation. This information is important to show trends in the lateral lay of the web, such as would be caused by the wrap of the web on the white roll, or by some constant shifting of the web in back of the steering roll. The maximum efficiency of the system is obtained when the steering roll is swinging back and forth about its geometrically perpendicular position relative to the movement of the web. A continuous check of the angle of steering enables the pressman to know what is occurring.

The primary object of the invention herein is to provide a structure for converting the swivelling movement of the steering roll into an electrical signal which can energize a translating device such as a meter to visually indicate this signal into a position indication. The invention also contemplates the building of the indicating apparatus into a novel circuit to enable the meter to be used for multiple purposes, providing not only great economy in components but giving great convenience and efficiency in use thereof.

Another problem which has been solved by the invention herein relates to providing the operator with information concerning the lateral position of the web as "seen" by the scanners, irrespective of the angular position of the steering roll. The invention has as another object the provision of means for giving a continuous indication of this information, and in addition, utilizing the same meter for this purpose with a novel switching system for implementing such use.

Still a further object of the invention, which solves other problems, is to provide a structure which will enable the operator to move the steering roll as he desires for the purpose of seeing the reaction thereof on the scanning devices or for any other desired purpose, the said structure being combined with the indicating apparatus all lending to the economy and simplicity of the circuitry.

Other objects of the invention and advantages thereof will appear as the preferred embodiment is described hereinafter, in connection with which the drawings illustrate the same and the details thereof, both in view of the actual structure as well as in a circuit diagram. The invention is directed not only to the mechanical structure, but as well to the electrical arrangement by virtue of which the mechanical structure can be used to greatest advantages, and in addition to certain other aspects which do not readily permit of illustration except by circuit diagram.

In the drawings:

FIG. 1 is a sectional view taken through the steering roll installation of a printing press and illustrating the environment of the invention, certain elements of the invention being illustrated.

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FIG. 2 is a perspective view of the actuating cylinder of the steering roll shown in FIG. 1 having structure mounted on the piston rod for cooperating with a bridge circuit to indicate the position of the steering roll.

FIG. 3 is a circuit diagram of the invention showing the manner in which the same is associated with the structure of FIGS. 1 and 2.

The structure which is contemplated by the invention provides efficient execution of a plurality of functions through the use of simplified arrangements that utilize a novel switching circuit, the windings of the electro-hydraulic valve of the web guide control briefly described above, and a single indicating device such as a meter for giving all visual indications desired. These are in addition to a novel coupling between the steering roll and the electrical circuit to give the basic indication of angular position of the steering roll.

An electrical balanced bridge circuit is provided in which the meter is connected from the center point between one pair of balance arms to the wiper of a potentiometer, the halves on opposite sides of the contact of the wiper comprising the other pair of balance arms. The potentiometer is mounted on the support for the hydraulic cylinder driven by the electrohydraulic servo valve, and the piston of the cylinder is coupled with the wiper of the potentiometer so that the movement of the piston and hence the movement of the steering roll is coupled with the wiper. The meter indicates balance and hence indicates angular position of the steering roll.

The system is controlled by a single switch having three positions, for different conditions of the circuit, depending upon the functions desired to be performed by the apparatus. The three conditions are described hereinafter. Before discussing the details of the invention, it is desired to point out that the circuit in one condition disconnects the differential windings of the electrohydraulic servo valve from the output of the amplifier and connects them to a source of direct current which can be manually varied so that the steering roll can be swivelled at will by the operator, while observing the response of the amplifier, or if he desires the response of the steering roll itself to this swivelling.

In another condition, while the apparatus is connected for automatic operation thereof, the manual positioning of the steering roll is not possible, because the amplifier output is connected to affect the differential windings of the electrohydraulic valve, but the indicating meter can be switched back and forth to indicate either the output of the amplifier or the angular position of the steering roll.

Reference may now be had to FIG. 3 which comprises a circuit diagram of a system embodying the invention. The control panel, in whatever location it may be, is provided with a switch Sw_1 the movable portion of which has three positions or attitudes, as they will be called. A pair of diametrically opposed and electrically independent arcuate contact wipers 20 and 22 engage various contacts to close and open certain circuits which will be explained. There are five contacts shown, which consist of contacts 24, 26, 28, 30 and 32. The three attitudes of the switch Sw_1 may be referred to and they are suitably marked and indexed as points or positions on an escutcheon plate traversed by a control knob or arm with an indicator, coupled with said wipers 20 and 22 as "Position," "Manual" and "Automatic." The switch Sw_1 is illustrated in the attitude designated "Position." Both of the circuits controlled by the switch Sw_1 are open when this attitude obtains.

These two circuits are relay circuits whose purpose it is to energize the relay coils S_1 and S_2 as will be explained. The relay coils S_1 and S_2 are adapted to be connected across the conductors 34 and 36 of a 115 volt A.C. line through the switch Sw_1 . The contact 24 connects with the conductor 34 through a "go-down" switch Sw_2 which is a safety switch relating to the speed of the press. At

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slow press speeds it is self-opening. Through leads 38 and 40, the contacts 28 and 30 are also connected to conductor 34. When the switch Sw_1 is in the second attitude, namely—"Manual" the arcuate contact wipers are rotated counter-clockwise through 45° so that the left hand wiper 20 bridges the two contacts 24 and 26 and thereby closes the A.C. circuit through the override switch Sw_3 , the conductor 42 and energizes the relay coil S_2 . In the third attitude, namely—"Automatic" the arcuate contact wipers both move another 45° counterclockwise, and this carries the wiper 20 to a position bridging the contacts 26 and 28, retaining the closed circuit through the coil S_2 , but in addition, the wiper 22 now bridges the contacts 30 and 32. This closes the energizing circuit of the relay coil S_1 through the conductor 44, so that in effect, at the "Automatic" location of the switch Sw_1 , both coils S_1 and S_2 are energized in parallel, while in the "Manual" attitude, only the relay coil S_2 is energized. In "Position" attitude, neither is energized.

As previously explained, the system with which this structure is used depends upon the swinging or pivotal movement of a steering roll to achieve and maintain lateral centering of a web of paper as it passes through a printing press. Scanners viewing the opposite edges of the moving web generate signals which are amplified and then converted into currents flowing through the differential windings of an electromagnetic hydraulic servo valve. Equal signals produce no differential and unequal signals will produce a differential and cause movement of a hydraulic cylinder to swing the steering roll until the scanners can detect no difference in the amount of web intercepting their light beams.

In the circuit diagram of FIG. 3, the amplifier is shown at 46 and its output amplifier tubes have their plates connected by way of the leads 48 and 50 through the respective windings S_3 and S_4 to the B+ supply of the amplifier, by way of the lead 52. Note the interposition of relay contacts between the amplifier 46 and the windings S_3 and S_4 for a purpose to be explained.

When the currents flowing in the windings S_3 and S_4 are different, a valve will operate the cylinder (not shown in FIG. 3) to swing the steering roll, shown in FIG. 3 as a block 54 and the steering roll is intended to adjust the centering of the web as explained in said co-pending application.

The steering roll 54 is mechanically coupled to the wiper 56 of a potentiometer P_1 the right hand terminal 58 of which is connected to the line conductor 36 and the left hand terminal of which is connected to the terminal 60 of the rectifying circuit which is shown. Note that there is a rectifier 62 having one side connected through the resistor R_1 to the left hand line conductor 34. The resistor R_2 and the condensers C form a simple π filter. The negative side of the rectifying circuit is the conductor 64 which in turn connects to the line conductor 36. The maximum D.C. voltage thus appears between the terminal 60 and the conductor 64, so that P_1 has the full voltage across the same. Note that there is a pair of resistors R_3 and R_4 also connected across the D.C. output in parallel with the potentiometer P_1 . The meter circuit which includes the meter M, is connected on one side by the conductor 66 and the wiper 56 to the potentiometer P_1 and is connected on the other side through resistor R_5 and potentiometer P_2 to the common terminal 68 between the resistors R_3 and R_4 which are equal in value. This is a bridge circuit which will be balanced only when the wiper 56 and the terminal 68 are at equal potentials. Under these conditions the meter M will read zero, with its needle in the center of its dial, since a centered needle D.C. meter is used. When the steering roll 54 moves, it will therefore move the wiper 56, unbalancing the bridge circuit, and cause the needle of the meter M to swing right or left. The meter M is located at the control panel, and hence enables the pressman to ascertain at a glance the exact position of the

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steering roll, that is the degree from normal by which the steering roll has been swung.

In the circuit as illustrated, with the switch Sw_1 in "Position" attitude, the meter M is connected through the contacts of the relay which is intended to be energized by the relay coil S_2 , into the bridge circuit. Thus, the negative terminal of the meter is connected to the arm 70 which in the arrangement illustrated is connected to the contact 72 of the conductor 66, while the positive terminal of the meter M is connected to the arm 74 which in turn engages the contact 76.

If the pressman, in setting up the press, discovers that the position of the steering roll is not to his satisfaction, he can adjust the same readily by means of the circuit, and while the switch Sw_1 is in the first position. Note that the amplifier 46 has its plate leads 48 and 50 connected to the switch arms 78 and 80 (through the lead 101) and these arms engage contacts 82 and 84 respectively. The contacts 82 and 84 cause the current output of the amplifier 46 to flow through a dummy load consisting of the resistors R_6 and R_7 connected at a common terminal to the contact 86 which in turn is connected by lead 52 to B+. The electro-hydraulic servo valve windings S_3 and S_4 have their right hand ends as viewed, connected to the switch arm 110 which in this position is open. Obviously the windings are not influenced in the first position by the amplifier 46.

The left terminal of the winding S_4 connects to contact 88 and arm 90 which in turn engages the contact 92 connected by the lead 94 to the wiper 96 of the potentiometer P_3 . It will be appreciated that this potentiometer P_3 is connected across the output of the rectifying circuit also, since one end is connected at 60 and the other end by way of the lead 98 to the line conductor 36. The left hand terminal of the winding S_3 connects to the contact 100 and the switch arm 102 which is engaged with contact 103 which in turn connects with the lead 66, which extends to the wiper 56 of the potentiometer P_1 .

The contact point of the wiper 96 of the potentiometer P_3 is controlled from a convenient place on or near the control panel. It is mechanically coupled with a knob which may be turned one way or the other to send a current through the differential windings S_3 and S_4 forcing them to balance one another through movement of the steering roll 54. In effect, the voltage of the wiper 96 is compared with the voltage at the wiper 56 in a bridge circuit in which the detector comprises the two windings S_3 and S_4 in series.

In the second attitude of the switch Sw_1 , namely—"Manual" the relay coil S_2 will be energized, which will switch the arms 70 and 74 to the contacts 104 and 106 respectively thereby connecting the meter M to the output of the amplifier 46 through the resistor R_5 which maintains the range of the meter. Now, the meter M reads the output of the amplifier showing how it performs. Since the manual control exercised by the potentiometer P_3 has not been changed, because the relay coil S_1 is still not energized, the pressman can swing the steering roll 54 independently of the control system by manually changing the position of the wiper 96 (wiper 56 being connected thereto through windings S_3 and S_4) and the meter will indicate how the amplifier 46 reacts.

In the third attitude of the switch Sw_1 , the relay coil S_2 remains energized and hence the meter M is still connected to the amplifier output, but the energization of the relay coil S_1 causes all of the switch arms of this relay to move to their opposite contacts. Arm 78 swings to contact 100; arm 102 swings off contact 103; arm 90 swings off contact 92; arm 80 swings from contact 84 to contact 88; and arm 110 swings to contact 86. Under these conditions, the dummy load resistors R_6 and R_7 are no longer in the circuit, and the right hand terminals of each of the windings S_3 and S_4 connect by the lead 112 through arm 110 and contact 86 to the lead 52, which

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it will be recalled connects with the B+ terminal of the amplifier 46. The plate lead 48 now connects by way of the conductor 101 and arm 78 to the contact 100 only, which is the left hand terminal of the winding S_3 . The plate lead 50 now connects by way of the arm 80 only to the contact 88 which is the left hand terminal of the winding S_4 . The conductor 94 and the conductor 66 are both open.

Thus, in the "Automatic" attitude of the switch Sw_1 , the meter M reads the differential between the outputs of the two plate circuits of the amplifier 46 which represents the degree of misalignment of the web of paper off center. If the apparatus is properly adjusted, any indication off zero on the meter should immediately result in swinging of the steering roll 54 followed by a return of the meter needle to zero.

At any time, if it is desired to ascertain the angle of the steering roll as measured by the position of the wiper 56, instead of the misalignment of web related to the output of the amplifier 46, the normally closed switch Sw_3 is opened. This de-energizes the relay coil S_2 and inserts the meter M into the bridge circuit between the potentiometers P_1 and P_2 . This can be done whether the switch Sw_1 is in "Manual" or in "Automatic" attitudes, but in the latter, the wiper 96 is ineffective to move the steering roll.

A summary of the functions of the circuit for the various attitudes of the switch Sw_1 conveniently can be charted as follows:

Attitude of Switch Sw_1	Meter Reads	Throw Override Switch Sw_3	Manual Positioning By Use of Potentiometer P
Position.....	Position of Steering Roll.	No effect.....	Yes.
Manual.....	Output of Amplifier 46.	Will change meter to read steering roll position.	Yes.
Automatic.....	do.....	do.....	No.

When in "Automatic" attitude, the switch Sw_1 energizes the relay coil S_1 across which there is connected a lamp L . This lamp therefore will be ignited to indicate that the circuit is in the particular condition. Obviously there could be different color lamps connected across the coil S_2 or in connection with the relay contacts to give different indications of circuit conditions.

FIGS. 1 and 2 illustrate a printing press 120 which is provided with a steering roll 54 over which the web 124 is led in a 180° turn. Reference to the printing press will be intended as the machine itself including its framework, some of the structural members of which are illustrated at 126 in FIG. 1. The steering roll 54 is an elongate cylinder which is mounted for rotation on an axis designated 128 (which would emerge from the page of FIG. 1). The roll is journaled between brackets, one of which is shown at 130 that are mounted on the ends of a transverse structural member 132 to form a yoke 134. A central stud 136 depending from yoke 134 is disposed in bearings in a socket or cylindrical sleeve 138 mounted on the beam 41 that extends between the side framing structural members 126 of the printing press 120. A plate such as at 142 is welded to each end of the beam 41.

The beam 41 is fixed and may be considered the base 43 upon which the yoke 134 is pivotally supported, and the stud and sleeve may collectively be considered the pivotal structure 144. The pivotal axis 143 is preferably spaced rearward of the rotational axis 128 by the radius R of steering roll 54.

The reference character 146 is a scanner, and there may be two on opposite sides of the web 124 responsive to the position of the edge of the web relative thereto to produce electrical signals (see FIG. 3). For example,

a source of light may be directed at a photoelectric cell, and the edge may intercept the beam to permit more or less light from activating the photoelectric cell. Either two scanners on opposite edges, or one scanner and a fixed potential reference point provide a pair of signals which are fed to an amplifier 46 which provides the pair of outputs previously discussed.

The outputs of the amplifier are intended to be applied to the differential windings S_3 and S_4 of an electro-hydraulic servo valve (not shown) to control the flow of hydraulic fluid to one end or the other of a cylinder 148 (FIG. 2) which is secured to one of the plates 142 by a clamp 150. The conduits to the opposite ends of the cylinder 148 are shown at 152 and 154. The piston in the cylinder 148 has two rod ends protruding from opposite ends of the cylinder as shown at 156 and 157. The rod end 156 is provided with an eye end 158 that links with an extension member 160 secured to a bracket 162 that is mounted on the outer surface of one of the journal brackets 130 of the steering roll 54. Obviously, movement of the piston in the cylinder 148 will be translated into swinging movement of the yoke 134 because of the described linkage.

The rod 157 extends from the cylinder 148 and has a bracket 164 secured thereto to the upper end of which there is clamped a rack 166. There is a clamp 168 mounted on the cylinder end 169 having an upper extension 170 to which a plate 172 is bolted. A potentiometer casing 174 is mounted on the plate and the element thereof comprises the potentiometer P_1 . The wiper 56 is driven by a shaft, the latter being designated 176 and shown extending through the plate 172 and having a pinion 178 secured to the end thereof, the rack 166 being guided through a suitable opening 180 in the extension 170 and being meshed with the pinion 178. Since the clamp 168 is fixed relative to the cylinder 148, movement of the piston and the integrally secured rods 156 and 157, besides swinging the steering roll, will also change the position of the slider or wiper 56 of the potentiometer P_1 for the purposes of providing an indication of the angular disposition of the steering roll 54. The cable 182 has three conductors corresponding to the leads 66, 58 and the conductor 97' leading to the terminal 60 (FIG. 3).

Obviously many different forms of the actual structure are feasible and practical without departing from the spirit or scope of the invention as defined in the appended claims. The structure of the yoke 134, pivotal assemblage 144 and the base 43 supporting the same are certainly capable of wide variation. In addition, the particular manner of linking the movement of the steering roll 54 to the potentiometer P_1 which is shown in the figures is intended only by way of example and not limitation.

As indicated above, the particular application of the invention to a flexible paper web passing through a printing press is not intended as a limitation upon the scope and compass of the invention. Any elongate member which is passing through a machine and which must be operated upon by the machine, either by virtue of printing means or mechanical functions other than printing, is normally required to pass through the machine along a path which provides for proper registration of the operating means with the elongate member itself and/or with other operations performed or to be performed upon the member. This path is one which must be predetermined. The member cannot be permitted to meander at will through the apparatus, especially where the operations to be performed must take place within thousandths of an inch of predetermined places on the member. The desired path is a locus along which the member moves, and the invention is concerned with means for measuring not only the departure of the member from this desired locus, but as well the movement that some adjustable structure has taken on order to attempt to preserve this locus.

The compact circuitry is such that the operator can read on a meter either the position of the member relative to the locus (the output of the amplifier) or the position of the adjustable structure relative to its normally centered attitude (the output of the potentiometer P_1). It is such that the operator can connect the amplifier to the servo mechanism which drives the adjustable structure or can connect the servo mechanism with a device which enables manual adjustment of the adjustable structure independent of the amplifier. These functions can be performed in various permutations by simple changes in the circuit and switching arrangements. The invention contemplates the various modifications feasible for different kinds of machines.

What it is desired to secure by Letters Patent of the United States is:

1. Apparatus for indicating the angular position of a steering roll, said steering roll being mounted for swivelling movement and having a pivot structure and a base mounting said pivot structure, a fluid cylinder connected to said base and having a piston coupled with said steering roll for moving same, comprising, an electrical circuit including a source of potential and an indicating device connected between two points in said circuit and responsive to a potential difference, if any, between said two points, one component of said circuit having a variable impedance capable of changing the potential between said two points, said piston being coupled to said variable impedance component whereby to cause variation with movement of said piston.

2. Apparatus for indicating the angular position of a steering roll of a printing press, said roll being pivotal relative to the press and having a driving element connected between said press and said roll to swing the roll comprising, an electrical impedance element having a variable part coupled with said driving element, an electrical circuit including a source of potential and an indicator responsive to the difference in potential between parts of said circuit including said electrical impedance element.

3. Apparatus according to claim 2 in which the driving element comprises a fluid cylinder and piston, and the electrical impedance element comprises a potentiometer in which said variable part comprises a slider coupled with said piston.

4. In a structure of the character described in which there is a cylinder having a piston coupled with a steering roll for swivelling the roll, means for indicating the angular position of the roll relative to the support for the roll, comprising a rod connected with the piston, a balance circuit including a potentiometer as one pair of the balance arms thereof with the wiper of the potentiometer comprising the balance terminal between said pair of balance arms, a source of potential connected across the potentiometer, a detector connected from said wiper to a potential point of said source for detecting the difference in potential, if any, between said point and said wiper, and a mechanical coupling between said rod and said wiper whereby movement of said piston will move said wiper.

5. A structure according to claim 4 in which the said potential point is such as to divide the source into substantially two equi-potential parts.

6. A structure according to claim 4 in which said mechanical coupling comprises a rack and pinion connection.

7. In a machine having a continuously moving flexible web passing through the machine to be operated upon by the machine, a steering roll for controlling lateral position of the web as it passes through the machine, at least one scanning means sensing the edge of the web and providing a first signal related to the position of the said edge, a device producing a second signal to be compared with the first signal, an amplifier receiving both of said signals and providing a pair of outputs each related to

the respective signals and servo means normally actuated by said signals to swing the roll; apparatus for indicating either the angular position of the steering roll or the differential between the outputs of the amplifier, said apparatus having a balance circuit, a variable impedance in said circuit mechanically coupled with said steering roll to be varied with swinging movement of the steering roll to change the condition of balance, a detector, and switch means for connecting said detector either to said pair of outputs or to said balance circuit.

8. In combination with a machine having a flexible web passing therethrough, a steering roll for adjusting lateral position of the web, a servomechanism including edge-sensing means providing a pair of output signals related to the locations of the edges of the web and a driving mechanism responsive to said output signals and coupled to the steering roll to swivel said roll for adjusting the lateral web position to maintain a predetermined location; a first circuit providing manually variable signals adapted to be connected with said driving mechanism to swing said steering roll independently of said output signals, a second circuit adapted to connect said output signals to said driving mechanism, and switch means for establishing either of said connections mutually exclusively of one another.

9. The combination of claim 8 in which there is a balance circuit including a variable impedance coupled with said steering roll whereby swinging of the steering roll varies the condition of balance, a detector for indicating the condition of balance in said balance circuit, and means for connecting said detector to said output signals when said simulated signals circuit is connected to said driving mechanism.

10. A circuit for use with a steering roll swinging mechanism, said steering roll mechanism including a steering roll arranged for swivelling movement to adjust the lateral position of a web passing over the steering roll, scanning means responsive to the lateral position of the web and providing a pair of first signals related thereto, an actuating device coupled to swing the roll, a control structure energized by the differential between said first signals and adapted to have the first signals applied thereto, a balance bridge having a variable impedance, a detector adapted to be connected to said bridge for indicating the condition of balance, a source of signals adapted to be connected with said control structure and including means manually adjusting said signals, switch means having a plurality of positions wherein contacts are adapted to be either bridged or disconnected for making and breaking circuit connections; one position of said switch means connecting said detector with said bridge and connecting the said source of said manually adjustable signals to said control structure, and disconnecting the scanning means and control structure; another position of said switch means disconnecting the detector from said bridge and connecting said scanning means to said detector, while establishing a connection between the said source of manually adjustable signals and the control structure.

11. A structure as claimed in claim 10, in which there is a third position of said switch means, in which the control structure and detector are connected in parallel to said scanning means whereby the said pair of first signals is applied to said detector to indicate a differential between said signals while the steering roll is swivelled by said control structure.

12. In a structure of the character described, a steering roll having a pivotal mounting and a hydraulic actuator adapted to be controlled by a valve for swivelling the steering roll, the steering roll adapted to have a flexible web passing over the same and being movable by swivelling to continuously center the web, scanning means for providing a pair of signals related to the position of the web, and an amplifier having the signals applied thereto and providing a pair of output signals the differential

between which comprises a measure of the lateral position of the web, a pair of differential windings arranged to receive the output signals of the amplifier for energizing said control valve to operate said actuator; an indicating apparatus comprising, a balance bridge circuit having a variable impedance, means mechanically coupling the impedance to said steering roll to move therewith, and a detecting device connected in the bridge circuit to indicate the position of the steering roll.

13. A device as claimed in claim 12, in which there is a relay having a plurality of contact sets some of which provide said connection between said detecting device and bridge circuit and others of which are adapted to connect said amplifier to said detecting device, said relay adapted to be energized to connect the said detecting device either with the bridge circuit to indicate position of the steering roll, or to the amplifier to indicate the position of said web.

14. In the arrangement as claimed in claim 13, a manually operated switch movable between at least two positions, whereby a different one of said connections to said detecting device is provided in accordance with the position to which said switch is operated.

15. An apparatus as claimed in claim 13 in which there is a second relay having one set of contacts providing connection to said differential windings and another set of contacts providing connection to a dummy load, said relay adapted to be energized either to connect said amplifier to said windings or to said load, the circuit being arranged so that the second relay is normally in condition for establishing a connection between said amplifier and load, and is energized, if at all, only when the said first relay is connecting the detecting device to said amplifier.

16. In the arrangement claimed in claim 14, a second relay having one set of contacts providing a connection to said differential windings and another set of contacts providing connection to a dummy load, said relay adapted to be energized either to connect said amplifier to said windings or to said load, and in which said switch has a first position of said switch not energizing either relay, the second position of the switch energizing only the first relay, and the third position of the switch energizing the second relay without de-energizing the first relay.

17. An apparatus as claimed in claim 13 in which there is a manually adjustable simulated signal producing circuit adapted to be connected to said differential windings to enable independent movement of said steering roll.

18. An apparatus as claimed in claim 15 in which there is a manually adjustable simulated signal producing circuit adapted to be connected to said differential windings to enable independent movement of said steering roll, and said second relay has a third set of contacts connecting said signal producing circuit with said differential windings only when said second relay is in normal condition connecting said amplifier to said dummy load.

19. In combination with a machine having a directing structure, a moving member passing through the machine and adapted to be directed in a locus wherein work is performed on said member, the directing structure being adjustable and coupled with said moving member to direct the same, means responsive to changes in the position of said moving member relative said locus and providing a signal having an electric potential indicative of said position, a servo mechanism responsive to said signal and acting upon said directing structure to adjust the same in accordance with the potential of said signal, means for indicating either the potential of said signal or the adjustment made to said directing structure and comprising: a source of potential providing a second signal and having an impedance in circuit with said source and adjustable to vary the potential of the second signal, a mechanical coupling between said adjustable

impedance and said directing structure whereby adjustment of said directing structure varies said impedance, a translating device for indicating electric potential, and switching means selectively connecting said translating device either to be energized by said first signal or said second signal.

20. The combination of claim 19 in which there is a further source of energy providing a third signal for driving said servo mechanism, and said switching means is also arranged selectively to connect said servo mechanism with said further source whereby to drive said servo mechanism by said third signal independent of said first signal.

21. In combination with a machine having a flexible member passing through the same to be operated upon by said machine, said flexible member adapted to pass through the machine along a predetermined locus relative to the machine, a steering structure connected with said machine and adjustable to direct the flexible member to said locus upon occasion of departure therefrom while passing through said machine, means including a potential source and responsive to the position of said flexible member relative to said locus after passing said steering structure providing a signal related to the said position, a servo mechanism adapted to be connected to said potential source for adjusting said steering structure in accordance with said signal, a second potential source having a variable impedance element in circuit therewith and providing a second signal related to the impedance of said impedance element included in said circuit, a mechanical connection between said impedance and said steering structure whereby the adjustment of said steering structure will change the said impedance, a meter connected to said second potential source and driven by said second signal to indicate the position of said steering structure, a third potential source providing a third signal and said third potential source adapted to be connected to said servo mechanism for adjusting said steering structure in accordance with said third signal and having manual means for changing said third signal, and switch means for connecting either one or the other of said first and third potential sources to said servo mechanism.

22. In combination with a machine having a flexible member passing through the same to be operated upon by said machine, said flexible member adapted to pass along a predetermined locus relative to said machine, a moving structure coupled with said flexible member and adapted to be adjusted to shift said flexible member back to said locus upon occasion of departure therefrom, a first potential source including means responsive to the amount of departure of said flexible member from said locus to provide a first signal related to said departure, a servo mechanism adapted to be connected to said first potential source and coupled to said moving structure to adjust the same as directed by said first signal, a meter, a second potential source including a manually adjustable element for providing a second signal adapted to be connected to said servo mechanism, and switch means for connecting either the first or the second potential source to said servo mechanism while said meter is connected to said first potential source, the manual adjustment of said element of said second source serving to enable manual adjustment of said moving structure independent of said first signal.

23. The combination of claim 22 in which there is a third potential source adapted to produce a third signal and including a variable element mechanically coupled to said moving structure whereby said third signal will be related to the position of said structure, and second switch means are provided for switching said meter to connect same either to said third or first source regardless of the source to which said servo mechanism is connected.

References Cited in the file of this patent

UNITED STATES PATENTS

2,777,069	Saeman	Jan. 8, 1957
2,782,030	Webster et al.	Feb. 19, 1957
2,792,504	Slamar et al.	May 14, 1957

OTHER REFERENCES

Machine Design, pages 159-162 (Web Guiding Control), September 1951.