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REMOTE POSITION CONTROLLING APPARATUS

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FIG. 1

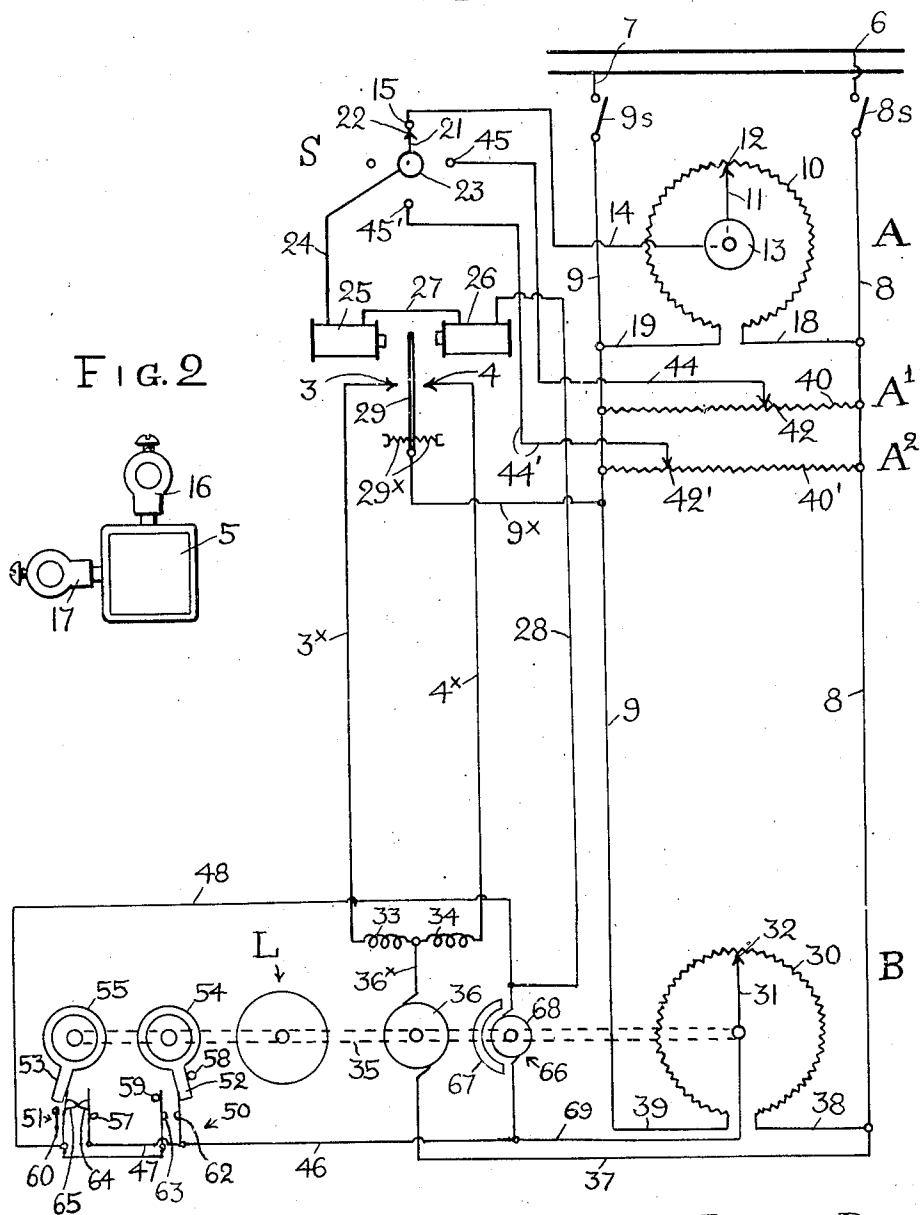
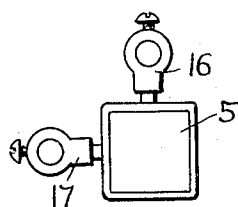


FIG. 2



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REMOTE POSITION CONTROLLING
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5 Claims. (Cl. 318—29)

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This invention relates to remote control systems. The principal object of the invention is to provide a remote control system which is capable of moving a load at a remote point to a selected one of a plurality of predetermined positions or to any desired position by operation of a control device at the control point. Another principal object of the invention is to provide a remote control system which will not only enable the load to be moved from the control point to a selected one of a plurality of predetermined positions or to any desired position, but which will provide for changing, i. e., predetermining, the predetermined positions to which the load is to be moved, by adjustment of the control device at the control point without the need of going to the remote point.

For the attainment of these and such other objects of invention as may appear or be pointed out herein, an embodiment of the invention is shown in the accompanying drawing, wherein:

Fig. 1 is a diagrammatic illustration of the improved remote control system of this invention; and,

Fig. 2 is an end view of a composite resistor element which may be used for a plurality of transmitting components at the control point.

The control device at the control point comprises the transmitting component A of a balanced or Wheatstone circuit, which component has a member which may be selectively adjusted to move a load L at the remote point to any desired position. The control device also comprises a plurality of transmitting components A¹, A² which are pre-adjusted for moving the load to predetermined positions. The receiving component B at the remote point is controlled by the transmitting components A, A¹, or A² to move the load L, respectively, to any desired position to which A is selectively adjusted or to predetermined positions corresponding to A¹, A².

The transmitting component A has a pair of relatively movable members, one of the members having a resistor element 10 preferably arranged in the form of a circle and the other member having a contact arm 11 provided with a distal contact element 12 slidably engageable with the resistor element 10, the contact arm being provided with a knob 13, by which the arm may be selectively adjusted. One end of resistor element 10 is connected by a short lead 19 to a wire connected through switch 9s to one terminal 7 of the source of current supply; the other end of the resistor element 10 is connected by a short lead 18 to a wire 8, leading through

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switch 8s to the other terminal 6 of the source of current supply. The proximal end of contact arm 11 is connected by a lead 14 to one contact 15 of a rotary switch S, which rotary switch has a plurality of contact points, one of which is the aforesaid contact 15, which contacts are slidably engaged by the distal contact 22 of the switch arm 21 which, by means of a knob 23 may be selectively turned to engage any desired one of the plurality of contacts. The proximal end of the switch arm 21 is connected by lead 24 to a polarized relay which is diagrammatically illustrated by the two coils 25, 26, the inner terminals of which are connected by a short lead 27. The other terminal of the polarized relay 25, 26 is connected by a lead 28 through an armature 68 of a generator 66 more fully described hereinafter to the proximal point of a contact arm 31 associated with the receiving component B at the remote point. Contact arm 31 is secured to rotate with a shaft 35 of a load motor 36, at the remote point. Contact arm 31 is provided with a distal contact 32 slidably engageable with a resistor element 30 of circular form, as shown. One end of the resistor element 30 of the receiving component B is connected by a lead 39, to the aforesaid supply wire 9, while its other end is connected by a lead 38 to the other supply wire 8.

Armature 29 of polarized relay 25, 26 is engageable with either a contact 3 or a contact 4, depending upon the direction of current flow through the polarized relay. Relay contact 3 is connected by lead 3* to the outer terminal of a reversing field winding 33 of the load motor 36, while the other contact 4 is connected by lead 4* to the outer terminal of the other reversing field winding 34. The inner terminals of windings 33, 34 are connected by a short lead 36* in the armature of motor 36, from whence the armature circuit continues by a lead 37, through the aforesaid supply wire 8. The other supply wire 9 is connected, by a lead 9*, to the proximal end of armature 29 of the polarized relay.

With the supply switches 8s, 9s closed, the rotary selector S is adjusted to cause its contact arm 21 to engage stationary contact 15 associated with the transmitting component A when it is desired to condition the system for moving the load L at the remote point to any desired position; and the contact arm 11 of the transmitting component A is selectively adjusted for the desired load position. Closing of the supply switches 8s, 9s impresses the current supply across both the resistor element 10 of the transmitting component

55 A and the resistor element 30 of the receiving

component B. The selectively adjustable contact arm 11 of the transmitting component A and the motor driven contact arm 31 of the receiving component B are connected in series, together with the polarized relay 25, 26, in a balancing circuit between the resistor elements 10, 30 of the transmitting and receiving components A, B and including generator 66 whose function will be described later. This circuit may be traced from distal contact 12 of contact arm 11, through the contact arm and lead 14, to stationary contact 15 of rotary switch S, and through switch arm 21 and lead 24 to the polarized relay 25, 27, 26, from whence, by the lead 28 to the proximal end of contact arm 31 of the receiving component B, the distal contact 32 of which engages the resistor element 30, as described. The contact arms 11, 31 of components A, B are shown in Fig. 1 in positions parallel with one another, so that their distal contacts 12, 32 engage points of the respective resistor elements 10, 30, which are of the same potential. Hence, there will be no flow of current through the said balancing circuit and through the polarized relay 25, 26; the armature 29 of the polarized relay will therefore be maintained, as by positioning springs 29^x, in a central or neutral position of the polarized relay, as shown, engaging neither of the contacts 3, 4, so that the circuit to the load motor 36 is broken. When, however, contact arm 11 of the transmitting component A is moved in one direction or the other, so that its contact element 12 engages transmitting resistor element 10 at a point not corresponding to the point at which the contact arm 31 of the receiving component B engages the receiving resistor 30, current will flow through the polarized relay by reason of the difference of potential between the two terminal ends of the balancing circuit. The said flow of current through the balancing circuit and the polarized relay 25, 26 will attract its armature 29 in one direction or the other, depending upon the direction in which the contact arm 11 of the transmitting component A had been selectively adjusted, it being understood that knob 13 of the transmitting component A is moved in one direction or the other depending upon the direction in which it is desired to move the load. For example, if the flow of current through polarized relay 25, 26 is such as to attract its armature 29 to the right, as shown in Fig. 1, to engage contact 4, a circuit to field winding 34 of the reversible load motor 36 will be completed, which circuit may be traced from supply wire 9, lead 9^x, armature 29 of the polarized relay, stationary contact 4, lead 4^x, to the outer terminal of field winding 34, from whence by common lead 36^x to the armature of the load motor 36, and by lead 37 to the other supply wire 9. Energization of field winding 34 will cause rotation of load motor 36 in the desired direction, which rotation imparted to shaft 35 will turn contact arm 31 of the receiving component B in a direction to move its distal contact 32 towards a point on the resistor element 30 corresponding to the point on the transmitting resistor element 10 to which the contact arm 11 had been selectively adjusted. Said corresponding points on the resistor elements 30, 10 of the receiving and transmitting components B, A, are points of equal potential, so that when contact arm 31, driven by load motor 36, reaches its said corresponding point, the potential in the balancing circuit, and, through the polarized relay 25, 26 will drop to zero, whereas the relay armature 29 will be released to move to its neutral position

(as shown in Fig. 1) to disconnect the load motor, thus stopping load motor rotation with the load L in a position corresponding to the selected adjustment of transmitting component A.

The transmitting component A¹ has a resistor element 40 which is engaged by a contact element 42 connected by a lead 44 to a stationary contact 45 of the rotary switch S. The transmitting component A² has a similar resistor element 40' engaged by a contact element 42', connected by lead 44' to another contact 45' of the rotary switch S. It is understood that a transmitting component similar to A¹, A², together with its associated contact at the rotary switch S, similar to contact 45, 45', will be provided for each required predetermined position. The contact element 42, 42' of the transmitting components A¹, A² are adjusted along the respective resistor elements 40, 40' in accordance with the predetermined position to which the load is to be moved. When it is desired to move the load to the predetermined position corresponding to the pre-setting of transmitting component A¹, for example, the switch arm 21 of rotary switch S is moved to engage contact 45 associated with transmitting component A¹, to complete a balancing circuit through the polarized relay 25, 26 similar to the circuit previously traced in connection with transmitting component A. The engagement of the rotary switch arm with contact 45 will energize load motor 36 for rotation in a direction depending upon the pre-setting of contact element 42 of the transmitting component A¹ and upon the position of contact arm 31 of the receiving component B (which, in turn, depends upon the previous load position), to turn the load to a position at which the contact arm 31 of the receiving component B will be at point corresponding to the pre-adjusted position of contact element 42 of the transmitting component A¹, this operation being similar to that more fully described above in connection with transmitting component A.

It will thus be seen that the load L at the remote point can be moved to any desired position (by manipulation of the transmitting component A) or to any one of a plurality of predetermined positions (as preset in the series of transmitting components A¹, A²) and which predetermined positions may be selected by turning the rotary switch S to the contact associated with the selected one of the transmitting components. It will further be seen that the system may be adjusted for desired predetermined positions by merely adjusting the position of the contact elements 42, 42' of the transmitting components A¹, A², at the control point without the need of making any adjustments at the receiving component B at the remote point.

As was mentioned above, the motor rotation will be reversed when the arm 31 overruns by inertia its balanced position in which the current in the circuit including the differential relay is reduced to zero. Such reversal may repeat itself, causing hunting or oscillation of the motor about the stopping position. To prevent such hunting, means are provided to anticipate de-energization of the motor by deenergizing the relay in advance to the motor reaching the stopping position. To increase the accuracy of the final position of the load, further means are provided to render the anticipating means effective only in a predetermined direction.

The anticipating means comprise a reversible generator 66 having a permanent magnet 67 as field and an armature 68. One of the armature

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terminals is connected by a lead 69 to the arm 31, and the other terminal is connected to the lead 28 as was mentioned hereinbefore, so that the generator is connected in series with the relay coils 25, 26. The generator is so arranged that it develops a voltage in opposition to the voltage in the relay circuit. Hence, the generator will deenergize the relay in advance of the deenergization caused by the balancing of the bridge circuit, thereby eliminating hunting of the motor. The deenergizing effect will be gradually reduced as the motor speed is reduced when approaching its stopping position. The generator is normally short circuited by switches 50, 51. Each switch 50, 51 comprises a pair of resilient contact arms 62, 63 and 64, 65, respectively connected in parallel, the arms of each pair being resiliently urged away from each other for opening the circuit therebetween. The switches are operated by lugs 52, 53 extending from discs 54, 55 frictionally mounted on shaft 35. The rotation of the discs and the lugs is limited by stops 57, 58, 59 and 60, so that each disc can move through a certain angle of rotation between the stops, this rotation being used to open and close the switches 50, 51.

The switches are operated as follows: During rotation of the motor in a counterclockwise rotation, as shown on the drawing, the lug 52 will rest against stop 58 thereby causing contacts 62, 63 to be disengaged, lug 53 will close the contacts 64, 65, contact 64 being stopped by stop 57, thereby short circuiting the generator through contacts 64, 65.

Assuming now that the motor has moved the arm 31 into the stopping position and overruns this position by inertia, then the motor rotation will be reversed. The lug 52 will now be moved clockwise through a small angle until it is stopped by stop 59, causing the contacts 62, 63 to be closed, thereby short circuiting the generator. The lug 53 will also be rotated in a clockwise direction permitting the contacts 64, 65 to open and will make more than three quarters of a revolution before it can close the contacts 64, 65, causing contact 65 to rest against the stop 60. With the next reversal however, that is when the lugs again are driven counter-clockwise, both pairs of contacts will remain open during the rotation of lug 53 until it reaches again the closing position shown in Fig. 1. Hence, the generator will be operative to deenergize the relay coils 25, 26 before the arm 31 again reaches the stopping position, thus preventing hunting or oscillation of the motor. This effect, however, as explained, will take place only if the reversal occurs in counter-clockwise direction. If the reversal, following an overrunning of the stopping position by the motor causes the lugs to rotate clockwise, then the lug 52 will almost immediately short circuit the generator by closing contacts 62, 63.

In Fig. 1, separate resistor elements 10, 40, 40' are shown for the three transmitting components A, A¹, A²; it may be possible, as shown in Fig. 2, to use a single resistor element for a plurality of transmitting components. In Fig. 2, the resistor element designated 5 is engaged by two contact elements 16, 17 at different sides thereof, so that respective ones of the contact elements 16, 17 may be selectively adjusted (or in the case of the continuously variable transmitting component A, slidably engaged) at any desired point throughout the entire length of the resistor element, irrespective of the position of the contact elements of the other transmitting components.

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Although resistor element 5 is shown to be square outline and engaged on the two sides thereof by contact elements 16, 17, it will be clear that the resistor element may be of any desired sectional outline and may be engaged at points about the resistor element by any desired number of contact elements.

I claim:

1. In a control apparatus for placing an electric motor at a remote point in a selected position, the combination of a pair of control elements at a control point, a pair of control elements at a remote point, one element of the pair at the control point being electrically connected with the corresponding element at the remote point, the other element at the control point being otherwise movable to a selected position, the element at the remote point corresponding to the movable element being movable and operatively connected to the motor; means to control the operation of the motor by the relative position of the movable elements for causing the motor to place the movable element at the remote point in a position corresponding to the position of the movable element at the control point for stopping the motor; means to deenergize the motor in advance of the movable element at the remote point reaching the said position corresponding to the position of the selected element at the control point; and switch means included in a by-pass circuit for said deenergizing means and controlled by the direction of the motor rotation and load movement, said switch means being arranged to close said by-pass, thereby short-circuiting the deenergizing means, when the load is approaching its final position in a predetermined direction, and to open the by-pass upon and during reversal of the motor rotation and load movement subsequent to the movable element at the remote point overrunning its position corresponding to the position of the selected element at the control point.

2. In a control apparatus for placing an electric motor at a remote point in a selected position, the combination of a pair of control elements at a control point, a pair of control elements at a remote point, one element of the pair of the control point being electrically connected with the corresponding element at the remote point, the other element at the control point being otherwise movable to a selected position, the element at the remote point corresponding to the movable element being movable and operatively connected to the motor; means to control the operation of the motor by the relative position of the movable elements for causing the motor to place the movable element at the remote point in a position corresponding to the position of the movable element at the control point for stopping the motor; means to deenergize the motor in advance of the movable element at the remote point reaching the said position corresponding to the position of the selected element at the control point; and a pair of switches included in series connection in a by-pass circuit for said deenergizing means and controlled by the direction of the motor rotation, one of the switches of said pair being arranged to close when the load is approaching its final position in a predetermined direction and to open upon reversal of the motor rotation and load movement, the other of said switches being arranged to open during load movement in the said predetermined direction, and to close upon reversal of the motor rotation and after a predetermined

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load movement, thereby opening the by-pass during said predetermined load movement and rendering the deenergizing means operative for the purposes aforesaid.

3. In a control apparatus for placing an electric motor at a remote point in a selected position, the combination of a pair of control elements at a control point, a pair of control elements at a remote point, one element of the pair of the control point being electrically connected with the corresponding element at the remote point, the other element at the control point being otherwise movable to a selected position, the element at the remote point corresponding to the movable element being movable and operatively connected to the motor; means to control the operation of the motor by the relative position of the movable elements for causing the motor to place the movable element at the remote point in a position corresponding to the position of the movable element at the control point for stopping the motor; means to deenergize the motor in advance of the movable element at the remote point reaching the said position corresponding to the position of the selected element at the control point; and a pair of switches each having a pair of contacts included in series connection in a by-pass circuit for said deenergizing means and controlled by the direction of the motor rotation, one of the switches of said pair being arranged to open its contacts when the load first approaches its final position, to close its contacts upon a first reversal of the motor rotation by reason of the movable element at the remote point overrunning its position corresponding to the position of the selected element at the control point, and to reopen its contacts upon a second reversal, the other of said switches being arranged to close its contacts when the load first

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approaches its final position, to open its contacts upon the first reversal, and to close its contacts upon the second reversal after a predetermined load movement, thereby rendering the deenergizing means operative for the purposes aforesaid during such predetermined load movement.

4. A control apparatus as described in claim 3, wherein each switch of said pairs comprises a pair of yieldably supported contacts biased into a disengaged position, and an actuator frictionally connected with the load motor and positioned to urge the contacts into an engaged position as controlled by the direction of the motor rotation.

5. A control apparatus as described in claim 4, wherein the actuator of the switch opening its contacts upon the second reversal is arranged and positioned to travel a shorter distance than the actuator of the other switch closing its contacts upon the second reversal, thereby maintaining the contacts of both switches open during a predetermined movement of the load.

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