July 4, 1939. A. A. STEIN 2,164,958

ELECTRICAL REVERSING CONTROLLER-REMOTELY ADJUSTABLE

Filed Feb. 17, 1938 2 Sheets-Sheet 1

Fig. 1

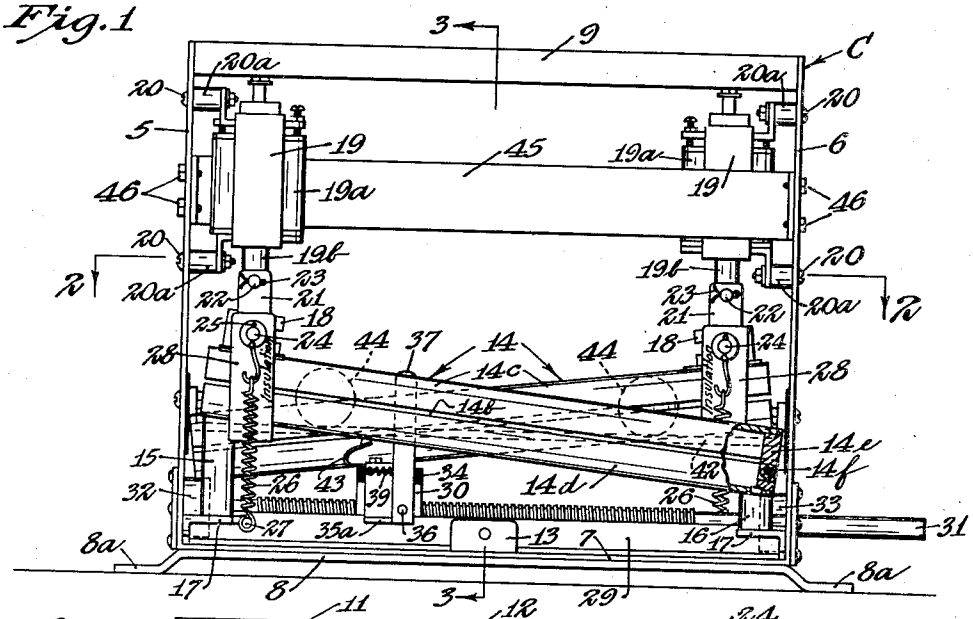


Fig. 2

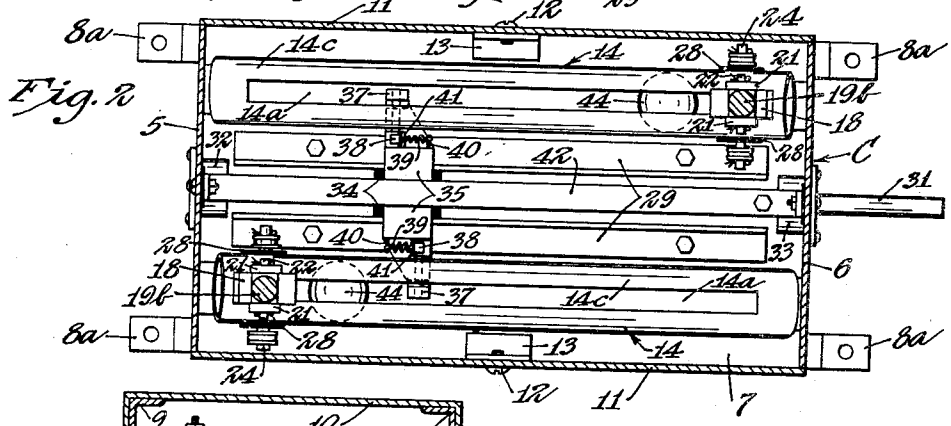
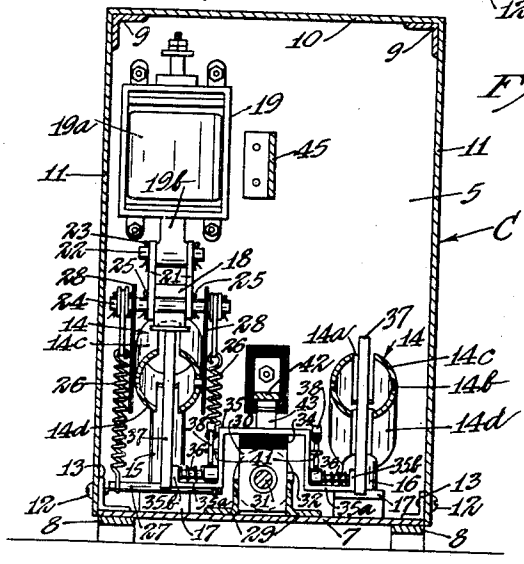


Fig. 3



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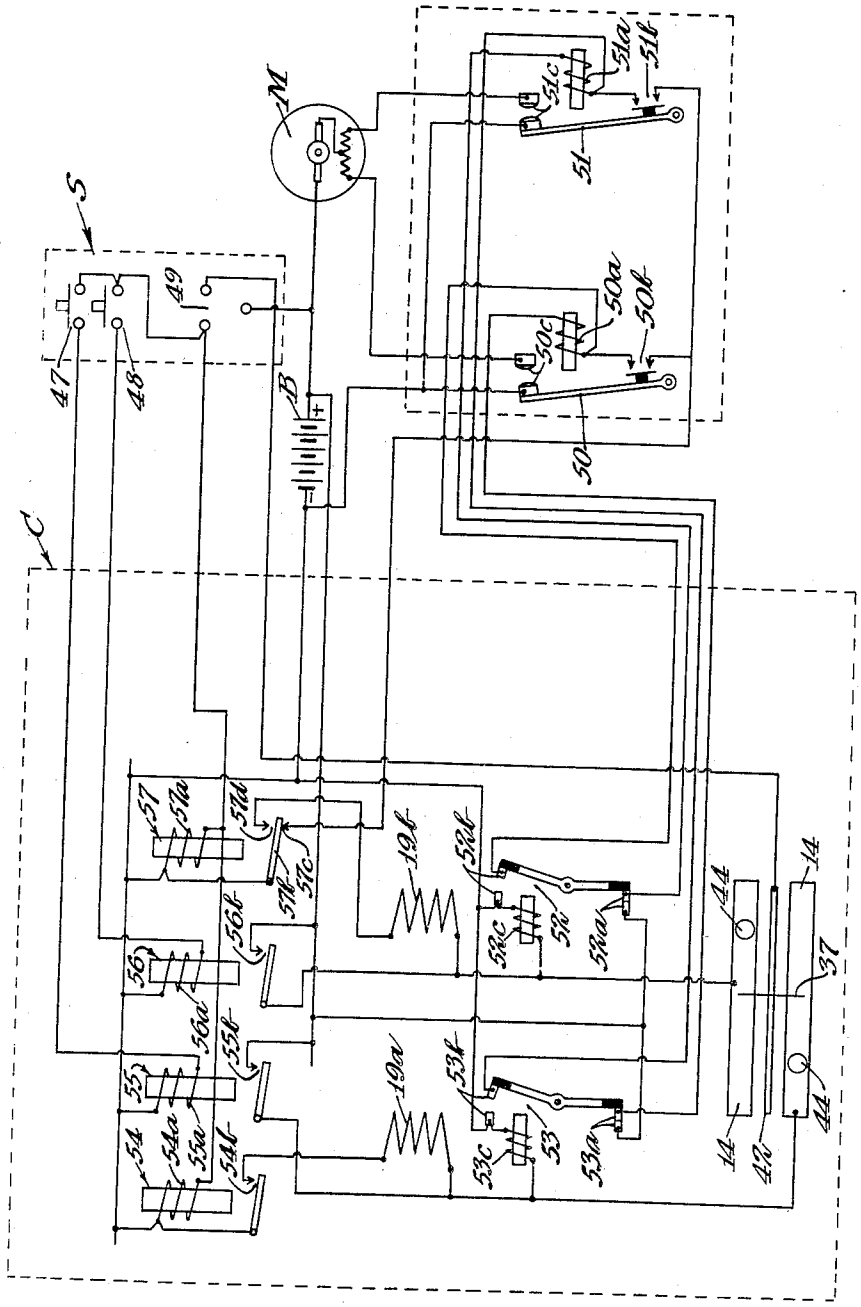


Fig. 4

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UNITED STATES PATENT OFFICE

2,164,958

ELECTRICAL REVERSING CONTROLLER— REMOTELY ADJUSTABLE

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Application February 17, 1938, Serial No. 190,988

11 Claims. (Cl. 200—47)

My invention relates to apparatus for controlling electric motors and particularly to remotely adjustable automatic motor reversing controllers.

In certain types of machinery a movable portion thereof is propelled in successively opposite directions in recurring cycles between the respective ends of a path of predetermined length by a reversible electric motor which is reversed each time said movable portion reaches an end of said path. In many instances the frequently recurring reversals of a motor in such service is effected by manipulation of a manually operated reversing controller or switch and hence necessitates constant attendance. Also, in such types of machinery, it is usually necessary to frequently alter the distance of travel of the propelled machine part and the positions of the ends of the path of travel thereof.

An object of my invention is to provide an automatic electrical reversing controller adapted for so controlling a reversible electric motor as to produce alternately forward and reverse operation of mechanism driven by said motor.

Another object is to provide such a controller which is self adjustable in response to manipulation of control means included therewith.

Yet another object is to provide such a controller which is electrically remote controllable for purposes of automatic self adjustment.

Still another object is to provide such a controller wherein the respective limits of movement of mechanism associated therewith for control thereby may be adjusted independently of each other.

A further object is to provide such a controller of light, compact, rugged and inexpensive construction and particularly flexible with respect to application thereof to various machines.

These and other objects and advantages of the invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the views, and in which:

Fig. 1 is a front view of an embodiment of my invention;

Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1 as indicated by the arrows;

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 1 as indicated by the arrows; and

Fig. 4 is an electrical connection diagram in accordance with which my controller may be arranged.

Referring to the drawings the parts of the illustrated embodiment of my invention are contained in and supported by a casing C having end walls 5 and 6 and a bottom wall 7. Strips 8 of suitable material are secured to the bottom of the bottom wall 7 and extend beyond the ends thereon and are bent downwardly to form mounting feet 8a. The upper ends of the end walls 5 and 6 are connected by brace members 9 which may be of angular cross section, as shown. A cover is provided forming a top wall 10 and side walls 11 of the casing C. The lower portions of the side walls 11 are secured to the bottom wall 7 by means of screws 12 passing through apertured portions of the walls 11 and screw-threadedly engaged in internally screw-threaded apertured portions of angular clips 13 suitably secured to the bottom wall 7.

A pair of generally parallel oppositely inclined tubular members 14 are disposed within the lower part of the casing C and extend generally longitudinally thereof. The tubular members 14 are constructed of electrically conductive material and are mounted on the upper ends of insulating posts 15 and 16, which in turn are supported at their lower ends by bracket elements 17 suitably secured to the end walls 5 and 6 of the casing C. Each of the tubular members is provided throughout its medial portion with slots 14a in its upper and lower sides. Also each of the tubular members 14 is longitudinally split, as along the line 14b, so as to divide the tubular member 14 into respective upper and lower halves 14c and 14d. At the lower end of each of the members 14 a lug 14e is formed in the upper half 14c and extends downwardly into the lower half 14d. The lower end portion of each lug 14e is apertured and is pivotally connected to the lower half 14d of the member 14 by means of a pivot pin 14f so that the upper half 14c of each of the members 14 is upwardly swingable relative to the corresponding lower half 14d.

Each of the upper halves 14c is provided at its free end with a notched member 18 mounted thereon and comprising a hook. Means is provided for raising the upper half 14c of each of the tubular members 14, this means preferably being of an electromagnetic nature so as to be electrically remote-controllable. The preferred form of lifting means shown in the drawings consists of a solenoid 19 secured to the casing C by suitable means such as bolts 20 and spacers 20a and having an operating coil 19a. A solenoid 19 is provided for each of the respective upper halves 14c of the members 14, one solenoid being mounted on the end wall 5, the other being mounted on the end wall 6. The solenoids 19

contain magnetic plungers 19b suitably connected to the respective hooks 18 and the upper halves 14c. The means of connection to the hooks 18 consists in a pair of links 21 disposed parallel to each other and at opposite sides of the hook 18 and the lower end of the plunger 19b. The links 21 are secured to the plunger 19b by means of a pin 22 passing through the upper ends of the links and through a suitable diametrical aperture in the lower end of the plunger 19b. Suitable means such as the cotter keys 23 disposed in diametrical apertures in the pin 22 are provided to retain the pin 22 in place and to retain the links 21 on the pin 22. A pin 24 is extending through apertured lower ends of the links 21 and through the notch of the hook 18. Cotter keys 25 are provided to retain the pin 24 in place and retain the links 21 on the pin 24.

Means is provided for normally retaining the upper halves 14c of the tubular members 14 in closely parallel relation to the respective lower halves 14d. For this purpose helical tension springs 26 are connected between the respective ends of the pin 24 and the respective ends of an anchoring pin 27 mounted on the brackets 17. Obviously the springs 26 will normally maintain the respective upper and lower halves of the tubular members in closely parallel relation and energization of the coil 19a will cause upward movement of the plunger 19b to raise the upper half 14c of a tubular member 14 against the tension of the springs 26. To prevent electric connection between the springs 26 and the tubular members 14 aprons 28 formed of sheet insulating material and having apertures through their upper portions are mounted on the pin 24 as shown.

Electrical contact means movable longitudinally of the respective tubular members 14 in the interiors thereof are provided, and means is provided whereby the respective contact means will move in unison and may be connected to a moving part of a mechanism or machine to move in unison therewith. A pair of angular members 29 extending longitudinally of the casing C are mounted on the bottom wall 7 in spaced parallel relation so as to provide guide means for an element movable longitudinally thereof. A block 30 is provided and its lower portion is disposed between the angle members 29 to be guided thereby in movement longitudinally thereof. The block 30 is provided with an aperture extending horizontally and parallel to the angle members 29. The block is internally screw-threaded in the apertured portion thereof. An externally screw-threaded shaft 31 extending longitudinally of the casing C is screw-threadedly engaged at its medial portion in the block 30 and is journalled in bearings 32 and 33 mounted on the respective end walls 5 and 6 of the casing C. The right-hand end of the shaft 31 extends externally of the casing C to provide for connection of the shaft 31 to a mechanism. Obviously rotation of the shaft 31 will move the block 30 longitudinally with respect to the guide formed by the angle members 29. A slab 34 of insulating material is mounted on the top of the block 30, and upon the slab 34 is mounted a bar 35 of electrical conducting material bent to form respective brackets 35a extending to points below the respective tubular members 14. Each bracket is up turned and apertured at its free end to form a bearing 35b, and a shaft 36 is journalled in each of the bearings 35b. Each shaft 36 carries at its outer end an electrical contact finger 37 projecting upwardly through the longitudinal slots 14a of a corresponding one of the tubular members 14. The inner end of each shaft 36 carries an upwardly extending arm 38. Each arm 38 is provided at its upper end with a helical tension spring 39 connected with the arm 38 and an anchoring element 40 mounted on the member 35 in a direction from the arm 38 toward the upper end of the tubular member 14 associated with the arm 38. A stop pin 41 is provided for each of the arms 38, is mounted on a member 35, and is positioned to so limit movement of the arm 38 responsive to tension of the spring 39 that the arm 38 will normally remain in a vertically projecting position thereof. Above the member 35 and parallel to the shaft 31 an electrically conductive contact bar 42 is provided, the respective ends of the contact bar 42 being insulatedly mounted on the respective end walls 5 and 6. To provide an electrical connection between the finger carrying member 35 and the contact bar 42, an electrical contact finger 43 is mounted on the upper side of the member 35 and is of resilient nature and so shaped and proportioned as to bear against the lower side of the contact bar 42 and slide therealong as the block 30 is moved longitudinally of the casing C.

For cooperation with the contact fingers 37 spherical electrical conductive elements 44 are placed within the respective tubular members 14 in positions up the inclines of the respective tubular members 14 from the contact fingers 37 associated with the respective tubular members 14. The contact fingers 37 and the spherical conductive elements 44 constitute electrical switches, the connections to the spherical conductive elements being provided through the conductive tubular members 14. The spherical conductive elements 44 are of such diameter as to normally be clamped between the respective upper halves 14c and lower halves 14d of the tubular members 14. When the solenoids 19 are energized to raise the upper halves 14c of the tubular members 14, the spherical elements 44 are released and are free to roll down the inclines of the tubular members 14 responsive to the pull of gravity. This rolling action will, of course, be terminated when the spherical elements 44 reach positions where they engage the corresponding contact fingers 37. Releasing of the spherical elements 44 and rolling thereof responsive to gravity enables adjustment of my controller as will be explained later. Normally the spherical elements 44 are retained in fixed positions by the clamping action of the tubular member 14. If the shaft 31 is rotated in one direction through a sufficient distance by a moving part of a mechanism to which the shaft 31 is connected, one of the contact fingers 37 will reach engagement with the corresponding one of the spherical elements 44. The electrical switch comprised by the inter-engaged contact finger 37 and spherical element 44 may be utilized to operate an electrical control circuit for reversing an electric motor used to drive a mechanism to which the shaft 31 is mechanically connected. This will cause reversal in the direction of rotation of the shaft 31 whereupon the block 30 will move in a direction opposite to the direction in which it previously moved. If the remaining one of the contact fingers 37 engages the remaining one of the spherical elements 44, another reversal of the motor may be effected as described in connection with the first contact finger 37 and spherical element 44. The result will be that the motor will be periodically re-

versed to drive a mechanism first forwardly and then reversely in recurring cycles.

A flat bar **45** disposed in a vertical plane extends longitudinally of the interior of the casing C and is secured at its respective ends to the respective end walls **5** and **6** of the casing C, as by means of bolts **46**. The bar **45** is provided for the purpose of mounting thereon auxiliary electrical apparatus for use in connection with the above described portions of my reversing controller.

Fig. 4 is an electrical connection diagram of the above described controller mechanism and auxiliary relays and devices associated therewith for use in controlling an electrical motor M. In the diagram of Fig. 4, a source of electrical energy is represented by a battery B. In this diagram means is shown for changing connections to the motor M responsive to operation of the above described parts of my controller, so as to cause periodic reversal of the motor M in recurring cycles, and means is also shown for manually controlling the motor M during the process of changing the adjustment of my controller. Such an electrical circuit diagram as illustrated in Fig. 4 is suitable for use in my controller in cases where a machine having a reciprocating or rotating part is intended to be driven by a reversible electric motor in such a manner that the moving part of the machine will move in respective directions responsive to rotation of the motor M in respective directions. For such use of my controller the shaft **31** thereof may be connected by any suitable mechanical transmission means to the movable part of the driven machine so that the block **30** of my controller will move back and forth in unison with forward and reverse movement of the movable part of the machine.

A control station S which may be remote from other parts of my controller is provided and includes a pair of electrical switch elements **47** and **48** such as push buttons or the like and a single pole double throw electric switch **49**. For convenience in direction operation of the circuit, the respective ends of the battery B are designated as positive and negative by means of plus and minus signs. A pair of magnetic contactors **50** and **51** are provided in direct association with the motor M, and are connected therewith and with the battery B in a conventional circuit wherein actuation of the contactor **50** will cause rotation of the motor M in one direction, and actuation of the contactor **51** will cause rotation of the motor M in the other direction. Contactors **50** and **51** are provided with respective operating coils **50***a* and **51***a* and "sealing-in" contacts **50***b* and **51***b*. The "sealing-in contacts **50***b* and **51***b* are constructed in accordance with the conventional practice and are closed coincidental with the closing of the main contacts **50***c* and **51***c* of the respective contactors **50** and **51**. Contactor operating relays **52** and **53** are provided, these relays having respective lower pairs of contacts **52***a* and **53***a* which are normally closed and respective pairs of upper contacts **52***b* and **53***b* which are normally open. The relays **52** and **53** have respective operating coils **52***c* and **53***c* which, when energized, will operate the relays to open the lower contacts and close the upper contacts. With the relays **52** and **53** both de-energized neither of the contactor operating coils **50***a* and **51***a* are energized, but actuation of the respective relays **52** and **53** through energization of their operating coils **52***c* and **53***c* will cause energization of the contactor operating coils **50***a* and **51***a*. The electrical connections between the contacts of the relays **52** and **53** and the coils of the contactors **50** and **51** are such that only one of the contactors **50** and **51** can be actuated at a time.

In normal operation of my controller the control station switch **49** is in its right-hand position so as to connect the positive side of the battery B to the contact bar **42** of my controller and incidentally to the contact fingers **37**. One end of each of the relay operation coils **52***c* and **53***c* are connected to the negative side of the battery B. The remaining ends of the respective relay coils **52***c* and **53***c* are connected to the respective tubular members **14** and therethrough to the respective spherical conductive elements **44**. Obviously as the pair of contact fingers **37** travel in alternate directions one finger will contact one of the spherical elements **44** at one end of the range of travel of the finger **37** to cause energization of one of the relay coils **52***c* and **53***c*, resulting in closure of one of the contacts **50** and **51**. As the actuated one of the contactors **50** and **51** reaches its closed position, the "sealing-in" contacts **50***b* or **51***c* thereof will be closed to complete a circuit between the contactor coil at the negative side of the battery to seal-in the coil circuit of the contactor. Operation of one of the relays **52** or **53** will cause energization of the corresponding contactor and also, by opening of the lower relay contacts, the coil circuit of the previously closed one of the contactors will be interrupted to cause opening of that contactor prior to closure of the newly actuated contactor. Reversal of the motor M due to the change in position of the respective contactors **50** and **51** produce reversal of the direction of movement of the movable part of a machine to which the shaft **31** of my controller is connected, and hence causes reversal in the direction of movement of the contact fingers **37**. The finger **37** which has just been in engagement with a corresponding one of the spherical elements **44** is soon withdrawn from such engagement but the contactor closed from such engagement remains closed by current feeding through the "sealing-in" contacts of the closed contactor. When the pair of contact fingers reach the other end of their limit of movement and one of the contact fingers **37** engages the remaining one of the spherical elements **44**, an operation similar to that described above will occur to again reverse the motor M.

The above description pertains to normal operation of the reversing controller illustrated in the drawings and provision is also made for manually controlling the controller in such manner as to effect repositioning of one or both of the spherical elements **44** with respect to the corresponding ones of the tubular members **14** so as to alter the distance of travel of the movable part of a machine driven by the motor M and mechanically connected to the shaft **31** of my controller. For such adjusting procedure the switch **49** of the control station S is shifted to its left-hand position to break the connection between the positive side of the battery and the contact bar **42**, and thus prevent control of the motor M by the contact fingers **37** and spherical elements **44**. A series of auxiliary relays **54**, **55**, **56** and **57** having coils **54***a*, **55***a*, **56***a*, and **57***a* are provided. The relays **54**, **55**, and **56** are provided with normally open respective contacts **54***b*, **55***b*, and and **56***b* which are respectively closed responsive to energization of the respective coils **54***a*, **55***a*, and **56***a*. The relay **57** has a movable contact element **57***b* nor-

mally engaged with a stationary contact element 57c and shiftable upon energization of the coil 57a out of engagement with the contact 57c and into engagement with a contact 57d. The circuit is so arranged that shifting of the switch 49 to the left causes energization of the coils 54a and 57a. The contacts of the relay 57 are so connected that energization of the coil 57a will interrupt the supply of electrical energy to the "sealing-in" circuits of the contactors 50 and 51. The contacts of the relays 54 and 57 are so arranged in the circuit as to connect one terminal of each of the solenoid coils 19a to the negative side of the battery B. The contacts of the relays 55 and 56 are connected in respective circuits from the positive side of the battery B to the remaining terminals of the respective solenoid coils 19a and to the terminals of the respective relay coils 52c and 53c so that closure of the contacts 55b will energize the relay coil 53 and a corresponding one of the solenoid coils 19b, and closure of the relay contacts 56b will cause energization of the relay coil 52c and the remaining one of the solenoid coils 19a. The coils 55a and 56a of the relays 55 and 56 are connected to be respectively energized by closure of the respective push-button switches 47 and 48.

In adjusting my controller, as mentioned above, the switch 49 is shifted to the left to energize the relays 54 and 57 and thereby set up circuits whereby the solenoid coils 19a and 19b are connected for operation responsive to manipulation of the respective push-buttons 47 and 48. Shifting of the switch 49 to the left also connects the push-buttons 47 and 48 to the positive side of the battery B so as to retain the push-buttons 47 and 48 and the relays 55 and 56 operative. To change the position of the lower spherical element 44, as indicated in Fig. 4, the push-button 47 is pressed, energizing relay 55 and resulting in energization of the relay coil 53c in the corresponding solenoid coil 19a. Energization of the solenoid coil 19a releases the spherical element 44 which will then roll down into engagement with the corresponding contact finger 37. Energization of the relay coil 53c results in operation of the motor M to move the contact finger 37 to the left. The released one of the spherical elements 44 will then be pushed up the incline of the corresponding tubular member 14 by the corresponding one of the contact fingers 37. When the operator observes that the machine driven by the motor has reached the newly desired limit of movement in the direction involved, he releases the push-button 47 which de-energizes the relay coil 53c to stop the motor M and de-energizes the corresponding one of the solenoid coils 19a to produce retention of the newly shifted lower spherical element 44 in its newly acquired position. To set the upper spherical element 44 in a newly desired position, the push-button 48 is operated and setting of the upper spherical element 44 is accomplished in a manner similar to the above described resetting of the lower spherical element 44. When both spherical elements 44 have been set in accordance with the desired new range of movement the switch 49 may be shifted to the right to re-establish connections producing alternate directions of operation of the motor M and the machine driven thereby in recurring cycles.

From the above it should be apparent that I have invented an electrical reversing controller adapted for controlling an electrical motor to produce alternate directions of rotation of the motor and alternate directions of movement of a moving part of a machine driven by the motor in recurring cycles. It is to be further noted that my controller is adapted for automatic adjustment thereof responsive to operation of an electrical remote-control circuit. Obviously the controller equipment contained within the casing C may be disposed remotely from the control station S and remotely from the battery B and the contactors 50 and 51. The shaft 31 of the controller may be connected to a moving part of a machine by any suitable mechanical transmission means and such mechanical transmission means may, if desired, be of such nature that the casing C may be located relatively remote from the machine from which the shaft 31 is driven.

While I have shown my reversing controller as applied to an electric motor and electrical control means therefor, it should be apparent that other types of driving means for a machine may be readily controlled by my controller through any desired conventional forms of electrically operatable control means.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What is claimed is:

1. A reversing controller for mechanism having electrically controllable apparatus for propelling a movable portion thereof in successively opposite directions including, a guide of which one end is disposed at a higher level than the other, an electrical contact element arranged for movement generally longitudinally of said guide and adapted to be connected to an oscillatable portion of a mechanism for movement in unison therewith, an electrically conductive element supported by said guide in longitudinally movable relation thereto upwardly of said contact element for engagement thereby and co-operation therewith in constituting an electrical switch unit adapted to be connected in a control circuit of an electrically controllable apparatus said conductive element being movable downwardly of said guide responsive to gravity, and means for normally restraining said conductive element from movement longitudinally of said guide said means being releasable to enable movement of said conductive element independently thereof.

2. A reversing controller for mechanism having electrically controllable apparatus for propelling a movable portion thereof in alternate directions in recurring cycles including, a pair of guides each having one end thereof disposed at a higher level than the remaining end thereof, a pair of electrically conductive elements carried by the respective guides in longitudinally movable relation therewith, said elements being movable downwardly of the corresponding guides responsive to gravity means associated with said guides for normally restraining said elements from movement relative thereto, said means being releasable to enable movement of said elements independently thereof, a pair of electrical contact elements arranged for movement longitudinally of the respective guides and engagement with said respective conductive elements to form, in conjunction therewith, respective electrical circuit-controlling means adapted for use in controlling electrically controllable reversible apparatus, and means so interconnecting said contact elements that one will move longitudinally upwardly as the other moves longitudinally downwardly of the respectively corresponding guides, said contact elements being adapted to be con-

nected to a movable portion of a mechanism for movement in unison therewith and said conductive elements being disposed in the respective guides upwardly of the respectively corresponding contact elements.

3. A reversing controller for mechanism having electrically controllable apparatus for propelling a movable portion thereof in alternate directions in recurring cycles including, a pair of oppositely inclined guide members disposed in respective substantially parallel vertical planes, a pair of electrical contact elements arranged for movement in unison longitudinally of said pair of members and respectively associated with the respective members, said contact elements being adapted to be connected to a movable portion of a mechanism for movement in unison therewith, a pair of electrically conductive elements supported by the respective members up the slopes thereof from said contact elements for engagement by said contact elements and co-operation therewith in constituting respective electrical switch units adapted to be connected in control circuits of an electrically controllable propelling apparatus said conductive elements being movable downwardly of the corresponding guide members responsive to gravity, and releasable means for restraining said conductive elements from movement longitudinally of said members.

4. A reversing controlled for mechanism having electrically controllable apparatus for propelling a movable portion thereof in alternate directions in recurring cycles including, a pair of oppositely inclined guide members disposed in respective substantially parallel vertical planes, a pair of electrically conductive elements supported by said respective members and adapted to travel down the slopes thereof responsive to gravity, releasable means associated with each of said guide members for normally restraining the element thereon from movement longitudinally thereof, a body movable longitudinally of said members and adapted to be connected to a movable portion of a mechanism for movement in unison therewith, a pair of electrical contact fingers carried by said body and situated for engagement with said respective elements to form, in conjunction therewith, respective electrical circuit-controlling means adapted for use in controlling electrically controllable reversible apparatus, said elements being situated up the slopes of the respective corresponding members from the respective corresponding contact fingers.

5. A reversing controller for mechanism having electrically controllable apparatus for propelling a movable portion thereof in alternate directions in recurring cycles including, a pair of oppositely inclined tubular members disposed in respective substantially parallel vertical planes, a pair of spherical, electrically conductive elements situated within said respective members and movable down the slopes thereof responsive to gravity, the medial portion of each of said members having a longitudinally extending slot therein, releasable means associated with each of said members for normally restraining the spherical element therewithin from movement longitudinally thereof, a body movable longitudinally of said pair of members and adapted to be connected to a movable portion of a mechanism for movement in unison therewith, a pair of electrical contact fingers carried by said body and projecting through said respective slots for engagement with the respective spherical elements to form in conjunction therewith respective electrical circuit-controlling means adapted for use in controlling electrically controllable reversible apparatus, said spherical elements being situated up the slopes of the respective tubular members from the respective contact fingers.

6. A reversing controller for mechanism having electrically controllable apparatus for propelling a movable portion thereof in alternately opposite directions in recurring cycles including, a pair of electrically conductive tubular members having respective, oppositely inclined axes disposed in respective substantially parallel vertical planes, a pair of spherical, electrically conductive elements contained within said respective members and being movable down the slopes thereof responsive to gravity, the medial portion of each of said members having a longitudinally extending slot therein and each of said members being longitudinally divided into two parts, means interconnecting the lower ends of the respective parts of each of said members to permit swinging movement of one part relative to the other, means yieldably urging the respective parts of each of said members together to normally grip the corresponding spherical element therebetween, means associated with each of said members operatable to spread the parts thereof apart to free the corresponding spherical element for movement longitudinally of said member, a body movable longitudinally of said pair of members and adapted to be connected to a movable portion of a mechanism for movement in unison therewith, a pair of electrical contact fingers carried by said body and projecting through the slots of the respective tubular members for engagement with the respective spherical elements to co-operate with the same and said members in constituting respective electrical circuit-controlling means adapted for connection in circuit with electrically controllable reversible apparatus, said spherical elements being situated up the slopes of the respective tubular members from the respective contact fingers.

7. A reversing controller for mechanism having electrically controllable apparatus for propelling a movable portion thereof in alternately opposite directions in recurring cycles including, a pair of electrically conductive tubular members having, oppositely inclined axes disposed in respective generally parallel vertical planes, a pair of spherical, electrically conductive elements contained within said respective members and movable down the slopes thereof responsive to gravity, the medial portion of each of said members having a longitudinally extending slot therethrough vertically aligned with the axis thereof and each of said members being longitudinally divided into respective upper and lower halves thereof, means interconnecting the lower ends of the respective halves of each of said members to permit swinging movement of one half relative to the other, means yieldably urging the respective halves of each of said members together to normally grip the corresponding spherical element therebetween, means associated with each of said members operatable to spread the halves thereof apart to free the corresponding one of said spherical elements for movement longitudinally of said member, a body movable longitudinally of said pair of members and adapted to be connected to a movable portion of a mechanism for movement in unison therewith, and a pair of electrical contact fingers carried by said body and projecting through the slots of the respective tubular members for en-

gagement with the respective spherical elements to co-operate with the same and said members in constituting respective electrical circuit-controlling means adapted for connection in circuit with electrically controllable reversible apparatus, said spherical elements being situated up the slopes of the respective tubular members from the respective contact fingers.

8. A reversing controller for mechanism having electrically controllable apparatus for propelling a movable portion thereof in alternate directions in recurring cycles, including, a pair of electrically conductive tubular members having oppositely inclined respective axes disposed in respective substantially parallel vertical planes, a pair of spherical, electrically conductive elements contained within said respective members and movable down the slopes thereof responsive to gravity, the medial portion of each of said members having a longitudinally extending slot therethrough vertically aligned with the axis thereof and each of said members being longitudinally divided into respective upper and lower halves thereof, the lower half of each of said members being fixedly mounted, means interconnecting the lower ends of the respective halves of each member for vertical swinging movement of the upper half relative to the lower half, resilient means urging the respective halves of each of said members together to normally grip the corresponding spherical element therebetween, electromagnetic means energizable to lift the upper halves of the respective members to free the respecting spherical elements for movement down the slopes of the respective members, a body movable longitudinally of said pair of members and adapted for connection to an oscillatable body for movement in unison therewith, and a pair of electrical contact fingers carried by said body and projecting through the slots of the respective members for engagement with the respective spherical elements to co-operate with the same and said members in constituting respective electrical circuit-controlling means, said circuit controlling means being connected with said respective control circuits, and said spherical elements being situated up the slopes of the respective tubular members from the respective contact fingers.

9. A reversing controller for mechanism having electrically controllable apparatus for propelling a movable portion thereof in successively opposite directions including, an elongated, longitudinally apertured guide member disposed in other than a horizontal position, an electrical contact member having a portion thereof situated within and movable longitudinally of said guide member, said contact member being adapted for connection thereof to an oscillatable body for motion in unison therewith, an electrical contact element carried in said guide member above said contact member for engagement therewith, said contact element being movable longitudinally of said guide member and movable downwardly thereof responsive to gravity, and releasable means for normally restraining said contact element from movement longitudinally of said guide member, said contact member and said contact element constituting an electrical switch.

10. The combination defined in claim 9, and electrically actuatable means for operating said restraining means.

11. A reversing controller for mechanism having electrically controllable apparatus for propelling a movable portion thereof in successively opposite directions including, an elongated guide member disposed in other than a horizontal position, an electrical contact member having a portion thereof situated within and movable longitudinally of said guide member, said contact member being adapted for connection thereof to an oscillatable body for motion in unison therewith, an electrically conductive spherical element carried by said guide member above said contact member and adapted for movement toward the lower end of said guide member responsive to gravity, and releasable means for normally restraining said conductive element from movement longitudinally of said guide member, said contact member and said conductive element together comprising an electrical switch.

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