

O. P. HIPPLE.
CONTROL APPARATUS.
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1,376,436.

Patented May 3, 1921.

2 SHEETS—SHEET 1.

Fig. 2

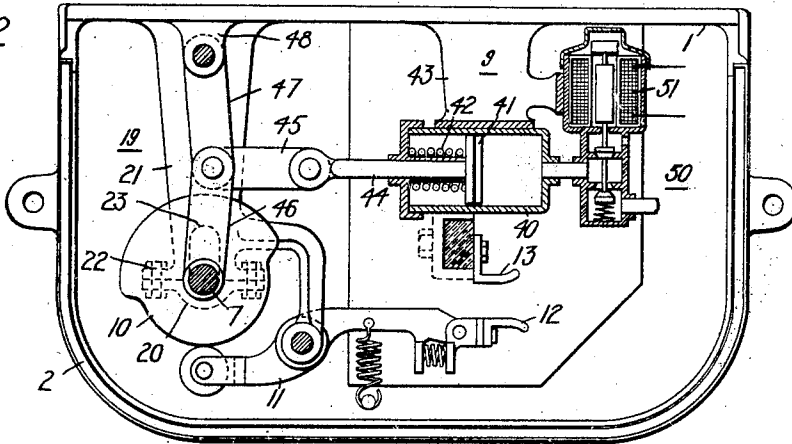
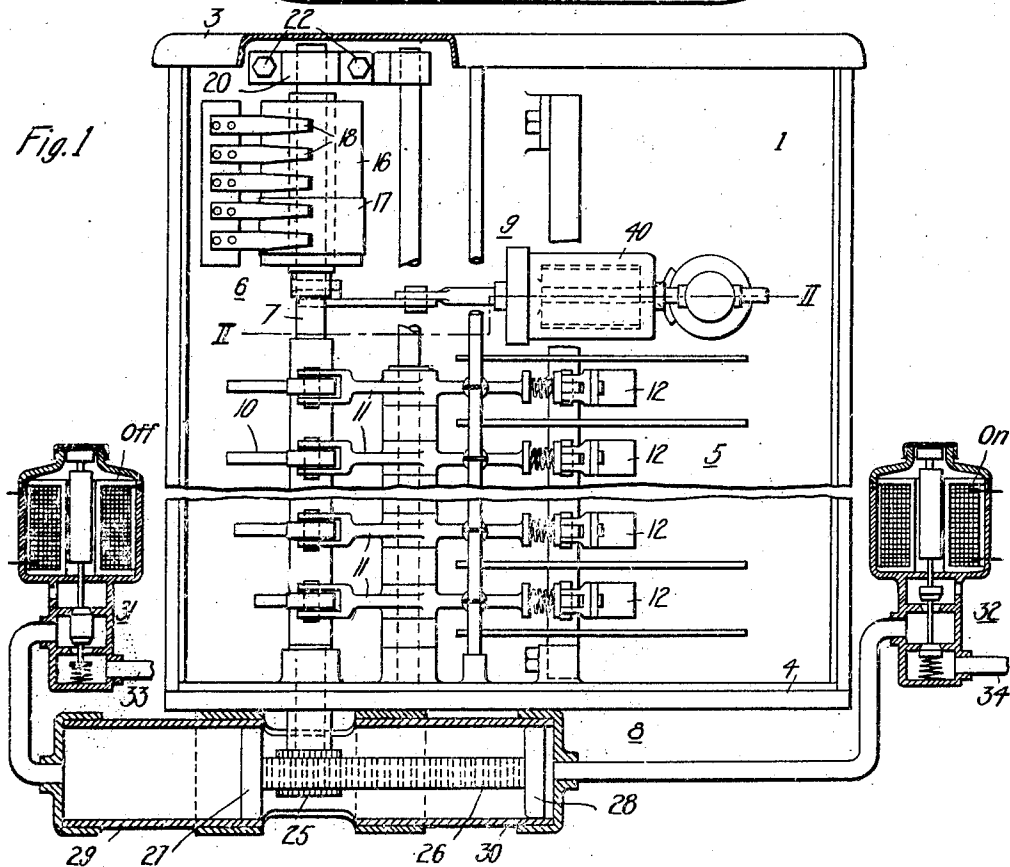


Fig. 1



WITNESSES:

Felix C. Rodgers
W. R. Coley

INVENTOR

Oliver P. Hipple

BY

Herby E. Glean
ATTORNEY

1,376,436.

2 SHEETS—SHEET 2.

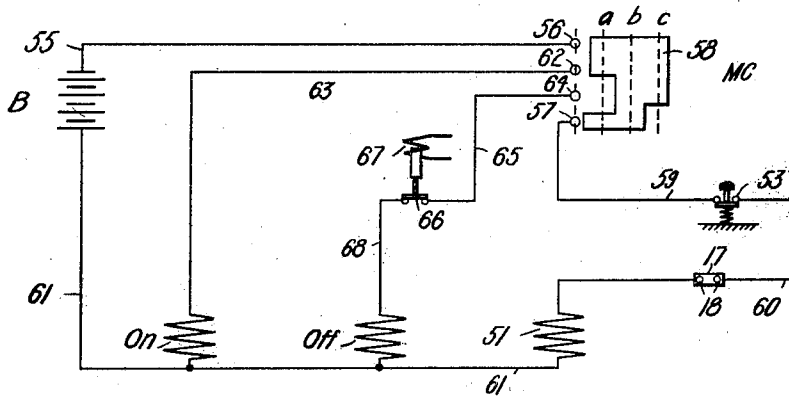


Fig. 3

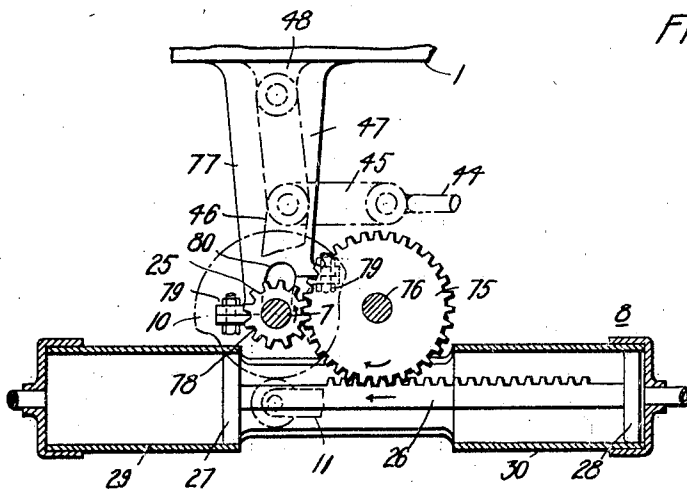


Fig. 4

Felix C. Rodgers
W. R. Coley

Oliver P. Hipple

BY
Shirley G. Carr
ATTORNEY

ATTORNEY

UNITED STATES PATENT OFFICE.

OLIVER P. HIPPLE, OF WILKINS TOWNSHIP, ALLEGHENY COUNTY, PENNSYLVANIA,
ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A COR-
PORATION OF PENNSYLVANIA.

CONTROL APPARATUS.

1,376,436.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, OLIVER P. HIPPLE, a citizen of the United States, and a resident of Wilkins township, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Control Apparatus, of which the following is a specification.

My invention relates to control apparatus and especially to cam-operated or drum controllers embodying rotatable members.

The object of my invention is to provide a device of the above-indicated character, wherein a bodily lateral movement of the rotatable member may be effected under predetermined conditions.

More specifically stated, it is the object of my invention to provide a rotatable element for controllers that is laterally biased by a toggle-joint to a certain contact permitting position and power-operated means for actuating the toggle-joint to move the rotatable element to a contact-preventing position.

My invention may best be understood by reference to the accompanying drawings, wherein Figure 1 is a view, partially in elevation and partially in section, of a control apparatus constructed in accordance with my present invention; Fig. 2 is a view in transverse section, taken along the line II—II of Fig. 1; Fig. 3 is a diagrammatic view of a system of control embodying the present invention; and Fig. 4 is a fragmentary view, corresponding to Fig. 2, of a modification of the invention.

Referring to the drawings, the structure shown comprises suitable incasing means embodying, for example, a base or rear-plate member 1; a front cover member 2 and top and bottom cover members 3 and 4, respectively; a plurality of sets of main stationary and movable contact members 5 and of auxiliary contact members 6, both sets of movable elements being mounted upon a common rotatable shaft 7; an actuating mechanism 8 for the shaft and a power-operated device 9 for effecting bodily lateral movement of the rotatable controller elements under predetermined conditions.

The sets of main contact members 5 may be of any familiar type, such as drum seg-

ments that are engaged by control fingers, or the cam-operated type, such as is here illustrated, wherein the rotatable shaft 7 is provided with a plurality of suitably configured cams 10 which engage intermediately pivoted lever arms 11, to which are secured movable contact members 12 that cooperate with stationary contact terminals 13 in a familiar manner.

The auxiliary contact members 6 are shown as comprising a drum body 16 upon which is mounted one or more contact segments 17 for the purpose of engaging stationary control fingers 18 in the desired controller positions.

The shaft 7 is provided with suitable end brackets or bearings 19 which respectively embody a front semi-cylindrical and a rear elongated member 20 and 21, respectively, which are suitably flanged and are secured together by means of bolts 22, for example, to inclose a bearing slot 23, of oval or elliptical form, having a width substantially equal to the diameter of the shaft 7, thereby permitting a bodily lateral movement of the shaft, as subsequently set forth in detail.

The actuating mechanism 8 is of a familiar electrically-controlled, pneumatically-actuated type, comprising a pinion 25 which is secured to the outer end of the shaft 7 and meshes with a horizontally-movable rack member 26, the opposite ends of which constitute pistons 27 and 28 that travel within suitable operating cylinders 29 and 30, respectively. A normally-open valve 31 communicates with the outer end of the cylinder 29, while a normally closed valve 32 is associated with the outer end of the other cylinder 30. Suitable actuating coils "Off" and "On" and inlet pipes or passages 33 and 34 for the respective valves 31 and 32 are provided, the inlet pipes being supplied with fluid pressure from any suitable source (not shown).

The mechanical operation of the actuating device just described, without regard to the electrical connections effected thereby, may be set forth as follows: Normally the apparatus is biased to the illustrated position by reason of the admission of fluid pressure to the cylinder 29. Upon concurrent energization of the actuating coils "Off" and

"On," such initial unbalanced fluid-pressure conditions are reversed, that is, fluid pressure is admitted through the valve 32 to the cylinder 30 and is exhausted from the cylinder 29 through the valve 31 to the atmosphere. Consequently, a movement of the pistons toward the left and, therefore, a clockwise rotation of the shaft 7, viewed from below, is effected.

To arrest such movement, at any time, it is merely necessary to deenergize the "off" coil, whereupon balanced high-pressure fluid conditions immediately obtain in the actuating mechanism to provide a positive and reliable stoppage thereof. To return the device to the illustrated position, the actuating coils "Off" and "On" are concurrently deenergized, whereby fluid-pressure conditions in the apparatus revert to the original state and the desired backward movement is produced.

The power-operated device 9 may be of any suitable remotely-controlled type and is shown as comprising an electrically-governed, fluid-pressure-actuated mechanism embodying an operating cylinder 40, within which travels a piston 41 that is biased toward the right by a coil spring 42. The cylinder is mounted upon a suitable bracket or standard 43 which may be secured to the base 1 of the controller. The piston stem 44 is pivotally secured to a short bar or rod 45 which, in turn, is pivotally related to two oppositely-extending link members 46 and 47, the outer ends of which are respectively loosely secured to the rotatable shaft 7 and pivotally mounted upon a stationary bracket 48.

For the purpose of controlling the admission of fluid pressure to the cylinder 40, a valve member 50 of the same type as the previously described valve 32 and having a normally energized actuating coil 51, is associated with the end of the cylinder 40 that is remote from the spring 42.

Upon the normal energization of the actuating coil 51, fluid pressure is admitted to the cylinder 40 to actuate the piston 41 toward the left, as seen in Fig. 2, whereby the toggle-joint or linkage mechanism is straightened, that is, the link members 46 and 47 are actuated to a substantially aligned position, as determined by the compression of the spring 42, or by a suitable stop member that may be provided. Thus, upon deenergization of the coil 51, the rotatable shaft 7 is bodily moved in a lateral direction, directly away from the contact lever 11, within the bearing slot 23 to the other extremity thereof and, consequently, all contacts that have been made by either the main contact members 5 or the auxiliary contact members 6 are immediately broken, and the controller may be returned to its "off" position, without requiring the opening of cir-

cuits in the reverse sequence from that employed during forward operation, whereby burning and undue wear of the various sets of contact members is obviated.

The electrical operation of my present invention will now be described in connection with Fig. 3, wherein the system shown comprises the actuating coils "On," "Off" and 51; the cooperating stationary and movable auxiliary contact members 18 and 17, respectively; a master controller MC having a plurality of operative positions *a*, *b* and *c* for primarily governing the energization of the several actuating coils from a suitable source of energy, such as a battery B; a limit switch or current relay L of the customary type; and a push-button device 53 for a purpose to be set forth.

Assuming that the master controller MC is actuated to its initial position *a*, a circuit is first completed from the positive terminal of the battery B through conductor 55, control fingers 56 and 57 which are bridged by contact segment 58 of the master controller, conductor 59, the push-button 53 in its normal closed position, conductor 60, cooperating stationary and movable contact members 18 and 17, respectively, of the auxiliary drum 16, the actuating coil 51 of the power-operated device 9, and conductor 61 to the negative battery terminal.

Another circuit is then established from the contact segment 58, through control finger 62, conductor 63, the actuating coil "On" and the conductor 61 to the negative battery terminal.

No movement of the controller is effected, however, until the master controller is actuated to its position *b*, whereupon a further circuit is established from the contact segment 58 through control finger 64, conductor 65, cooperating contact members 66 of the limit switch L in its lower position (the actuating coil 67 of the limit switch being connected in the main-machine circuit (not shown), in accordance with a familiar practice), conductor 58 and the actuating coil "Off" to the negative conductor 61.

Thus, intermittent forward movement of the rotatable controller elements, in accordance with the current traversing the machine to be governed and the coil of the limit switch L, is effected and the desired main and auxiliary circuits are closed in accordance with the design of the respective contact members of the controller.

When the controller has reached its final position or at any other time that the train operator desires, the master controller may be actuated to its final position *c*, whereupon contact between the contact segment 58 and the control finger 57 is interrupted to deenergize the actuating coil 51 of the power-operated device 9. Under such conditions, the previously-described actuation

of the toggle-joint mechanism is immediately effected to produce a bodily lateral movement of the shaft 7 and of its associated rotatable elements to a contact-preventing position.

The purpose of the push-button 53 is to permit the above-described action instantaneously at the will of the motorman or train operator, since the opening movement of the push button deenergizes the actuating coil 51.

I desire it to be understood that, although for the sake of simplicity and clearness, I have illustrated and described only one power-operated device 9, in actual practice two such devices, located near the respective ends of the shaft and arranged to be simultaneously operated, would probably be necessary to avoid any tendency toward undue bending or tilting action of the shaft.

Since the pinion 25 of the actuating mechanism is moved out of mesh with the rack member 26 whenever the power-operated device 9 is manipulated, it may occur in some cases that when the controller shaft 7 is returned to its illustrated normal position the teeth of the pinion and of the rack member will not mesh, although such possibility is very remote.

However, to completely avoid the possibility of such an undesirable occurrence, the structure illustrated in Fig. 4 may be employed. The apparatus illustrated comprises the pistons, operating cylinders and rack member of the actuating mechanism 8, together with the controller shaft 7 with which are associated the cams 10, the pinion 25 and the linkage or toggle-joint members 45, 46 and 47, as previously described. However, in lieu of the direct meshing of the pinion 25 with the rack member 26, an idler gear-wheel 75 that is mounted upon a stationary shaft or axle 76 is positioned to normally mesh with both the pinion 25 and the rack member 26 in the illustrated positions thereof, whereby the movement of the actuating mechanism 8 is transmitted through the idler gear-wheel 75 to the pinion 25 in order to produce rotative movement of the controller shaft 7.

The controller shaft is supported by a bearing that comprises a standard or bracket 77 that is suitably secured to the base-plate 1 of the controller and a cap member 78 which is secured to the bracket member 77 through the agency of suitable bolts and nuts 79, for example. The assembly of bearing parts is such that an arcuate slot 80 that is concentric with respect to the idler gear-wheel 75 is provided for the controller shaft 7, which initially rests in the lower end of the slot, as viewed in Fig. 4.

During forward operation of the controller, wherein movement of the various

toothed members occurs in the directions indicated by the respective arrows, power is transmitted from the rack member 26 through the idler gear-wheel 75 to the controller-shaft pinion 25 in the illustrated position, as previously mentioned. Upon a predetermined degree of rotative movement of the shaft, the oscillatable bar 11 that is associated with the movable contact member 12 (see Fig. 1) is moved outwardly in accordance with the configuration of the cam 10 in the manner already set forth in connection with the previous figures. In the present instance also, the point of contact of the oscillatable bar 11 with the cam member 10 is preferably directly opposite and adjacent to that end of the bearing slot, wherein the controller shaft 7 initially rests.

Upon the previously described manipulation of the power-operated device 9 to unbuckle the toggle-joint or linkage mechanism, the controller shaft 7 is immediately actuated to the other end of the arcuate slot 80 in the direction substantially directly away from the oscillatable contact-carrying bar 11, whereby the desired quick opening movement of the various sets of cooperating contact members of the controller is effected. During such movement, however, the pinion 25 remains in operative meshing relation with the idler gear-wheel 75 by reason of the previously-described concentric relation of the slot 80 and the gear-wheel. Consequently, when the controller shaft 7 is returned to its illustrated normal position in readiness for the next control operation, the pinion, gear-wheel and rack member are in proper meshing relation, since such relation is maintained throughout the return movement of the actuating mechanism 8 because of the peculiar relation of parts.

In the present instance, therefore, there is no possibility of the actuating mechanism 8 failing to properly govern the controller shaft 7 under any and all conditions.

If desired, in lieu of the described structure for effecting the above-mentioned bodily lateral movement of the rotatable controller elements, a converse type of structure may be employed, wherein gravity or the weight of parts is normally utilized to maintain the toggle-joint in its straightened position, and the energization of the actuating coil 51 in that case will admit fluid pressure to overcome the action of gravity and actuate the toggle-joint in the desired manner.

Consequently, I do not wish to be restricted to the specific structural details or arrangement of parts herein set forth, as various modifications thereof may be made without departing from the spirit and scope

of my invention. I desire, therefore, that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

- 5 1. In control apparatus, the combination with a rotatable member, of means governed by said member for displacing the axis of said member laterally.
- 10 2. In control apparatus, the combination with a rotatable member, of means for normally biasing said member radially to a certain position, and means dependent upon the rotative position of said member for removing the radial biasing effect.
- 15 3. In control apparatus, the combination with a rotatable member, of means embodying a toggle-joint for normally biasing said member radially to a certain position, and means governed by said member for actuating said toggle-joint.
- 20 4. In control apparatus, the combination with a rotatable member, of means for normally constraining said member radially to a certain position, and power-operated means governed by said member for removing such radial constraint.
- 25 5. In control apparatus, the combination with a rotatable member, of means for normally, laterally, biasing the axis of said member to a certain position, and means dependent upon the rotative position of said member for removing the lateral biasing effect.
- 30 6. In control apparatus, the combination with a rotatable member, of means embodying a toggle-joint for normally and laterally biasing the axis of said member to a certain position, and means governed by said member for actuating said toggle-joint.
- 35 7. In control apparatus, the combination with a rotatable member, of means for normally, laterally constraining the axis of said member to a certain position, and power-operated means governed by said member for removing such lateral constraint.
- 40 8. In control apparatus, the combination with a rotatable contact-making and breaking member, of means for normally biasing said member to a contact-making position, and means dependent upon the rotative position of said member for laterally actuating said member to a contact-breaking position.
- 45 9. In control apparatus, the combination with a rotatable contact-making and breaking member, of means for normally biasing said member to a contact-making position, and power-operated means dependent upon the rotative position of said member for laterally actuating said member to a complete contact-breaking position.
- 50 10. In control apparatus, the combination with a plurality of sets of normally open stationary and movable contact members, of a rotatable cam shaft for effecting predetermined actuation of said movable contact members, means embodying a toggle-joint for normally biasing said shaft to a contact-permitting position, and means for actuating said toggle-joint to move the shaft to a contact-preventing position.
- 55 11. In control apparatus, the combination with a plurality of sets of normally open stationary and movable contact members, of a rotatable shaft for effecting actuation of said movable contact members, a bearing for said shaft having an elongated slot, means embodying a toggle-joint for normally biasing said shaft to one end of said slot, and means for actuating said toggle-joint to move the shaft to the other end of the slot.
- 60 12. In control apparatus, the combination with a rotatable shaft, of an actuating device, an idler transmission mechanism interposed between said device and said shaft, and means for normally biasing said shaft to a predetermined position and for effecting bodily lateral movement thereof while maintaining an operative relation of said device, said idler mechanism and said shaft.
- 65 13. In control apparatus, the combination with a set of stationary and movable contact members, of a rotatable shaft for effecting actuation of said movable contact member and provided with a pinion, an actuating device embodying a toothed member, a toothed idler member meshing with said pinion and said toothed member, and means for normally biasing said shaft to a contact-making position and for laterally actuating said shaft to a complete contact-breaking position while maintaining operative meshing of said idler member with said pinion and said toothed member.
- 70 14. In control apparatus, the combination with a set of stationary and movable contact members, of a rotatable shaft for effecting actuation of said movable contact member, a pinion secured to said shaft, an actuating device embodying a rack member, an idler gear-wheel meshing with said pinion and said rack member, a bearing for said shaft having an arcuate slot that is concentric with respect to said gear-wheel, means embodying a toggle-joint for normally biasing said shaft to one end of said slot, and means for actuating said toggle-joint to move the shaft to the other end of the slot while maintaining the meshing condition of said pinion and said idler gear-wheel.
- 75 15. In control apparatus, the combination with a plurality of sets of normally disengaged stationary and movable contact members, of a rotatable shaft for effecting a predetermined sequence of engagement of the movable with the stationary contact members, means for normally biasing said shaft

to a contact-permitting position, and means for laterally actuating said shaft to a contact-preventing position.

16. In control apparatus, the combination
5 with a plurality of sets of normally disengaged stationary and movable contact members, of a rotatable shaft for effecting a predetermined sequence of engagement of the
movable with the stationary contact mem-
10 bers, means for normally biasing said shaft

to a contact-permitting position, and power-operated means electrically controlled by certain of said contact members for laterally actuating said shaft to a contact-preventing position.

In testimony whereof, I have hereunto
subscribed my name this 28th day of June,
1917.

15

OLIVER P. HIPPLE.