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SYSTEM OF CONTROL.

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1,382,935. Patented June 28, 1921.

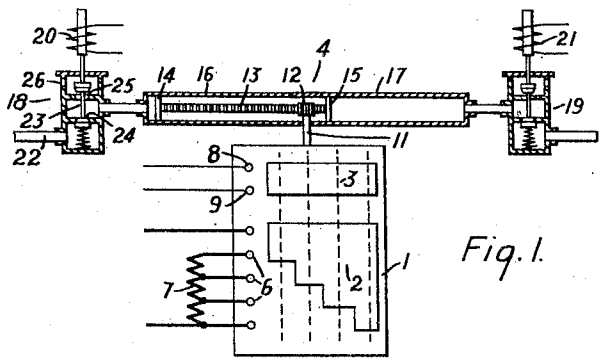


Fig. 1.

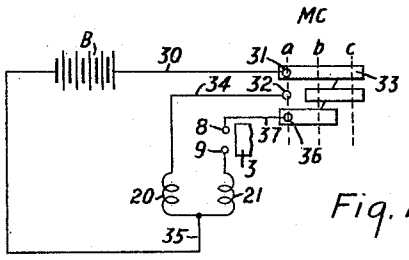


Fig. 2.

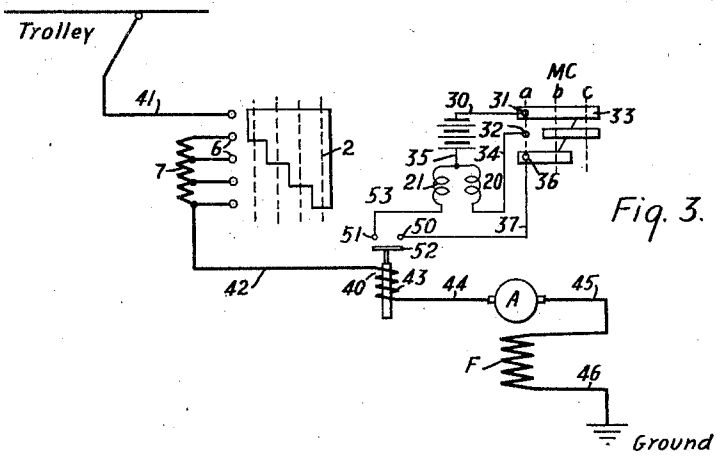


Fig. 3.

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SYSTEM OF CONTROL.

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To all whom it may concern:

Be it known that we, OTTO S. SCHAIRER, a citizen of the United States, and a resident of Oakmont, in the county of Allegheny and State of Pennsylvania, and WILLIAM R. COLEY, a citizen of the United States, and a resident of Edgewood, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Systems of Control, of which the following is a specification.

Our invention relates to systems of control and especially to the remote control of fluid-actuated mechanisms and the like.

One object of our invention is to provide a system of the above-indicated character comprising a movable member, a container therefor, similar fluid-governing means associated with each end of said container, and a relatively simple control scheme for positively actuating the governing means individually to produce movement of the member in the one or the other direction and collectively to arrest such movement, whereby a positive and reliable step-by-step movement of a controller or other device may be obtained.

Other minor objects of our invention will become evident from the following description and are fully set forth in the appended claims.

Our invention may best be understood by reference to the accompanying drawing, wherein Figure 1 is a diagrammatic view illustrating a longitudinal section of the fluid-actuated mechanism preferably employed in our system; Fig. 2 is a diagrammatic view of the preferred auxiliary control circuits for the mechanism; and Fig. 3 is a diagrammatic view of a modified form of such control circuits, together with a main circuit to be governed by the action of the mechanism.

Referring to Fig. 1, the apparatus shown comprises a drum controller 1, or the like, that is provided with a main-circuit contact segment 2 and an auxiliary-circuit contact segment 3 for purposes to be described; and a fluid-actuated mechanism 4.

The main-circuit contact segment 2 is of suitable configuration to successively engage a plurality of stationary contact members or control fingers 6, for the purpose of suitably governing a translating device, such as a resistor 7. The auxiliary-circuit contact segment 3 is adapted to bridge a pair of stationary control fingers 8 and 9 in all operative positions of the drum controller 1 for a purpose to be explained in connection with Fig. 2, that is to say, in all positions except the normal or "off" position illustrated.

The fluid-actuated mechanism 4 is of a familiar type and comprises the operating shaft 11 of the drum controller 1, to the upper end of which shaft a pinion 12 is rigidly secured to suitably mesh with a horizontally movable rack member 13, the opposite ends of which constitute pistons 14 and 15 that are respectively adapted to travel within appropriate containers or cylinders 16 and 17. Similar normally closed valve members 18 and 19 are associated with the outer ends of the respective cylinders 16 and 17, and actuating coils 20 and 21 for the valve members 18 and 19 respectively serve, when energized, to effect the admission of fluid pressure from any suitable source (not shown) through pipes or passages 22 to the corresponding cylinders.

Each actuating coil is adapted to electromagnetically operate a valve stem or rod 23 which is normally biased to close an inlet port 24 and to open an exhaust port 25, whereby each cylinder 16 and 17 is normally in communication with the atmosphere through the corresponding exhaust port 25 and outlet opening 26 in the casing for the valve member.

Assuming the various parts of the apparatus to occupy the illustrated positions, the operation thereof, without regard to the electrical connections effected thereby, may be set forth as follows: upon energization of the actuating coil 20 of the valve member 18, fluid pressure is admitted from the pipe or passage 22 through the opened inlet port 24 to the cylinder 16, whereby movement of the piston members toward the right and consequent actuation of the drum controller 1 toward the left occurs, there being no opposing fluid pressure in the cylinder 17 at this time, since the cylinder normally communicates with the atmosphere. To arrest such movement at any desired notch of the drum controller, it is merely necessary to also energize the other actuating coil 21, whereby fluid pressure is admitted to the

corresponding cylinder 17 and balanced high-fluid-pressure conditions immediately obtain in the two cylinders to effect a positive and reliable stoppage of the actuating mechanism. Further "forward" movement of the apparatus may again be effected by deënergizing the actuating coil 21 to exhaust fluid pressure from the cylinder 17. Thus, by successively balancing and unbalancing the fluid pressures in the cylinders 16 and 17, any desired step-by-step movement of the mechanism may be obtained.

To effect a return or "backward" movement of the apparatus, the actuating coil 21 alone is energized to thereby admit fluid pressure to the cylinder 17 and produce the desired movement, since only atmospheric pressure normally obtains in the other cylinder 16. Thus, by individually positively actuating the valve members 18 and 19, movement of the piston members in the one or the other direction is effected and, by collectively manipulating the valve members, a positive and reliable stoppage of such movement is secured.

Reference may now be had to Fig. 2, wherein the auxiliary governing system shown comprises the actuating coils 20 and 21, the auxiliary coöperating stationary and movable contact members 8, 9 and 3; a suitable source of energy, such as a battery B, and a master controller MC, or an equivalent controlling device, that is adapted to occupy a plurality of positions *a*, *b* and *c* for the purpose of suitably governing the actuating coils.

The operation of the system just described may be set forth as follows: When the master controller occupies its illustrated normal position *a*, although certain of its control fingers engage the contact segment thereof, no circuits are completed, by reason of the fact that the contact segment 3 of the drum controller 1 is normally disengaged from the coöperating contact members 8 and 9.

To produce "forward" movement of the drum controller, the master controller should be actuated to its final position *c*, since no movement of the mechanism will occur in position *b* of the master controller by reason of the fact that balanced high-fluid-pressure conditions thereupon obtain in the cylinders, as subsequently described in detail.

In position *c*, a circuit is completed from the positive terminal of the battery B through conductor 30, control fingers 31 and 32 which are bridged by contact segment 33 of the master controller, conductor 34, the actuating coil 20, and conductor 35 to the negative battery terminal. Thus, "forward" movement of the drum controller is effected in accordance with the previously described operating principles.

To arrest such movement at any time, the master controller is returned to its intermediate position *b*, whereby another circuit is completed from the contact segment 33 through control finger 36, conductor 37, auxiliary contact segment 3 of the drum controller 1, which is bridged by control fingers 8 and 9 in all operative positions of the main controller, and thence through the other actuating coil 21 to the negative conductor 35. Thus, fluid pressure is also admitted to the cylinder 17, and balanced high-fluid-pressure conditions obtain in the actuating mechanism, as hereinbefore explained.

In this way, by manipulating the master controller alternately between positions *b* and *c*, the train operator may effect any desired step-by-step movement of the drum controller.

To effect the return movement of the apparatus, the master controller MC is actuated to its normal position *a*, thereby deenergizing the actuating coil 20, by reason of the disengagement of the contact segment 33 from the control finger 32, while the energization of the actuating coil 21 is maintained until the main-controller contact segment 3 breaks contact with the coöperating control fingers 8 and 9 or, in other words, until the main controller is returned to its "off" position. Thus, no particular attention or special operation on the part of the motorman or train operator is necessary to effect the deënergization of the actuating coil 21 after the main controller reaches its "off" position, and thus, wasting of energy by maintaining the excitation of the actuating coil 21 under normal conditions is automatically prevented.

It will be understood that, if desired, however, the main-controller contact segments 3 may be replaced by a manually operated knife switch, or the like, whereby the train operator may deënergize the actuating coil 21 after the main controller has returned to its normal position; or an additional "off" position of the master controller may be provided, to which the controller may be actuated under such conditions.

The modified form of our invention that is shown in Fig. 3 comprises a substitution of a relay device 40 for the main-controller contact segments 3, 8 and 9 and, in addition, suitable main supply circuit conductors respectively marked "Trolley" and "Ground," a dynamo-electric machine, having an armature A and a field winding F of the series type, which is adapted to be connected in series relation with the variable resistor 7.

The relay device 40 is here shown as energized in accordance with the current traversing the main circuit and is provided with a plurality of coöperating stationary and movable contact members for governing the circuit of the actuating coil 21, as about to be described.

Assuming that it is desired to effect opera-

tion of the illustrated motor or other apparatus to be governed, the master controller may be moved to its final operative position *c* to effect the energization of the actuating coil 20 and thus produce "forward" movement of the drum controller 1 in the manner previously described. As soon as the drum controller 1 occupies an operative position, the main circuit is completed from the trolley through conductor 41, stationary contact members 6 and movable contact segment 2 of the main controller, the resistor 7, conductor 42, the actuating coil 43 of the relay device 40, conductor 44, armature A, conductor 45, field winding F, and conductor 46 to the negative supply-circuit conductor "Ground." The relay device 40 is thus actuated to its upper position to effect the bridging of stationary contact members 50 and 51 by a movable disk contact member 52.

Thus, upon "backward" movement of the master controller to its position *b*, another auxiliary circuit is completed from the contact segment 33 through conductor 37, stationary contact members 50 and 51, which are bridged by movable contact member 52 of the relay device 40, conductor 53 and thence, through the actuating coil 21, to the negative battery conductor 35. In this way, the above-described balanced high-fluid-pressure conditions obtain in the actuating mechanism 4.

Upon the return of the master controller to its normal position *a*, the circuit of the actuating coil 20 is deënergized, but the circuit of the other actuating coil 21 remains energized until the relay device 40 drops to its lower or inoperative position, that is to say, until the main circuit is interrupted, which occurs only when the main controller reaches its "off" position.

The relay device 40 thus accomplishes a similar purpose to that effected by the previously described main-controller contact segment 3. It will be understood that, instead of the current-relay device 40, a voltage-relay device energized in accordance with the electromotive force of the armature A or any other suitable electrical conditions of the main circuit may be utilized.

It will be understood that, if desired, the valves 18 and 19 may be of the normally open type, whereby fluid-pressure is normally admitted to both ends of the cylinder, and the electrical control of the apparatus will be analogous to that described.

We, therefore, do not wish to be restricted to the specific structural details or arrangement of parts and circuit connections herein set forth, as various other modifications thereof may also be effected without departing from the spirit and scope of our invention. We desire, therefore, that only such limitations shall be imposed as are indicated in the appended claims.

We claim as our invention:

1. The combination with a fluid-actuated mechanism comprising a movable member, a container therefor, and fluid-governing means associated with each end of said container, of means for positively actuating said governing means individually to produce movement of said member in the one or the other direction and collectively to arrest such movement.

2. The combination with a fluid-actuated mechanism comprising a piston member, a cylinder therefor, and valves associated with each end of said cylinder and each having an actuating coil, of means for energizing said coils individually to produce movement of said piston member in the one or the other direction and collectively to arrest such movement.

3. The combination with a fluid-actuated mechanism comprising a piston member, a cylinder therefor, and normally closed valves associated with each end of said cylinder and each having an actuating element, of means for remotely controlling said elements individually to admit fluid pressure to the one or the other end of said cylinder and collectively to admit fluid pressure to both ends of the cylinder.

4. The combination with a fluid-actuated mechanism comprising a piston member, a cylinder therefor, and normally closed valves associated with each end of said cylinder and each having an actuating coil, of remote-control means for energizing said coils individually to admit fluid pressure to the one or the other end of said cylinder and collectively to admit fluid pressure to both ends of the cylinder.

5. The combination with a movable member and a container therefor normally under atmospheric-pressure conditions, of means for admitting fluid pressure to the one or the other end of said container to produce movement in a corresponding direction and for admitting fluid pressure to both ends of the container to stop such movement.

6. The combination with a fluid-actuated mechanism comprising a piston member, a cylinder therefor, and similar valves associated with each end of said cylinder and each having a normally closed inlet port and a normally open exhaust port, of means for actuating said valves individually to admit fluid pressure to the corresponding end of said cylinder for producing movement of said piston member in the one or the other direction and for actuating said valves collectively to admit fluid pressure to both ends of the cylinder for arresting such movement.

7. The combination with a fluid-actuated mechanism comprising a piston member, a cylinder therefor, and valves associated with each end of said cylinder and each having an actuating coil, of means for energizing

one of said coils to produce movement of said piston member in the one direction, means for energizing both coils to arrest such movement, means for energizing the second coil to produce movement of the piston member in the other direction, and means dependent upon predetermined conditions for deënergizing the second coil.

8. The combination with a fluid-actuated mechanism comprising a piston member, a cylinder therefor, and valves associated with each end of said cylinder and each having an actuating coil, of means for energizing one of said coils to produce movement of said piston member in the one direction, means for energizing both coils to arrest such movement, means for energizing the second coil to produce movement of the piston member in the other direction, and means operably connected to said piston member for deënergizing the second coil when a predetermined position is reached.

9. The combination with a fluid-actuated mechanism comprising a piston member, a cylinder therefor, and valves associated with each end of said cylinder and each having an actuating coil, of means for energizing one of said coils to produce movement of said piston member in the one direction, means for energizing both coils to arrest such movement, means for energizing the second coil to produce movement of the piston member in the other direction, and auxiliary contact means movable with the piston member for effecting the deënergization of said second coil when the normal piston position is reached.

10. The combination with a fluid-actuated mechanism comprising a piston member, a cylinder therefor, and valves associated with each end of said cylinder and each having an actuating coil, of a master controller for effecting the individual or collective energization of said coils, the interruption of one coil-circuit being dependent solely on the master controller and the interruption of the other coil-circuit being dependent solely on the position of said piston member.

11. The combination with a fluid-actuated mechanism comprising a piston member, a cylinder therefor, and valves associated with each end of said cylinder and each having an actuating coil, of a main controller movable with said piston member, and a master controller for effecting the individual or collective energization of said coils, the interruption of the coil-circuits being respectively dependent solely on the master controller and the main controller.

12. The combination with a fluid-actuated mechanism comprising a piston member, a cylinder therefor, and valves associated with each end of said cylinder and each having an actuating coil, of a main controller movable with said piston member, and a master controller for energizing one of said coils to produce movement of said piston member in the "forward" direction, for energizing both coils to arrest such movement and for energizing the second coil to produce movement of the piston member in the "backward" direction, the interruption of the first coil-circuit and that of the second coil-circuit being effected solely by the master controller and the main controller, respectively, in their normal positions.

In testimony whereof, we have hereunto subscribed our names this 23rd day of Feb., 1917.

OTTO S. SCHAIRER.
WILLIAM R. COLEY.