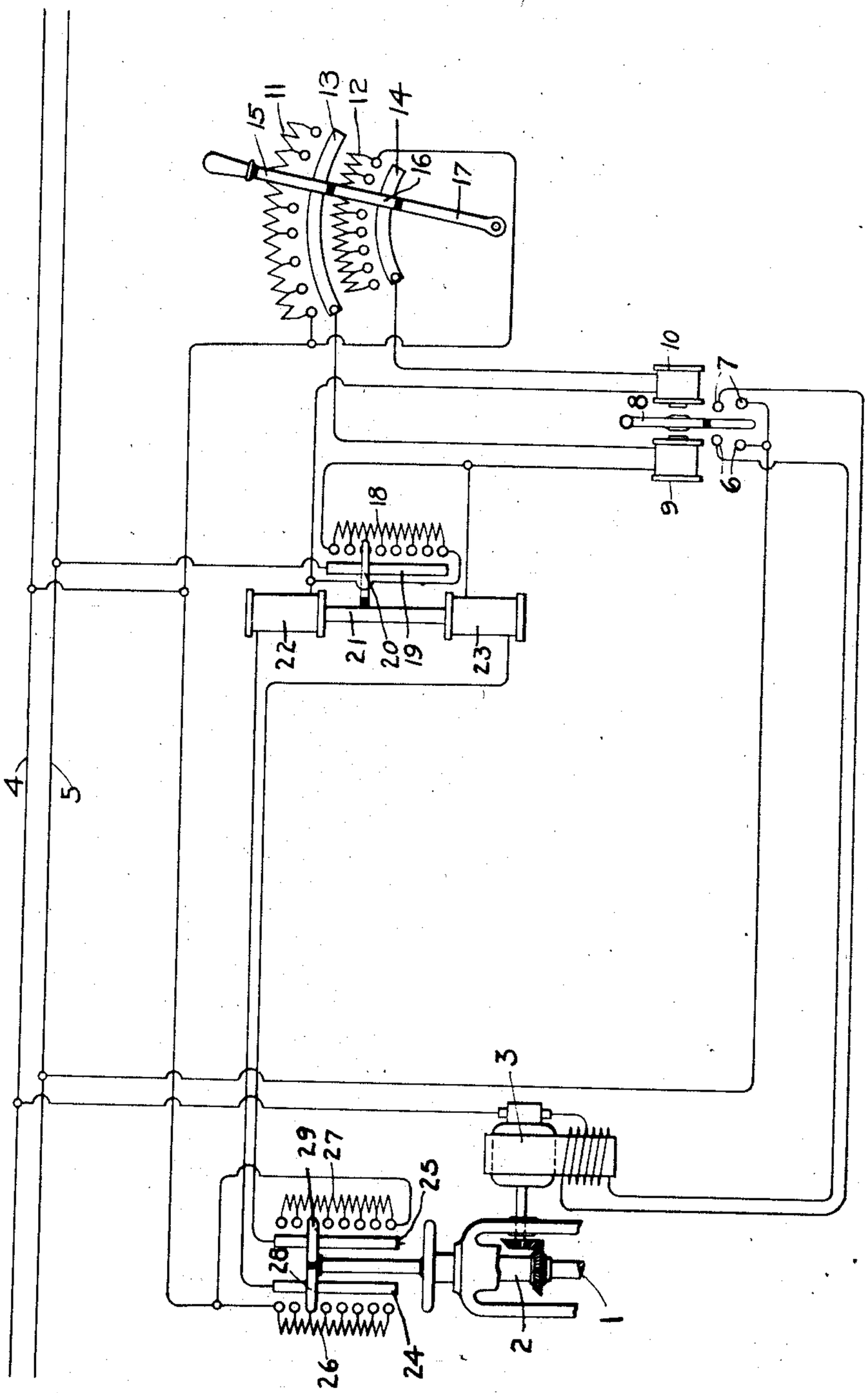
No. 811,773. PATENTED FEB. 6, 1906.

J. GOMBOROW.

SYSTEM OF DISTANT ELECTRICAL CONTROL.

APPLICATION FILED SEPT. 14, 1904.



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SYSTEM OF DISTANT ELECTRICAL CONTROL.

No. 811,773. Specification of Letters Patent. Patented Feb. 6, 1906.

Application filed September 14, 1904. Serial No. 224,387.

To all whom it may concern:

Be it known that I, JOEL GOMBOROW, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Systems of Distant Electrical Control, of which the following is a specification.

This invention relates to means for controlling the motion of an object within fixed limits, so that it can be stopped at any point in its travel and started in either direction from any such point.

The object of the invention is to render it possible to stop the object when the desired point of its travel has been reached, to indicate at the controlling-station the fact that the object is moving and its position at any instant while it is moving and the point at which it stops, and to effect the control and indication electrically in order to avoid the use of ropes, chains, gearing, &c., between the controlling-station and the working station, so that they can be separated hundreds or thousands of feet, if need be.

The accompanying drawing is a diagram of circuits embodying my system of distant electrical control.

The object to be moved may be a steam or hydraulic valve, a door, a hoist, steering-gear, or the like.

In the drawing is indicated at 1 the stem of a reciprocating valve, which can be raised and lowered by a rotatable nut 2, geared to an electric motor 3, which is supplied with current from the mains 4 5. The direction of rotation of the motor can be reversed in any suitable manner. For the sake of simplicity I have shown the motor-leads running directly to the contact-studs 6 7, which coöperate with the armature 8 of a differential relay, though in practice the relay would probably control an electric reversing-switch in the motor-circuit. The armature 8 lies between two similar electromagnets 9 10, so that when both are energized by equal currents the armature will remain in a central position, but if the currents are unequal the armature will be attracted by the stronger magnet and close the motor-circuit.

In order to control the rotations of the motor and insure its stopping at any given point in its travel, the following devices are provided: Two duplicate rheostats 11 12 are connected at opposite ends with the main 4. Adjacent to said rheostats are the contact-segments 13 14, each of which can be connected with the contact-studs of the rheostat by means of movable bridging contacts 15 16, carried, preferably, on a switch-lever 17. The segment 13 is connected with one terminal of the electromagnet 9 and the segment 14 with the electromagnet 10. The other terminals of said magnet-coils are connected with the opposite ends of a rheostat 18, adjacent to which is a contact-strip 19, connected with the main 5. A movable bridging contact 20 connects said strip with the contact-studs of the rheostat, said contact being carried by and insulated from a long core 21, which is common to two sucking solenoids 22 23, arranged with their common axis parallel with the strip 19. The solenoid 22 is adjacent to that end of the rheostat 18 which is connected with the electromagnet 9; but one terminal of said solenoid is connected with the other end of said rheostat. Similarly the solenoid 23 is located near the end of the rheostat which is connected with the electromagnet 10; but one terminal of said solenoid is connected with the end of the rheostat connected with the magnet-coil 9. The other terminals of said solenoids are respectively connected with two contact-strips 24 25, arranged parallel with each other and with two adjacent rheostats 26 27, which are connected at opposite ends with the main 4. The valve-stem carries two bridging contacts 28 29, which are insulated from each other, one connecting the strip 24 with the rheostat 26 and the other connecting the strip 25 with the rheostat 27. It will thus be seen that there are at each end of the system two rheostats connected with the positive main; that the segment 13, coils 9 and 23, and the segment 25 are in series along one conductor and that the segment 14, coils 10 and 22, and the segment 24 are in series along another conductor; that these conductors are connected by the rheostat 18, whose movable contact is connected with the negative main; that the coils 9 10 and the armature 8 form a relay; that the switch-lever 17 is a means for unbalancing the two circuits and operating the relay, and that the sliding contacts 28 29 and the solenoids 22 23, with the contact 20 and the rheostat 18, form a means for restoring said balance.

The operation of the invention is as fol-

lows: Assuming that all the rheostats have the same number of contact-studs and that their coils are all of the same resistance, it will be seen that when the several parts of the device stand as shown in the diagram all the circuits balance each other. Thus the five left-hand coils of the rheostat 11 plus the two upper coils of the rheostat 18 are in multiple with the two right-hand coils of the rheostat 12 plus the five lower coils of the rheostat 18, the circuit being, on the one hand, from the main 4 through the coils 11 18 and the contact-strip 19 to the main 5, and, on the other hand, through the coils 12 18 to the strip 19. The two electromagnets 9 10 therefore receive equal currents, and hence their opposite attractions for the armature 8 exactly balance and the motor-switch remains open. So, too, the current entering through the two upper coils of the rheostat 26 plus the five lower coils of the rheostat 18 exactly equals the current through the five lower coils of the rheostat 27 plus the two upper coils of the rheostat 18. Hence the solenoids 22 23 are equally energized and their opposite effects upon the core 21 are balanced. The valve is shown as five-sevenths open. Should the attendant at the controlling-station wish to, say, close the valve, he moves the lever 17 to the extreme left. This cuts out the entire rheostat 11 from the circuit of the electromagnet 9 and cuts the entire rheostat 12 into circuit with the magnet-coil 10. The coil 9 at once overpowers the coil 10 and swings the armature 8 against the contact-stud 6 and starts the motor 3 in a direction to move the stem downward and close the valve. The contacts 28 29 as they slide down cut more of the rheostat 26 into the circuit of the solenoid 22 and cut out the rheostat 27 from the circuit of the solenoid 23. This unbalances the two solenoids, so that the core 21 moves downward in synchronism with the contacts 28 29 and the valve-stem. The contact 20 thus serves as an indicator, informing the attendant which way the valve is moving and at what speed, and whereabouts it is at any instant. The downward movement of the contact 20 tends to transfer the lower coils of the rheostat 18 to the circuit of the electromagnet 9 until, when they are all cut in, this circuit again balances that of the electromagnet 10 and the motor-switch opens and stops the motor. At the same time, although the rheostat 18 has been cut out of the circuit of the solenoid 22 and the rheostat 27 has been cut out of the circuit of the solenoid 23, yet the rheostat 26 has been cut in for the solenoid 22 and the rheostat 18 for the solenoid 23, so that the two solenoids balance each other once more. This system therefore fulfils the requirements set forth at the beginning of this specification in a simple and inexpensive manner, requiring but a few conductors between the controlling-station and the working station.

It is to be noted that the mains controlled at 6 7 and actuating the motor may be entirely separate and independent of those actuating the controlling apparatus. Thus while the latter are direct current or fed only by a few galvanic cells the motor may be of an alternating type or on high-voltage mains.

The rheostats 11 12 18 26 27 are preferably of a continuous kind—say consisting of a slab of carbon—all of uniform resistance, which insures that the circuit is never broken in passing from stud to stud.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a system of distant electrical control, the combination with a movable object, of an electric motor for moving it, a relay controlling the motor and having opposed electromagnets, rheostats respectively in circuit with said magnets, means for simultaneously varying said rheostats in inverse ratio, a rheostat in circuit with both magnets, and means for automatically varying the portion thereof in circuit with each magnet in accordance with the movement of said object.

2. In a system of distant electrical control, the combination with a movable object, of an electric motor for moving it, a relay controlling the motor and having opposed electromagnets, rheostats respectively in circuit with said magnets, means for simultaneously varying said rheostats in inverse ratio, a rheostat in circuit with both magnets, and means for automatically varying the portion thereof in circuit with each magnet in accordance with the movement of said object, and in inverse ratio to the variation of the aforesaid rheostats.

3. In a system of distant electrical control, the combination with a movable object, of an electric motor for moving it, a relay controlling said motor, two balanced circuits including said relay, means at the controlling-station for unbalancing said circuits, and means operated by the motor for restoring said balance, comprising an indicator at the controlling-station for indicating the position of the movable object.

4. In a system of distant electrical control, the combination with a movable object, of an electric motor for moving it, a relay controlling said motor, two balanced circuits including said relay, means at the controlling-station for unbalancing said circuits, and means operated by the motor for restoring said balance, comprising an indicator at the controlling-station, consisting of a rheostat connected across said circuits, a movable contact therefor, and two solenoids for moving said contact, connected respectively with said circuits.

5. In a system of distant electrical control, the combination with a movable object, of an

electric motor for moving it, a switch for reversing said motor, two electromagnets for operating said switch, two parallel conductors each including one of said magnets, two rheostats at the controlling-station, connected with one side of the line, means for simultaneously connecting them inversely with said conductors, a rheostat connected across said conductors, a movable contact therefor connected with the other side of the line, solenoids for moving said contact, each connected with one of said conductors, two rheostats at the working station connected with the same main as those at the controlling-station, and means controlled by the movable object for connecting said rheostats with said circuits in inverse ratio.

In witness whereof I have hereunto set my hand this 7th day of September, 1904.

JOEL GOMBOROW.

Witnesses:

JOHN A. MCMANUS, Jr.,

ROBERT SHAND.