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ELECTRICALLY OPERATED VALVE

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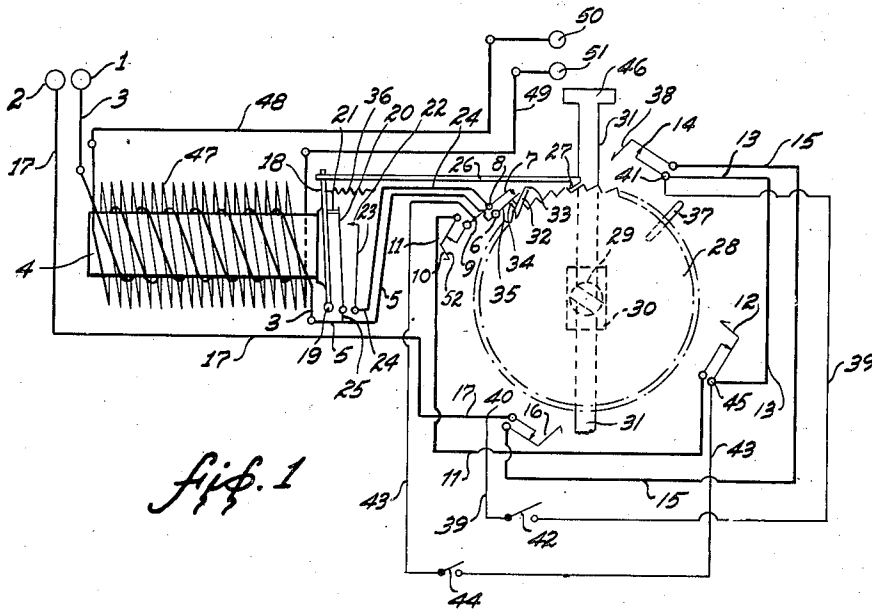


fig. 1

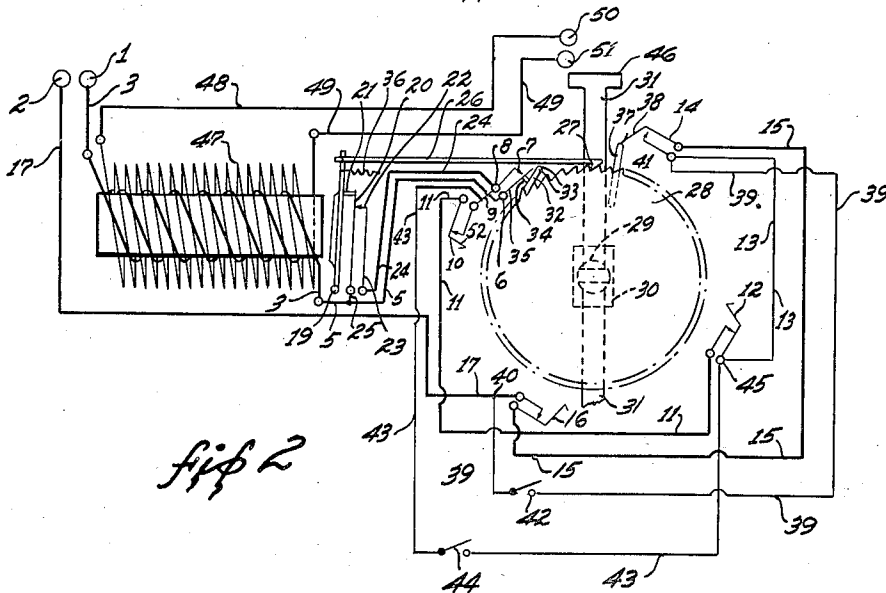


fig. 2

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ELECTRICALLY OPERATED VALVE

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3 Claims. (Cl. 137—139)

This invention relates to electrically operated valves and the object of the invention is to provide a valve which may be turned by electrically operated means and which may be stopped in the open or closed positions by automatically breaking the circuit for the electrically operated means.

Another object of the invention is to provide a valve, including a ratchet-wheel for turning the valve, and reciprocating means for advancing the ratchet-wheel to turn the valve successively to the open and closed positions.

A further object of the invention is to provide an electro-magnet and an armature, the armature being moved by energization of the electro-magnet to turn the valve.

Another object of the invention is to provide a valve which is automatically stopped at the open and closed positions and which may be carried past these positions by means of manually operable control circuits.

A further object of the invention is to provide a valve, including a ratchet-wheel for turning the valve, and an oscillating armature arranged to reciprocate a pawl for advancing the ratchet-wheel.

These objects and the several novel features of the invention are hereinafter more fully described and claimed and the preferred form of construction by which these objects are attained is shown in the accompanying drawing in which—

Fig. 1 is a diagrammatic view showing the valve advancing toward the closed position.

Fig. 2 is a similar diagrammatic view showing the position of the parts as the valve reaches the closed position.

As shown in Figs. 1 and 2, two terminals 1 and 2 are provided which may be connected to a source of current supply such as the usual electric lighting circuit. A lead wire 3 extends from the terminal 1 and is wound about an iron core 4 to provide a primary winding. This lead wire 3 is provided with a portion 5 which leads to and is connected to the terminal 6 of a switch 7 and when the switch is closed the current may flow to the terminal 8 and wire 9, thence through a switch 10 and through the wire 11 to the terminal of a switch 12. When this switch is closed, the current may flow therethrough to the opposite terminal and through the wire 13 to a switch 14, thence through this switch and through the wire 15 and through a switch 16. When the switch 16 is closed, the current may flow through the wire 17 to the terminal 2 thus completing the circuit.

An armature 18 is provided for the iron core

4 and is pivotally mounted at 19 while a spring contact 20 is provided having an insulating block 21 and this spring and block tend to follow the armature in its movement. A contact point 22 is provided which is adapted to be engaged by the spring arm 20 when the armature is moved to the position shown in Fig. 2 and this contact 22 is connected by a wire 23 to the wire 24 and this wire 24 leads to the terminal 8 of the switch 7. The spring arm 20 is also provided with a wire 25 which connects said arm to the wire 5.

An arm 26 is connected to the upper end of the armature 19 and is also provided with a hook end 27, as shown. A circular ratchet 28 is provided which is engaged by the hook end 27 of the arm 26 and this ratchet 28 is connected to the shaft 29 of a valve 30 shown in dotted lines in Figs. 1 and 2. The valve 30 is connected in a conduit 31 and is adapted to control flow through the said conduit.

A pawl 32 is pivotally mounted at 33 and is arranged to ride on the teeth of the ratchet-wheel 28 and the pawl 32 is provided with a lug 34 adapted to raise the spring arm 35 of the switch 7 to close the switch as each tooth of the ratchet moves beneath the pawl.

The first position of the armature 18 is shown in Fig. 2, at which time, the current will flow through the wires 3 and 5, thence through the wire 25 and spring arm 20 through the contact 22 and wire 23 and through the wire 24 to the terminal 8 of the switch 7. As the switch 7 is open the current will flow through the wire 9 and through the switch 10, thence through the wire 11 to the switch 12. The current then flows through the switch 12 and through the wire 13 and thence through the switch 14 which at this time is in the closed position shown in Fig. 1 and through the wire 15 and switch 16 and thence through the wire 17 back to the terminal 2 to complete the circuit. This energizes the electro-magnet and draws the armature from the position shown in Fig. 2 to that shown in Fig. 1.

By means of the arm 26 and hook end 27, the ratchet-wheel is turned the length of one tooth by this movement of the armature. At the same time, while this tooth is passing beneath the pawl 32, the pawl is raised so that the lug 34 raises the spring arm 35 of the switch 7 to close the said switch. This closing movement of the switch 7 takes place at about the time the spring arm 20 is moving away from the contact 22 so that the current changes its path to flow through the wire 5 to the terminal 6, thence through the switch 7 and terminal 8 and through the wire 9

and through the switch 11 and thence through the other switches to complete the circuit as hereinbefore described. However, as the armature completes its movement and engages the iron core 4, the pawl 32 drops into the next tooth of the ratchet thus opening the switch 7 and breaking the circuit and, at this time, the electro-magnet is deenergized so that the spring 36 may draw the armature back to the position shown in Fig. 2. As the armature moves back to the position shown in Fig. 2, the arm 26 is moved to the right to engage the hook end 27 in the next tooth of the ratchet-wheel. At the same time, the spring arm 20 is moved into engagement with the contact 22 so that the current may flow through the wires 3 and 5 and through the wire 25 and spring arm 20, thence through the wires 23 and 24 to the terminal 8 of the switch 7 and thence through the wire 9 and through the switch 10 and through the wire 11 to complete the circuit as hereinbefore described.

By this arrangement, an oscillating movement of the armature is produced which is transmitted into reciprocating movement of the arm 26 so that the ratchet-wheel is advanced one tooth on each movement of the armature toward the electro-magnet while opposite movement of the armature engages the hook end 27 in the next tooth of the ratchet-wheel for subsequent operation.

As will be noted from Fig. 1, an arm 37 is secured to the ratchet-wheel and this arm is arranged so that as the ratchet-wheel is turned in a counter-clockwise direction it engages the spring arm 38 of the switch 14 and raises this arm to position to open the switch as shown in Fig. 2. This arm is so positioned that at the time the switch 14 is opened the valve 29 is in the closed position, as indicated by dotted lines in Fig. 2. This breaks the circuit and stops the ratchet-wheel from further movement. In order to start the device operating again, it is necessary to provide a by-pass comprising a wire 39 which is connected at 40 to the wire 17 and which is connected at the opposite end to the terminal 41 of the switch 14. This wire is provided with a switch 42 which is preferably in the form of a switch button which may be held down with the finger for a moment and may be then released. When this switch is closed, the current may flow through the wire 11 and through the switch 12, thence through the wire 13 to the contact 41 and thence through the wire 39 back to the wire 17 and then to the terminal 2 to complete the circuit.

By holding this switch closed for a moment, the ratchet-wheel is advanced to move the arm 37 out from under the spring contact arm 38 allowing this contact arm to close the switch 14, at which time, the switch 42 may be released to the open position and the operation of the device will continue as before until the arm 37 engages beneath the spring arm 52 of the switch 10. When this occurs, the arm 37 has been moved through a quarter of a circle thus turning the valve 29 to the open position and when the switch 10 is thus opened, the circuit is broken and the valve is stopped in the open position. In order to again resume movement of the valve, it is necessary to provide a by-pass comprising a wire 43 which is connected to the wire 9, as shown, and this wire 43 is provided with a switch 44 which is in the form of a switch button and the wire 43 leads from the switch 44 and is connected to the terminal 45 of the switch 12. When it is desired to start the movement of the valve again, the switch 44 is manually closed so that the current

may flow to the terminal 8 of the switch 7, thence through the wire 9 and through the wire 43 and switch 44 to the terminal 45 of the switch 12 and thence through the wire 13 and switch 14 and through the wire 15 to the switch 16. The current flows through the switch 16 and through the wire 17 back to the terminal 2 to complete the circuit. This re-establishes counter-clockwise movement of the ratchet-wheel and as the arm 37 moves out from under the spring contact arm 52 of the switch 10, this switch is again closed, at which time, the switch 44 may be released to return to the open position and the operation of the valve will continue through the next quarter of the circle.

The switches 14 and 16 are utilized to stop the valve in the closed position while the switches 10 and 12 are utilized to stop the valve in the open position. The by-pass 43 conducts the current around the switches 10 and 12 while the by-pass 39 conducts the current around the switches 14 and 16 by simply closing the switch 42 or 44 as required. The wires 39 and 43 may be extended to any desired point or position for the switches 42 and 44 so that remote control may be provided for the device.

The valve 29 may be used in conjunction with any type of pipe line and for the purpose of illustration I have here shown it in conjunction with a gas burner 46. If desired, a secondary winding 47 may be provided about the electro-magnet and the opposite ends of this winding are connected by means of the wires 48 and 49 to the two terminal electrodes 50 and 51. By this arrangement when current flows through the primary winding on the electro-magnet, a current is induced in the secondary winding which produces a spark between the electrodes 50 and 51 to ignite the burner 46 when the gas is turned on. This ignition device may be used in conjunction with gas or oil burners but is not used in cases where the valve is used simply for opening or closing a valve in a pipe line where no burner is provided. In this connection it may be noted that either alternating or direct current may be used as with direct current the making and breaking of the circuit will produce a spark at the electrodes 50 and 51 as well as with alternating current.

By this arrangement, two manually operable switches 42 and 44 are provided in which the switch 42 may be labeled as the "Off" switch and the switch 44 may be labeled as the "On" switch. When the valve is turned to the "Off" position, it is necessary to close the switch 44 momentarily to start the valve in its movement toward the "On" position and when the valve is stopped in the "On" or open position the switch 42 may be closed momentarily to start the valve in its movement toward the "Off" or closed position. If desired, the switches 42 and 44 may be snap type switches rather than the push button type as described.

From the foregoing description it becomes evident that the device is very simple and efficient in operation, will not easily get out of order, provides an automatic control which may be remote from the valve and provides a device which accomplishes the objects described.

Having thus fully described my invention, its utility and mode of operation, what I claim and desire to secure by Letters Patent of the United States is—

1. In an electrically operated valve, a valve, a ratchet-wheel secured to turn with the valve, an

arm having a hook end engaging the ratchet-wheel, an armature connected to the said arm, an electro-magnet for said armature arranged upon energization to move the armature in one direction, a spring for moving the armature in the opposite direction, a series of switches positioned about the outer periphery of the ratchet-wheel and connected in the circuit to the electro-magnet, a contact arm carried by the ratchet-wheel and extending radially beyond the periphery of the ratchet-wheel, said contact arm being adapted to engage the switches successively as the ratchet-wheel is turned, said arm upon engaging any switch being arranged to open the switch and break the circuit to the electro-magnet, the switches being so positioned in relation to the ratchet-wheel that the opening of any switch by the contact arm will stop the valve in a predetermined position, and a pair of by-pass circuits about the switches provided with manually operable switches for re-establishing the circuits after being broken.

2. In an electrically operated valve, a valve, a ratchet-wheel secured to turn with the valve, an arm having a hook end engaging the ratchet-wheel, an armature connected to the said arm, an electro-magnet for said armature arranged upon energization to move the armature in one direction, a spring for moving the armature in the opposite direction, a series of switches positioned about the outer periphery of the ratchet-wheel and connected in the circuit to the electro-magnet, a contact arm carried by the ratchet-

wheel and extending beyond the periphery thereof, said contact arm being adapted to engage the switches successively as the ratchet-wheel is turned, said arm upon engaging any switch being arranged to open the switch and break the circuit to the electro-magnet, the switches being so positioned in relation to the ratchet-wheel that the opening of any switch by the contact arm will stop the valve in a predetermined position.

3. In a device of the character described, a ratchet-wheel, a valve connected to turn with the ratchet-wheel, electrically operated means for turning the ratchet-wheel a tooth at a time, a series of switches positioned equi-distantly about the outer periphery of the ratchet-wheel and connected in the circuit to the electrically operated means, each switch comprising a contact member and an arm resting on the contact member and having an angularly extending end, an arm connected to and extending from the periphery of the ratchet-wheel, said arm being arranged to engage the angularly extending ends of the switch arms as the ratchet-wheel is rotated, the arrangement being such that as the arm of the ratchet-wheel engages the respective switch arm it lifts the switch arm off from the contact member of the respective switch, the four switches being so positioned in relation to the ratchet-wheel that the valve is stopped upon each quarter turn by the engagement of the ratchet-wheel arm with the different switch arms.

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