I. G. WATERMAN.

ELECTRICALLY OPERATED VALVE.

APPLICATION FILED AUG. 28, 1906.

921,760.

Patented May 18, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

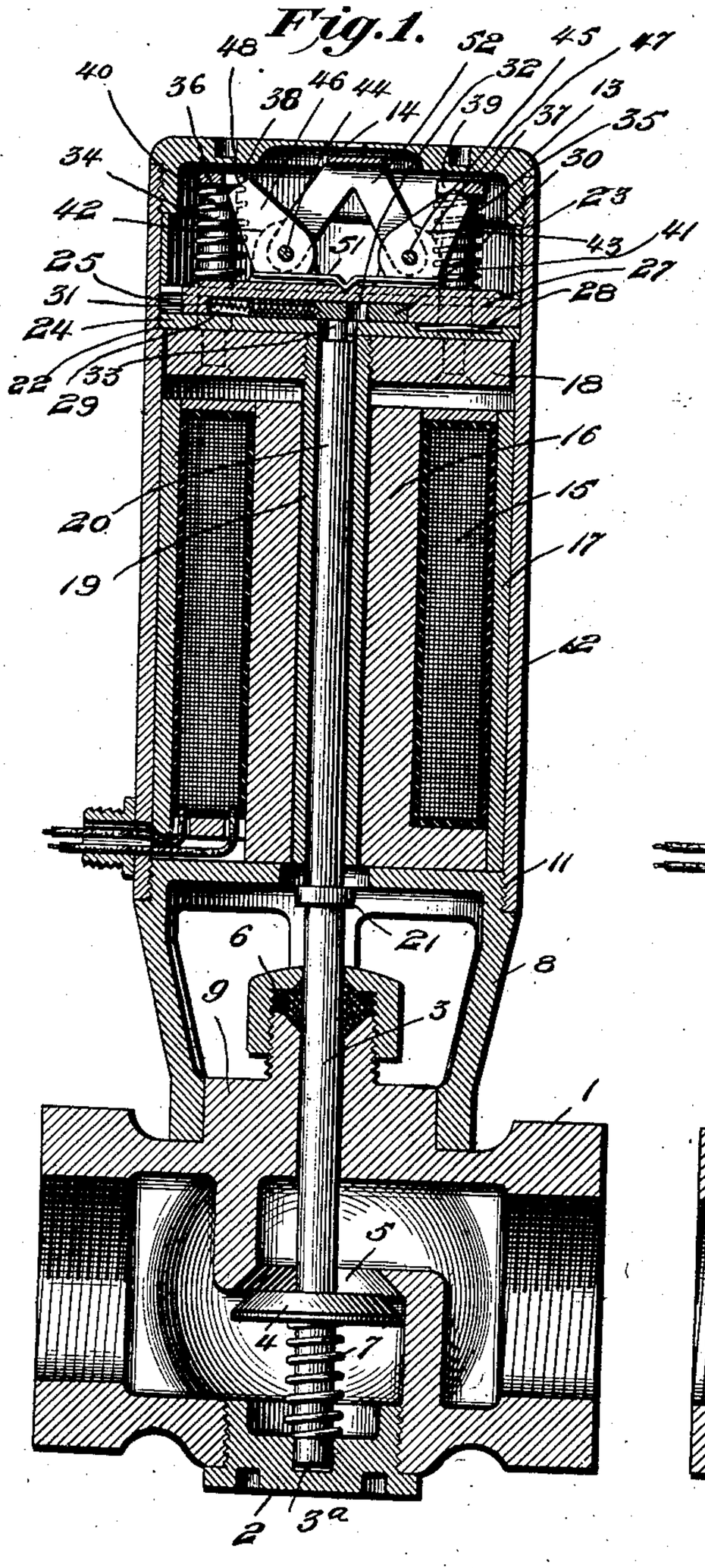
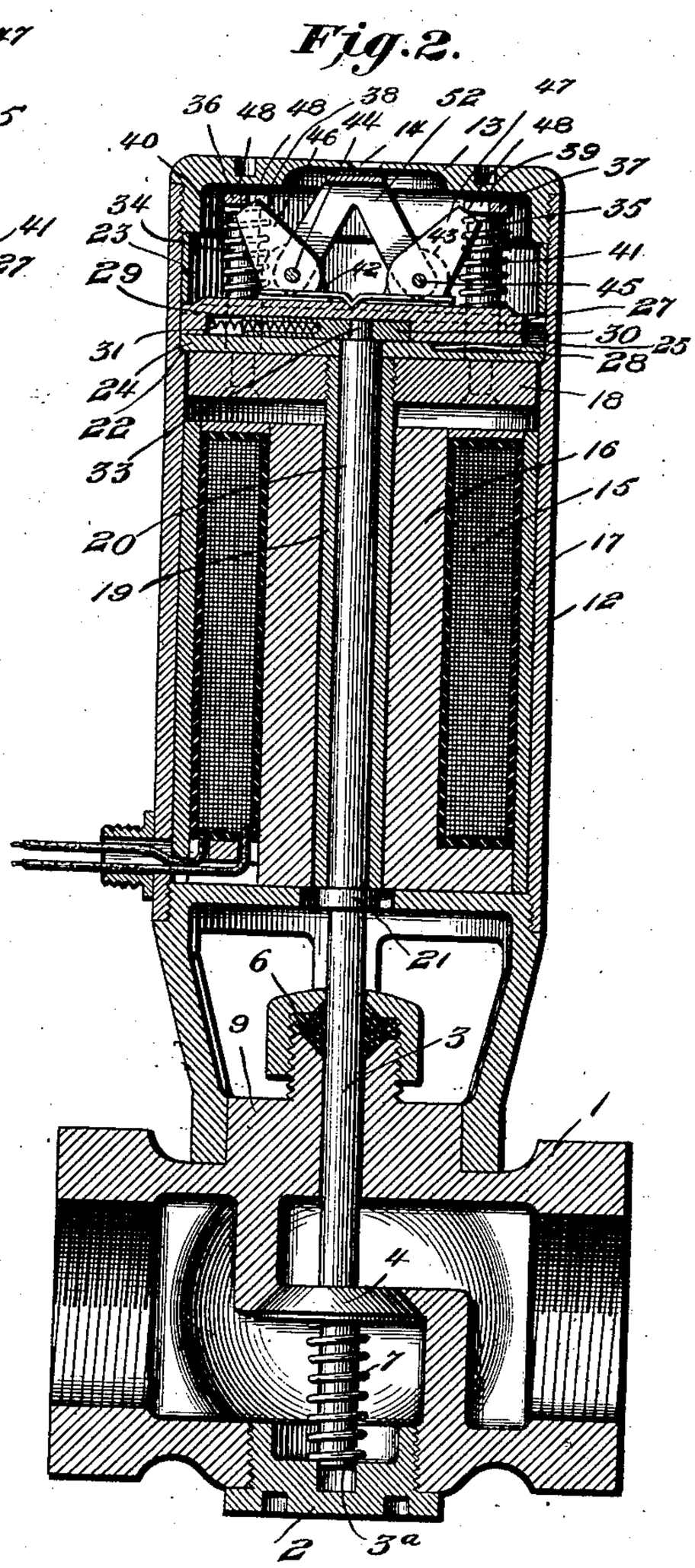


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

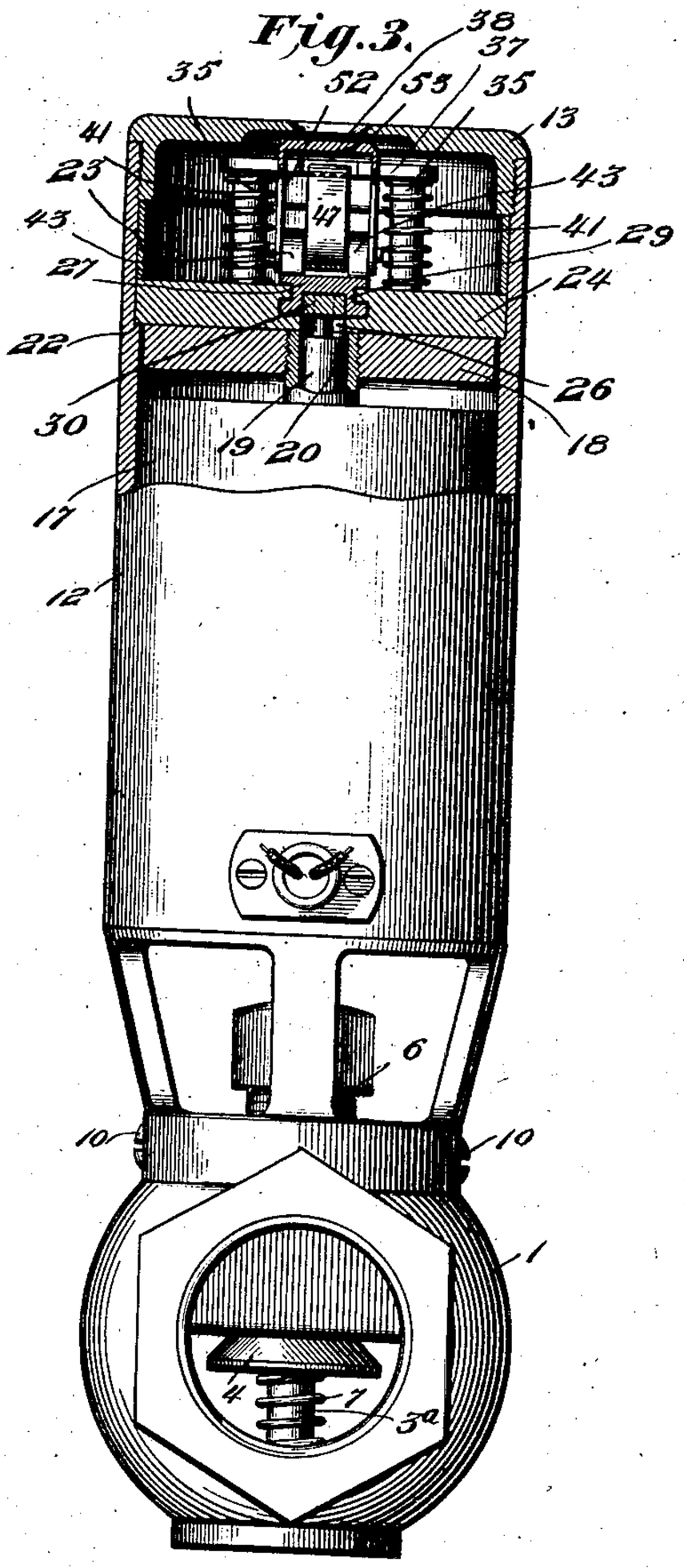


Fig. 4.

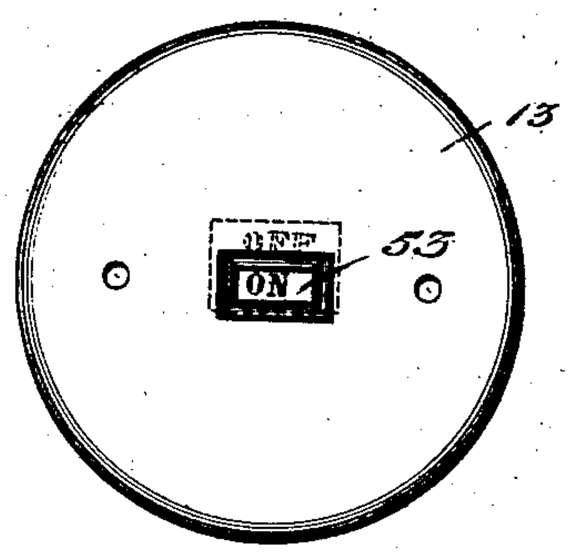
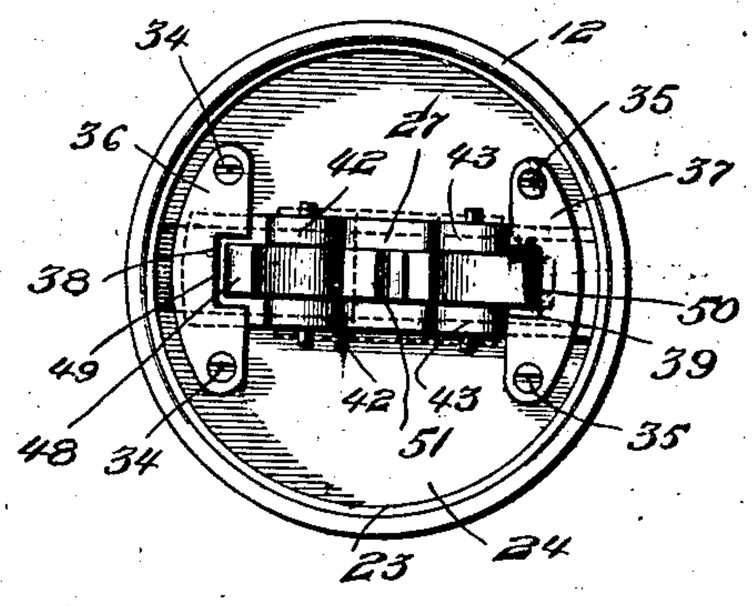


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ELECTRICALLY-OPERATED VALVE.

No. 921,760. Specification of Letters Patent. Patented May 18, 1909.

Application filed August 28, 1906. Serial No. 332,347..

To all whom it may concern:

Be it known that I, ISAAC G. WATERMAN, a citizen of the United States, residing at Santa Barbara, county of Santa Barbara, and State of California, have invented certain new and useful Improvements in Electrically-Operated Valves, of which the following is a specification.

This invention relates to electrically operated valves.

The present invention has for its objects the provision of an electrically operated valve wherein the armature and pole of the solenoid or magnet will be so constructed and disposed that a very strong magnetic pull will be exerted and the armature will have to move only a relatively short distance; an armature and valve which will move the same distance in the opening and closing operations of the valve; an electrical valve-operating mechanism of novel construction which is self-contained and adapted for attachment to or detachment from the valve-casing containing an automatically closing valve, so that the valve-shell with its contained valve can be originally fitted by a plumber and an electrician can afterward apply the electrical part of the valve; and an automatic mechanism of improved and novel construction adapted to automatically open the valve on a given electrical energization of the coil or solenoid and to close the valve on a succeeding electrical energization, said operating mechanism being so constructed that it is absolutely reliable in action and will not get out of order from wear, or catch, or otherwise become deranged.

Another object is to provide an indicator adapted to show whether the valve is open or closed.

The present electrically operated valve is adapted for use in connection with steam, air, or water valves and is capable of use where the pressure is very high, but is so adjusted that it will operate perfectly under low or moderate pressures.

Any desired form of electrical switch may be used for controlling the operation of the valve.

The invention is set forth in detail hereinafter and recited in the appended claims.

In the accompanying drawings:—Figure 1 is a vertical section, showing the valve in open position; Fig. 2, a vertical section, showing the valve closed; Fig. 3, a view at right angles to Fig. 1, showing the operating mechanism in section; Fig. 4, a plan view of the cap or head, showing the indicator; and Fig. 5, a plan view, showing the parts in the position shown in Fig. 1, but with the cap removed.

The valve-casing 1 is of an ordinary type. In the bottom of the valve-casing is a removable screw-plug 2, in a pocket in which slides the lower part 3^a of valve-stem 3, carrying the valve 4, which is adapted to fit the seat 5 in the valve-casing 1. The stem 3 passes through a gland or stuffing-box 6. A coil spring 7 encircling stem 3^a and interposed between the valve 4 and the plug 2, tends to seat the valve.

As thus far described, the valve is adapted to be inserted in any water, steam, or air pipe by a plumber or pipe fitter of ordinary skill, and the electrical operating mechanism of the valve may be placed in position later by an electrician. However, the entire valve may be furnished complete, ready to be coupled to the pipe.

The valve-operating mechanism is supported by a spider 8, which fits over a boss 9 on valve-casing 1 and is held thereto by screws 10. Screwed at 11 to the spider 9, is a metal shell 12, which incloses the operating mechanisms and has at its upper end a detachable cap 13 provided with a slot 14, through which the indicator may be observed.

The coil or solenoid 15 is wound on or slipped over an iron core 16 and is incased in an iron shell 17.

The numeral 18 designates the armature which is a circular plate or disk of iron to which is screwed a tube 19, which passes through the core 16 and is slidable therein. Slidable within the tube 19 is a valve-operating rod 20, which has a head 21 on its lower end adapted to bear against the valve-stem 3 and to be limited in its upward movement by abutting the tube 19. Surmounting the armature 18 and fixedly held against a shoulder 22 by a ring 23, which is held by the cap 13, is a circular guide-plate 24, which has an under-cut slot 25 extending diametrically thereacross from edge to edge thereof and intersecting an opening 26 in line with the opening in the tube 19. Slidable in the under-cut groove 25 is a slide 27, said slide being held snugly slidably in the groove 25 by a light leaf-spring 28 bearing against its under face. The under face of the slide 27 is grooved at 29 and receives a releasing plate 30, which is

movable independently in its groove 29 and is held yieldingly toward one end of the groove by a light coil spring 31. This releasing plate has an opening 32 adapted to receive the reduced tip 33 on the valve-operating rod 20 when the parts are in the position shown in Fig. 2, thus permitting spring 7 to close the valve 4.

Secured to the armature 18 and passing loosely through holes in the guide-plate 24 are two sets of pins 34 and 35. The pins 34 are bridged by a kicker-plate 36 and the pins 35 are bridged by a kicker-plate 37, said kicker plates having the respective notches 38 and 39.

Coil springs 40 and 41 surround the pins 34 and 35 between the kicker plates and the guide-plate 24 and thus hold the armature and its tube 19 drawn upwardly in the position shown in Figs. 1 and 2.

The slide 27 is provided with two sets of ears 42 and 43, located between and pivoted to which on the pins 44 and 45, are the pawls 46 and 47, which have slightly rounded free ends 48, the toes of these pawls being adapted for reception in the notches 38 and 39 and for alternate engagement with the edges 49 and 50 of the kicker-plates 36 and 37, according to the position of the slide 27. These pawls have flat surfaces, against which bear the free ends of a leaf spring 51, whose center part is bent and received in a notch in the slide 27 between the pawls. The form of spring can be changed, the purpose of the spring being to hold the two pawls in their upwardly inclined positions so that they will be adapted for engagement by the edges 49 and 50 of the kicker plates, the pawl 46 being engaged on a given energization of the armature, and the pawl 47 on a succeeding energization, to shift the slide 27 one way or the other to cause opening or closing of the valve.

A four-legged frame 52 has its legs secured to the pivots 44 and 45 and carries an indicator-plate 53 bearing the words "On" and "Off" which are adapted to be displayed through the sight opening 14, according to the position of the slide 27.

Assuming the valve is closed, as shown in Fig. 2, when the solenoid is electrically energized, the armature 18 is attracted very strongly to the polar faces of the coil and has to move but a slight distance to accomplish opening of the valve. The pins 34 and 35 and the tube 19, being connected to the armature, when the latter is attracted, the engagement of the tube 19 with the head 21 causes the valve-stem 3 to be pushed downwardly and the valve 4 to be opened, the reduced end 33 being withdrawn from the opening 32. Simultaneously with this operation, the edge 49 of kicker-plate 36 by its engagement with the toe 48 of pawl 46, shifts the slide 27 to bring the parts in the position shown in Fig. 1, thus positioning the pawl 47 for engagement by the edge 50 of kicker-plate 37 on the next energization of the solenoid. Immediately the electrical current ceases, the springs 34 and 35 retract the armature and tube 19, but the reduced end 33 being out of alinement with the opening 32, the spring 37 cannot close the valve. The valve remains open, the indicator having displayed the "On" sign through the sight opening 14, until the solenoid is again electrically energized, whereupon the armature is again attracted and, by the engagement of the edge 50 with pawl 47, the slide 27 is shifted to the position shown in Fig. 2, which brings the opening 32 in position to receive the reduced end 33 and permits spring 7 to close the valve, the "Off" sign of the indicator being then displayed through sight opening 14.

Instead of having the opening 32 in the slide 27 (although such a construction would be entirely operative) it is preferable to have the opening 32 in the releasing plate 30, which is independently movable by spring 31, so that shifting of the slide 27 before the tube 19 has disengaged the tip 33 from opening 32 will not check or derange the operation of the parts, the spring 31 permitting the engagement to continue while the slide 27 is being shifted.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In an electrically operated valve, the combination with a valve casing and valve in said casing, of a single electro-magnet having a magnetizable polar member and located outside the valve casing, an armature disposed closely adjacent the polar member aforesaid without intervening obstruction in the air gap therebetween, said valve being separate from the armature but operable thereby, means for operating the valve from the armature, and shiftable valve-controlling means located outside the valve casing and on the opposite side of the armature from the air gap aforesaid, said means being operated by the armature to automatically control the operation of the valve from the armature, whereby the opening and closing of the valve is automatically accomplished on alternate electrical energizations of the single electro-magnet aforesaid and the armature and controlling mechanism are unaffected by the pressure of the fluid in the valve casing.

2. In an electrically operated valve, the combination with a valve and a valve-stem, of means for impelling the valve in one direction, an electro-magnet, an armature controlled by the electro-magnet, said armature being adapted to move the valve in the opposite direction, a slide, independent pawls carried by the slide, kickers operated by the armature and adapted to alternately engage the respective pawls on alternate movements of the armature, whereby the slide is shifted

to and fro, and means controlled by the slide, which governs the operation of the valve by the armature.

3. In an electrically operated valve, the combination with a valve, of means for impelling the valve in one direction, an electro-magnet, an armature controlled by the electro-magnet, a valve-operating member for moving the valve in the opposite direction, means for moving said valve-operating member from the armature, a shiftable releasing member, a releasing device carried by said releasing member and movable relatively to said releasing member but also movable with it, said releasing device being adapted to catch and release the valve-operating member on alternate attractions of the armature by the electro-magnet, and means for automatically shifting said releasing member and its releasing device into and out of releasing position, whereby the valve is opened and closed on alternate electrical energizations of the electromagnet.

4. In an electrically operated valve, the combination with a valve, of an electro-magnet, an armature controlled by said electro-magnet, a slide, independent pawls carried by said slide, kickers operated by the armature and adapted to alternately engage the respective pawls on alternate movements of the armature, whereby the slide is shifted to and fro, spring means for retracting the armature, and operative connections between the armature and valve which are governed by the position of the slide.

5. In an electrically operated valve, the combination with a valve, of an electro-magnet, an armature controlled by the electro-magnet, means for operating the valve from the armature, a slide governing the operation of the valve by the armature, means for shifting the slide from the armature, and an indicator operated by the slide to indicate the position of the valve.

6. In an electrically operated valve, the combination with a valve, of an electro-magnet, an armature controlled by the electro-magnet, means for operating the valve from the armature, a slide governing the operation of the valve by the armature, and means for shifting the slide from the armature.

7. In an electrically operated valve mechanism, the combination with a single magnet, said magnet being of tubular form, of an armature arranged at one end of the magnet and normally separated therefrom by a small space, a tube on the armature extending into the tubular magnet, a valve, a valve rod having a projection engaging with the end of said tube, connections between said rod and the valve whereby the valve is moved in the first direction at the first energization of the magnet, a spring to move the valve in the second direction and controlling mechanism moved into first and second positions by successive energizations of the magnet, in the first position to prevent the valve from being moved by its spring and in the second position to permit the valve to be moved by its spring in the second direction.

8. In an electrically operated valve mechanism, the combination with the valve, of a single electro magnet, an armature, connections between the armature and the valve, whereby the valve is moved in the first direction at the first energization of the magnet, a spring tending to move the valve in the second direction, a slide moving in a path at a right angle to the movement of the armature and suitable connections between the slide and the armature whereby the slide is moved into two positions at successive movements of the armature, first to prevent the valve from being moved by its spring and second to permit the valve to be moved by its spring.

9. In an electrically operated valve mechanism, the combination with a suitable cylindrical metal shell, of a single tubular electro magnet arranged therein, an armature arranged in the shell above the magnet and normally at a short distance therefrom, a tube on the armature extending down into the tubular magnet, a guide plate in the shell above the armature having a cross-groove and a central opening registering with said groove, a slide fitted to said groove, a releasing plate fitted to a plate-groove in the slide and having an opening, a spring tending to maintain the releasing plate at one end of the cross-groove, connections between the slide and the armature to reciprocate the slide to one end and the other of its groove at successive energizations of the magnet, a rod in the armature tube having a flange to engage with the end of the tube and a tip to enter the opening in the releasing plate when the latter is in one position and to engage with the surface of the releasing plate when the latter is in the other position, a valve, a stem on the valve to engage with the flange end of the rod, and a spring to force the valve and rod in one direction.

In testimony whereof, I hereunto affix my signature in presence of two witnesses.

ISAAC G. WATERMAN.

Witnesses:

CHARLES RABUT,

LOUIS RABUT.