(No Model.) 4 Sheets—Sheet 1.

E. A. NEWMAN.

ANTI-FREEZING DEVICE FOR WATER PIPES.

No. 389,099. Patented Sept. 4, 1888.

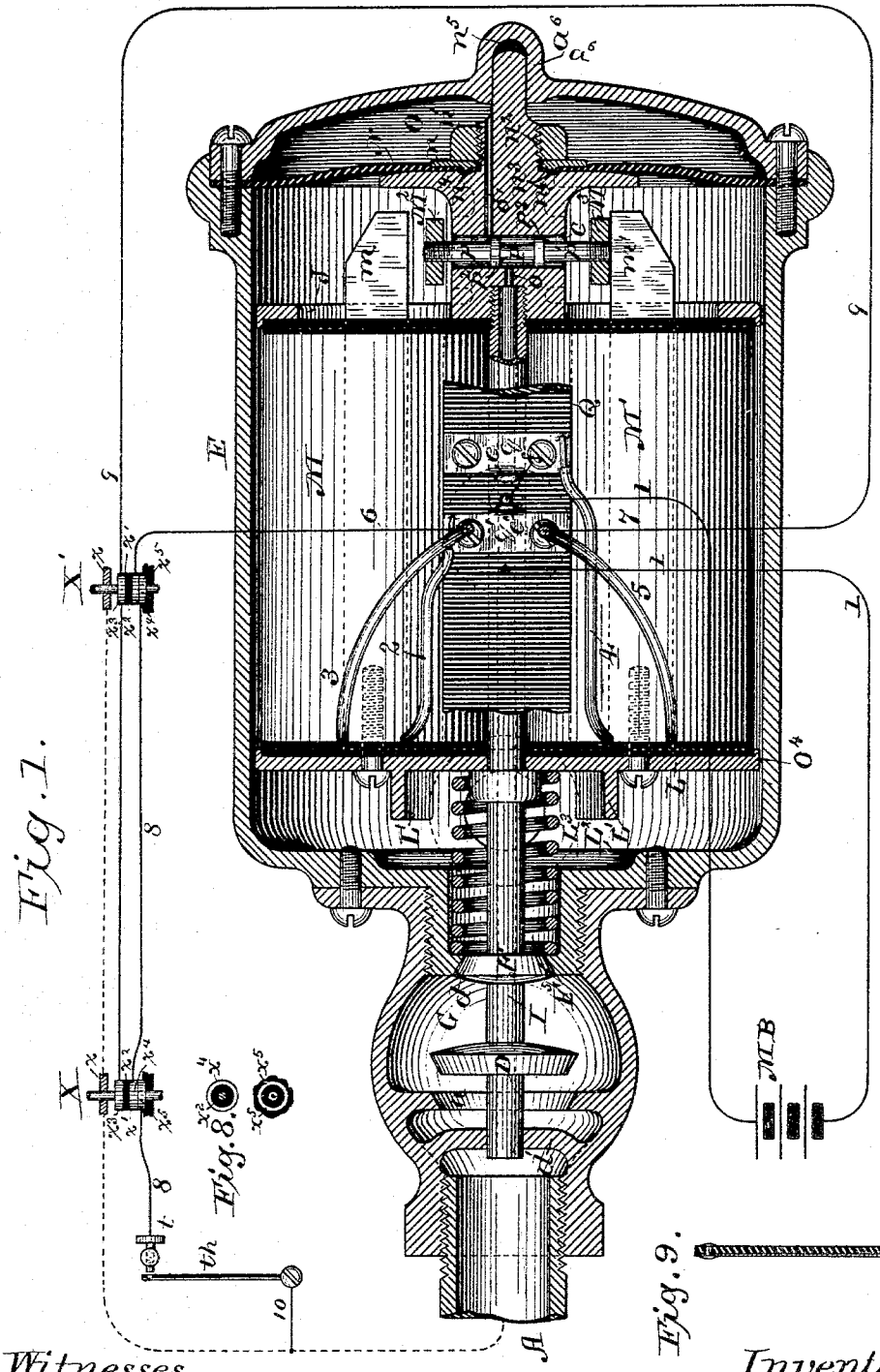

Fig. 1.

Fig. 8.

Fig. 9.

Witnesses.
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Inventor.
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(No Model.) 4 Sheets—Sheet 2.

E. A. NEWMAN.

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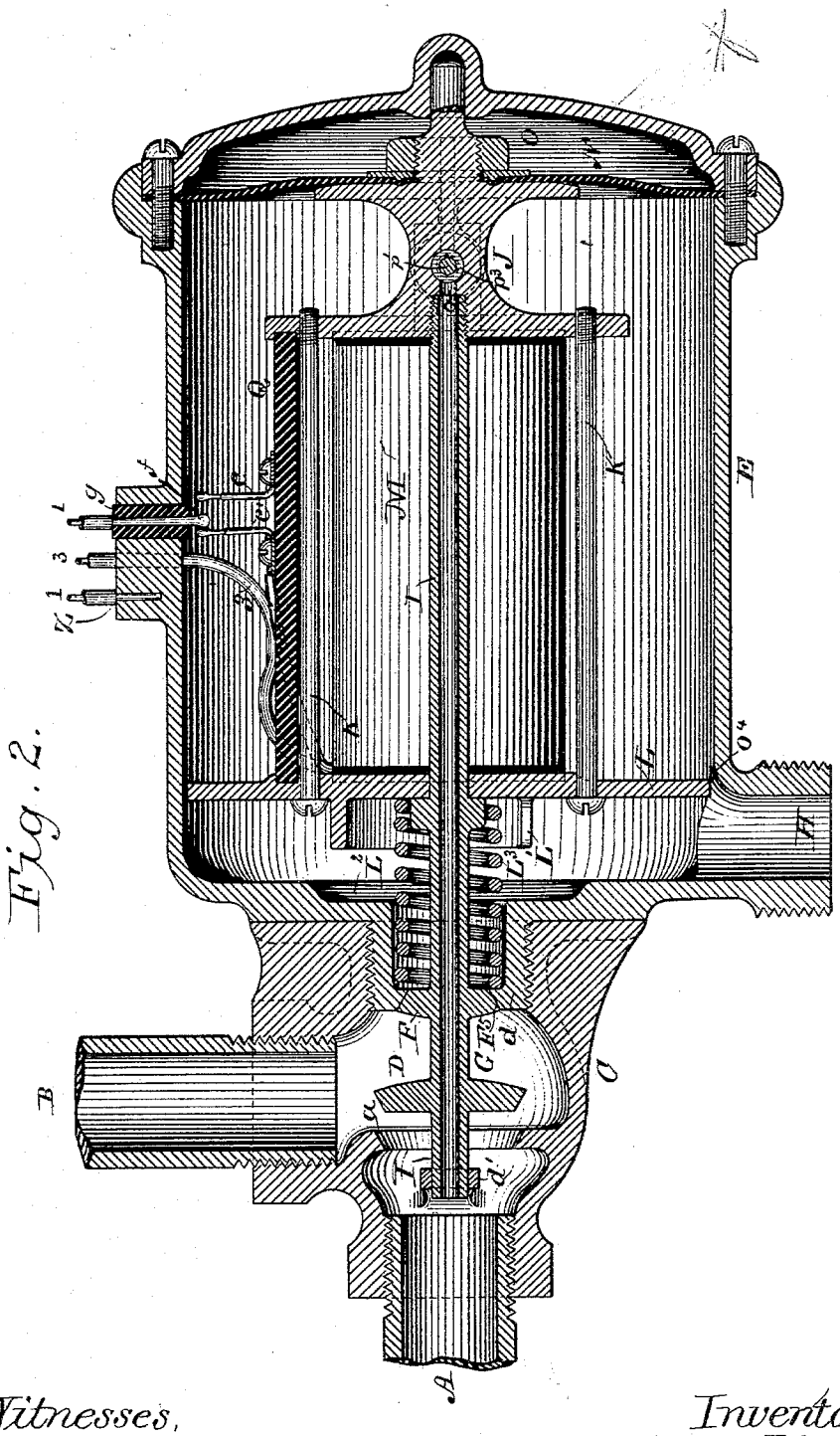

Fig. 2.

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(No Model.) 4 Sheets—Sheet 3.

E. A. NEWMAN.

ANTI-FREEZING DEVICE FOR WATER PIPES.

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Fig. 4.

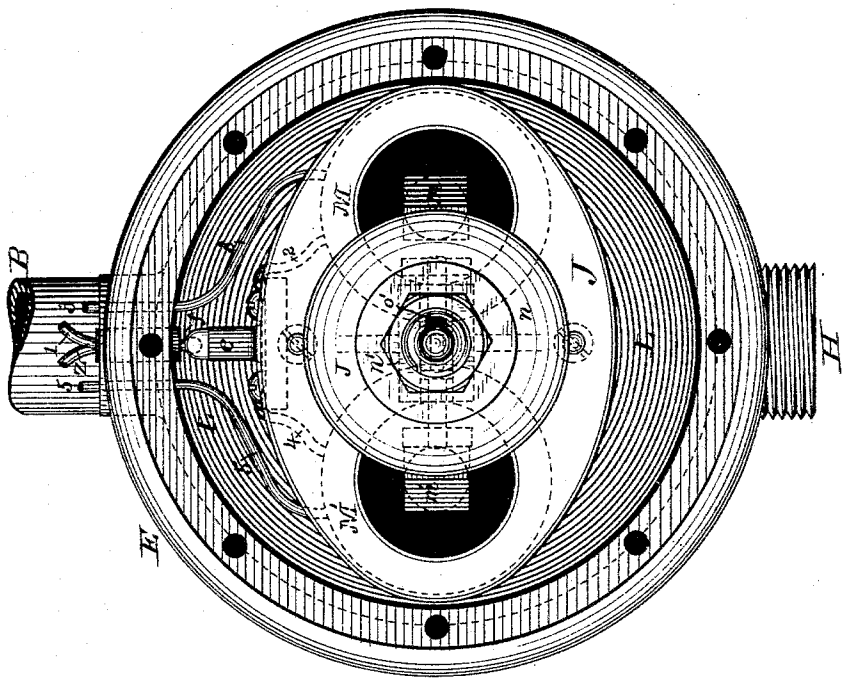
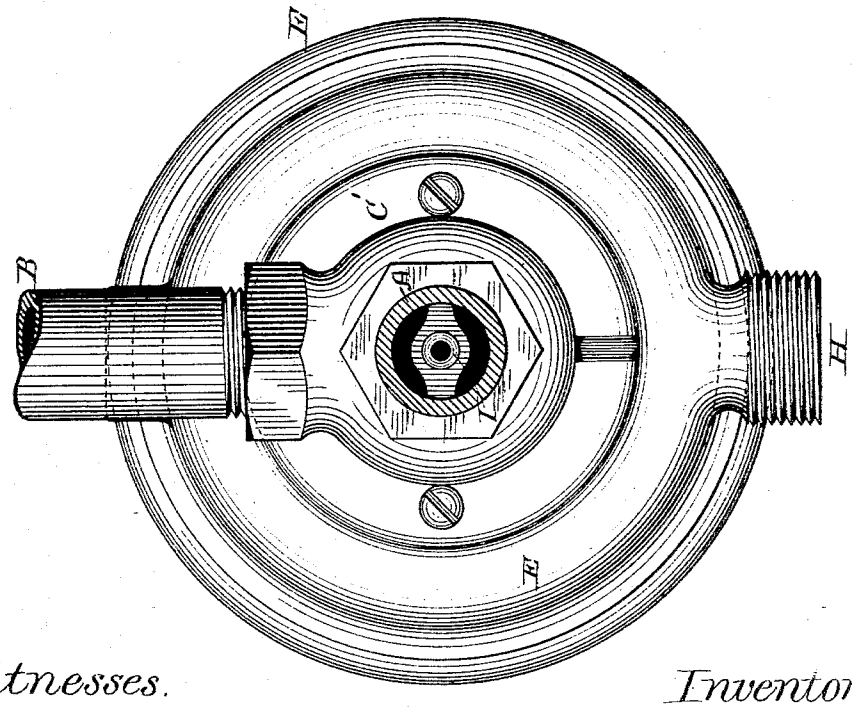


Fig. 3.



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(No Model.) 4 Sheets—Sheet 4.

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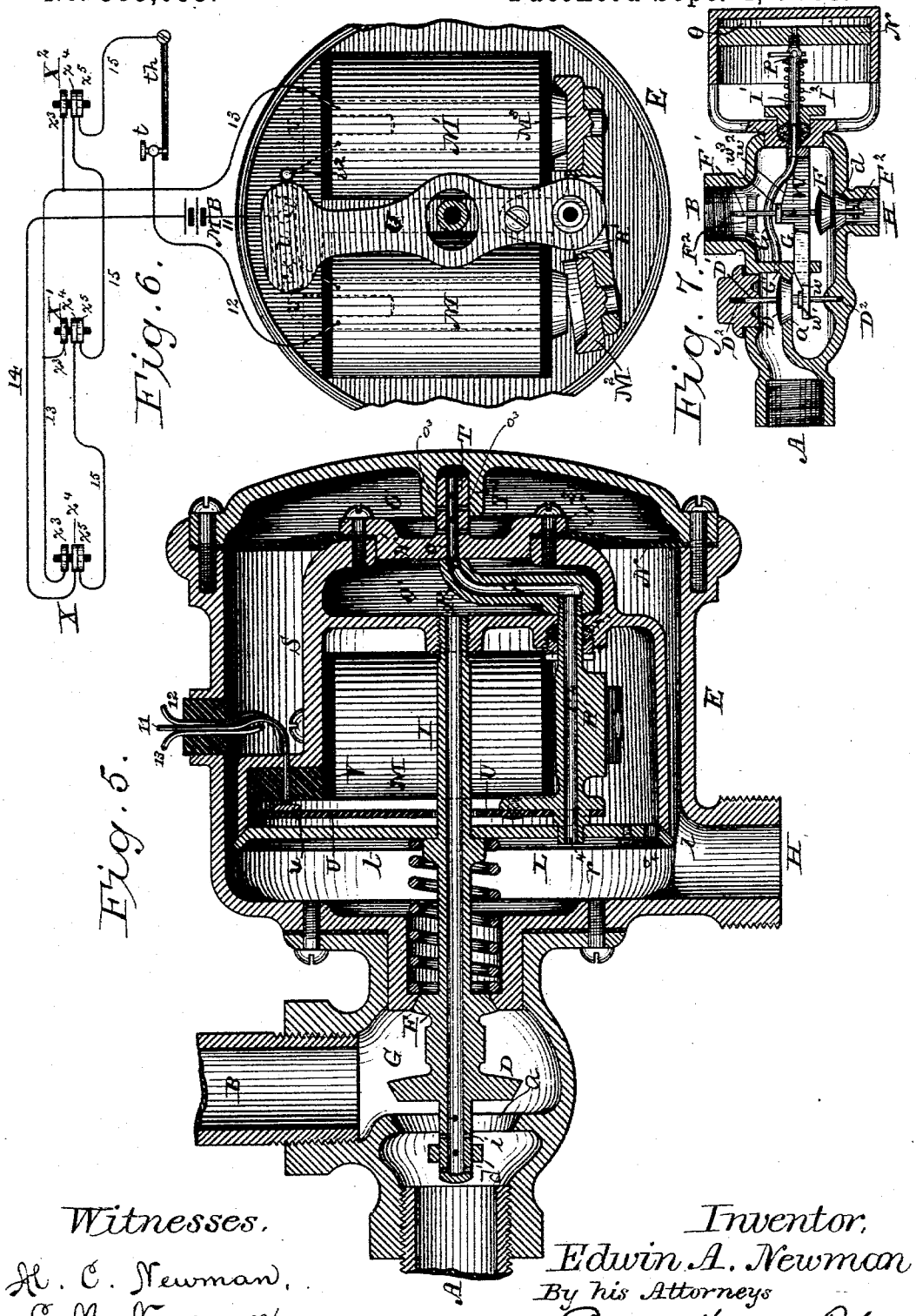

Fig. 6.

Fig. 7.

Fig. 5.

Witnesses.
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UNITED STATES PATENT OFFICE.

EDWIN A. NEWMAN, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO THE NEWMAN ANTI-FREEZING WATER PIPE COMPANY, OF CHICAGO, ILLINOIS.

ANTI-FREEZING DEVICE FOR WATER-PIPES.

SPECIFICATION forming part of Letters Patent No. 389,099, dated September 4, 1888.

Application filed November 12, 1887. Serial No. 254,092. (No model.)

To all whom it may concern:

Be it known that I, EDWIN A. NEWMAN, a citizen of the United States, residing at Washington, District of Columbia, have invented certain new and useful Improvements in Apparatus for Controlling the Flow of Water in Pipes, of which the following is a specification.

The object of my invention is to provide improved apparatus for controlling the flow of water in pipes, the special object being to prevent them from freezing.

Letters Patent of the United States have heretofore been granted to me for various forms of apparatus designed for this purpose. These apparatus all embody efficient and practical devices; but there are other ways in which the same result may be obtained.

My present invention embodies new forms of apparatus embracing certain improvements in the mechanical details of construction and the general system of operation.

In my previous patents I have shown and described valves operated directly by the expansion and contraction of thermostats. I have also heretofore used electro-magnetic devices for operating the valve or valves between the main and the service-pipe and drain-pipe, depending on electric energy to operate said valves.

The apparatus embodying my present invention provides for operating the main valve or valves by water-pressure controlled by independent valve apparatus.

The subject-matter claimed will be hereinafter designated.

In the accompanying drawings, Figure 1 is a longitudinal central section through my improved valve-controlling apparatus with some of the interior parts in elevation, showing also diagrammatically the electric-circuit connections. Fig. 2 is a longitudinal central section through the apparatus, taken at right angles to the section shown in Fig. 1. Fig. 3 is an end view showing the entrance-port. Fig. 4 is a view of the opposite end with the end plate removed. Fig. 5 is a longitudinal central section of a modified form of apparatus. Fig. 6 is a view of the interior of the apparatus, showing also the circuit-connections. Fig. 7 is a longitudinal central section of another modification, with the valves in elevation. Fig. 8 shows a bottom view of the switch-block of a faucet. Fig. 9 shows in section a view of the preferred form of thermostat employed.

Referring to the first four figures of the drawings, and particularly to Figs. 1 and 2, A indicates a pipe leading to the water-main; B, Fig. 2, the service-pipe of a building; C, the pipe-coupling and valve-casing. The pipe B is arranged at right angles to the pipe A, and a valve-seat, *a*, is formed in the casing C, just over the entrance of the pipe A. A valve, D, rests, when closed, upon the valve-seat *a*, and shuts off communication between the main and the service-pipes. The valve-operating apparatus is contained in a casing, E, secured to the valve-casing. A valve, F, rigidly connected to the valve D, rests, when closed, on a valve-seat, *d*, and closes communication between the interior of the casing E and the valve-chamber G, to which the pipes A and B are connected. The valves D and F move coincidently and really constitute a single valve. When the valve F is open, communication is established between the valve-chamber G and the lower part of the casing E, to which a drain-pipe is connected at H. When the valve D is open, the valve F is closed, and vice versa. When the valve D is open, the water from the main can pass freely into the service pipe, and none can escape through the drain-pipe; but when the valve D is closed no water can enter from the main, and the water from the service-pipe will pass through the valve-port F^5, into the drain-pipe, thus emptying the service-pipe, thereby preventing freezing. The valves D and F are operated automatically to turn off water from the pipes when there is danger of freezing and to again close the drain and turn on the water when the danger is passed, or when it is desired to draw water from the service-pipe.

I indicates a tubular valve-stem, connected rigidly to the valves D and F and open at both ends. At one end it extends beyond the valve D, and is supported in a bearing, *d'*, in which it is free to slide. At this end it opens into the pipe connecting with the main. At its opposite end it is rigidly secured to a metallic block, J, which is secured by bolts K to a

disk, L, that fits snugly the sides of the casing. The block J, disk L, and bolts K constitute a frame that carries the electro-magnets M M′ and their circuit-completers; also the tubular valve-stem I. Between the disk L and the block J are arranged, on opposite sides of the valve-stem I, electro-magnets M M′, whose cores or pole-pieces *m m′* project beyond the coils. The base of the block J is preferably oval-shaped, as shown in Fig. 4, and the coils of the magnet are countersunk therein. At the opposite ends the magnets are connected to the disk L, being suitably insulated therefrom, as indicated. Insulating material is also interposed between the magnets and the block J, as indicated.

A flange, L′, is formed on the disk L just in front of the valve F, so that water entering through the valve-port will be prevented from splashing and delivered evenly to the drain-pipe H. The casing is cut away at L^2 to receive the flange when it is moved toward the valve-chamber G. Between the disk L and the casing is a spring, L^3, that tends to hold the disk and the magnets, &c., which it carries away from the end of the casing. The block J is connected at its outer end to a flexible diaphragm, N, securely fastened at its edge to the casing and clamped on the block in any suitable way, preferably by a washer, *n*, and nut *n′*, fitting on a screw-threaded boss, n^2, on the block. The boss extends into a guiding-recess, n^5, in the end plate of the casing. The washer is shown as provided with an annular flange, n^3, and the block has a corresponding groove, n^4. This arrangement insures a tight fit. Between the diaphragm and the top of the casing there is a pressure-chamber, O, to which water is admitted from the tubular valve-stem I through channels *o o′* in the block. A transverse opening, *c*, is made in the block, in which is placed a balance-valve, P, that fits the opening snugly and is free to slide back and forth therein. The ends of the valve-stems *p p′* carry the armature M^2 M^3 of the electro-magnets M M′.

In the drawings, Fig. 1, the valve is shown closed—*i. e.*, water entering from the water-passage in the valve-stem I through channel *o* fills the opening between the valve-heads p^2 p^3; but it stops there. If, however, the magnet M is energized and draws its armature home, the valve-head p^2 will move past the channel *o′*, and the water from the valve-stem I will pass into channel *o′* and thence into pressure-chamber O. As the pressure increases in this chamber, the diaphragm will be expanded, thereby moving forward the valve-stem I, thus closing the valve D and opening the valve F. When the valve is again shifted, communication between the water-main (through valve-stem I) and the pressure-chamber is closed, and the water in the pressure-chamber may drain out through the channel *o′* and opening o^4 between the disk L and the casing near the drain-pipe H.

It is obvious that water may be admitted or discharged from the chamber O at pleasure by opening and closing the balanced valve P. The magnets M and M′ are arranged to open and close said valve. The magnet M moves the valve to admit the water to chamber O, and the magnet M′ moves the valve to allow the water to discharge, and also to cut off communication between the main and the pressure chamber.

I will now describe the electric-circuit connections for operating the apparatus.

Q indicates a plate of insulating material mounted on the magnet-carrying frame.

q q′ are contact-plates insulated from each other, and carrying contact-fingers *e e′*, adapted to alternately make contact with a contact, *f*, inserted in an insulating-block, *g*, in the case E. The contact *f* is electrically connected with circuit-wire 1. The ends of the contact-fingers *e*, *e′*, and *f* are preferably made or covered with platinum, the main body of the contacts being suitably insulated by paraffine or other suitable material. The circuit-wire 1 leads from contact *f* to battery M B and from battery back to the metallic casing at Z. The finger *e′* is connected to plate *q′*, which is connected with coils of electro-magnet M by insulated wire 2. The magnet M is connected by wire 3 to circuit-wire 6. The magnet M′ is connected by wire 4 to plate *q*, and thereby to contact-finger *e*. It is also connected by wire 5 to line-wire 7.

X and X′ indicate so much of two cocks or faucets as is necessary to illustrate my invention. *x* indicates the casing of the faucet, and *x′* a switch-block of insulating material, secured to the valve-stem of the faucet, and carrying on its upper and lower faces contact-rings x^3 and x^4, respectively, insulated from the spindle, and with insulating material, x^2, between them. x^5 indicates a stationary ring insulated from the faucet. By raising and lowering the switch-block electric connection may be made and broken between the casing *x* and ring x^3, or between the ring x^4 and ring x^5.

th indicates a thermostat of well-known construction. A circuit-wire, 8, leads from the contact *t* of the thermostat to ring x^5 of faucet X, then from ring x^4 of faucet X to ring x^5 of the next faucet, then to ring x^4, and thence to circuit-wire 6, which joins wire 3, leading to electro-magnet M. From the upper rings, x^3, of the faucets a circuit-wire, 9, leads to wire 5, connecting with electro-magnet M′. The thermostat is connected by wire 10 to a ground-circuit, including the casing of the faucets and the pipes and casing E.

The operation of the apparatus is as follows: If the weather is warm and there is no need of controlling the flow of water in the pipes, the electric circuit is broken at the thermostat and the battery is out of circuit; but, supposing the temperature to be so cold that there is a liability of the pipes freezing, the circuit will be closed at the thermostat and a circuit will run, say, from contact *t* to ring x^5 of faucet X; thence to ring x^4 (the faucet being closed) to ring x^5

in faucet X'; thence to ring x^4 to wire 6; thence to wire 3; thence through coils of electro-magnet M by wire 2 to plate q' and finger e' to contact f; thence by wire 1 to battery M B; then to the metallic casing E at Z, and then through the casing and pipes to ground-circuit to wire 10 through thermostat, which completes the circuit. The magnet M, being energized, will open the valve P and water will run in through the valve-stem I and channels o o' into pressure-chamber O, causing the diaphragm to expand and move the valve-stem toward the main valve-chamber G, thus closing valve D and opening valve F. The water will thus be cut off from the main, and the water in the service-pipe may discharge through drain-pipe H. In the act of closing the valve D the finger e' has moved away from the contact f and finger e has made contact with f, so that the electric circuit through magnet M is broken. Thus the battery-current is used only for an instant; but the balanced valve P remains in the position to which it is moved until moved positively by the opposing magnet, M'. When any one of the faucets is open, an electric circuit is completed, say, from ring x^3 by wire 9 to wire 5, coils of magnet M' by wire 4 to plate q and contact-finger e, contact f, wire 1, through battery to casing at Z, and thence by pipes and ground-circuit to faucet-casing at x, thus completing the circuit. The magnet M' will attract its armature M^3, and thus shift the valve P to the position shown in the drawings, Fig. 1, allowing the water in pressure-chamber O to escape and the valve D to be opened by pressure from the main, the drain-valve F being thereby closed. The service-pipe will thus refill and the drain-pipe will be closed.

It will be seen that the power necessary to operate the main valves is supplied by water-pressure from the main. The small balance-valve P, which is operated by electricity, requires but a small amount of electric energy, and the current for operating the valve is used only for an instant, so that there is but small consumption of battery, which will consequently last a long time without attention.

In Figs. 5 and 6 the form of apparatus is somewhat modified. The valve-stem I is provided with small perforations i at the end next the main to serve as a strainer. The disk L is flared at its edge l, and the magnets M M' lie transversely to the valve-stem. The magnets are inclosed in a metallic casing or frame, S, being suitably insulated therefrom. The diaphragm N is secured to the casing or frame S by means of a plug, N', that fits in a central opening in the diaphragm and a central opening in the frame S, the edges of the diaphragm being clamped between the top of the frame and a flange, N^2, on the plug. The plug has a stud, T, that moves in a guide, T', formed in the end of the casing E. A channel or passage, o, extends centrally through the plug and through the stud T, and side channels, o^3, lead to the pressure-chamber O. At its opposite end the channel o connects with a chamber, O', formed in the frame S, into which water from the valve-stem I is discharged. When there is communication between the chamber O' and the channel o, water flows into the chamber O and causes the diaphragm to expand, thus moving the frame, valve-rod, &c., toward the valve-chamber G, so as to close the valve D. Within the chamber O' is a valve, R, secured at one end to the armature-frame R' of the electro-magnets M M' and at its opposite end, r, arranged to register with the opening o to close communication between the chamber O and chamber O'. The valve R has a channel, r', leading from the end r to a channel, r^2, in the armature-frame R'. The channel r^2 extends entirely through the armature-frame and opens into the interior of the case E near the drain-pipe H. The armature-frame R' is pivoted at each end r^4 r^5 to the frame S and is free to rock on its pivots. The channel r^2 is formed through the axis of the armature. When the valve is in the position shown in the drawings, any water in the chamber O may pass out through channels o r' r^2 into case E and thence to pipe H. I preferably so form the diaphragm and its clamping devices that some water may be left in the chamber O, as I find it advantageous to keep the diaphragm moist. The opening o^4 in the disk L permits any water that may leak into the interior of the casing S to escape.

The armatures M^2 M^3 are secured to the frame R', which is bent as shown, so that when one armature is home the other is withdrawn. The frame is preferably formed of brass or some other diamagnetic material. At the inner end of the armature-frame is secured a plate, U, of insulating material, carrying a contact-plate, u. A block, V, of insulating material, is secured to the frame S just over the plate u, and carries three metallic contact pieces or buttons, v v' v^2. The contact v' is connected by a wire, 11, to battery M B. The contact v is connected, as shown, to magnet M, and the contact v^2 to magnet M'. The magnet M is also connected by wire 12 to contact t of the thermostat th, and the magnet M' is connected by wire 13 to the upper metallic rings, x^3, of faucets X X' X^2. The central ring, x^4, of faucet X is connected by a wire, 14, to battery. A circuit-wire, 15, runs from lower ring, x^5, of faucet X to central ring, x^4, of faucet X', and from lower ring, x^5, of faucet X' to central ring, x^4, of faucet X^2, from lower ring, x^5, of faucet X^2 to thermostat.

The operation of the apparatus is as follows: If the weather is warm, the electric circuit is broken at the thermostat and no current can flow. If the weather is cold, the contact will be closed at the thermostat, and an electric circuit will run, say, from contact t of thermostat to magnet M, thence to contact v, to plate u, contact v', to battery, wire 14 to ring x^4 of faucet X, lower ring, x^5, of faucet X, and then by circuit-wire 15 to faucets X' X^2

and to thermostat, thus completing the circuit. It is understood, of course, that all the faucets are closed when the water is cut off from the main. It would be unnecessary to cut off the water from the main when any one of the faucets is running, as there would be no danger of freezing. When the circuit is closed through magnet M, it will be energized, and the armature M^2 will be attracted, thus opening valve R and permitting water from the main to pass into pressure-chamber O, which will close the main valve D, as hereinbefore described in connection with Fig. 1 of the drawings. At the same time that the valve D is closed the contact-plate *u* has passed from contact-button *v* and made contact with contact-button v^2, thus electrically connecting the buttons v' and v^2. No current can pass from the battery M B through magnet M, as the circuit is broken at *v*, and no current can pass through magnet M′ as long as the faucets are closed, as the current is broken between x^3 and x^4; but if it is desired to draw water from the faucets the water will be turned on from the main in the act of opening the faucets, for as soon as contact is made at any of the faucets between rings x^3 and x^4 an electric circuit will be closed, say, from upper ring, x^3, to magnet M′, to contact v^2, plate *u*, contact v', battery M B, middle ring, x^4, of faucet X to upper ring, x^3, which completes the circuit. The magnet M′, being thus energized, will attract its armature M^3, thus turning the valve R so as to register with the port *o*, thus cutting off communication between the main (through valve-stem I) and the pressure-chamber O; but a passage is open from the pressure-chamber O through channels $o\ r'\ r^2$ to the drain-pipe. The pressure being thus relieved, the valve D will open and the valve F close, so that the service-pipes may be again filled, and the drain-pipe is closed.

The apparatus described are practical, simple, and operative; but the details of construction may be widely varied without departing from my invention.

In Fig. 7 I have shown an apparatus in which the valve between the main and the service-pipes is normally held open by water-pressure in the pressure-chamber, and the valve between the service-pipe and the drain-pipe is normally held closed, the valve between the main and the service-pipe being closed as soon as the water-pressure from the pressure-chamber is cut off, and the valve between the service-pipe and the drain-pipe is opened.

A indicates the connection with the main, B the connection with the service-pipe, and H the drain-pipe.

D indicates the valve between the main and the service-pipe, and F the valve between the service-pipe and the drain-pipe.

O indicates the pressure-chamber; N, a piston moving in said chamber. The valve D rests on a valve-seat, *a*, and is guided by a valve-stem, D′, that slides in guide-holes D^2 in the casing. The valve F rests on the valve-seat *d* and is guided by a valve-stem, F, passing through guides F^2. A hollow piston-rod, I′, leads from piston N into valve-chamber G and connects by a flexible tube, G′, to the water-main at G^2. The rod I′ is also rigidly connected with a plate, W, which slides back and forth in the valve-chamber. A cam-track, *w*, is formed on the upper face of the plate W, and moves under a collar, *w*′, on the valve-stem D′. A cam-track, w^2, moves under a collar, w^3, on the valve-stem F′. The piston-rod I′ passes through suitable packing between the valve chamber G and the pressure-chamber O. A spring, I^2, is interposed between the piston N and the valve-casing, and tends to move the piston into the pressure-chamber, so as to withdraw the cam-surface from the valve D and bring it to operate on valve F—that is to say, if the spring I^2 is free to operate the valve D will close and the valve F will be open; but if water is admitted through the tube G′ and hollow piston-rod into chamber O the water-pressure is sufficient to overcome the force of the spring I^2, and will move the cam-carrying plate W, so as to open the valve D and close the valve F. A valve, P, is arranged in the hollow piston-rod to regulate the flow of water in the said rod. This valve is preferably controlled by electro-magnetic devices arranged in any suitable way, in the electric circuit of which is included a thermostat.

I claim as my own invention—

1. The combination of the main, the service-pipe, the drain-pipe, a valve for opening and closing communication between the main and the service-pipe and between the service-pipe and the drain-pipe, the main valve-seat, a pressure-chamber, a water-passage leading from a point between the main valve-seat and the water-main to the pressure-chamber, an electrically-controlled valve for opening and closing said passage, and the main valve-stem operatively connected with the pressure-chamber, whereby communication between the main and the service-pipe is closed when the pressure-chamber is expanded and communication between the service-pipe and the drain-pipe is established, substantially as set forth.

2. The combination of the main, the service-pipe, the drain-pipe, a valve normally held open by the water-pressure in the main for opening and closing communication between the main and the service-pipe and between the service-pipe and the drain-pipe, the main valve-seat, the pressure-chamber, a water-passage leading from a point between the main valve-seat and the main to the pressure-chamber for admitting water to said chamber to close the main valve and open communication between the service-pipe and the drain-pipe, an electrically-controlled valve for opening and closing said passage, and the main valve-stem operatively connected with the pressure-chamber, substantially as set forth.

3. The combination of the main, the service-pipe, the drain-pipe, a valve for opening and closing communication between the main and the service-pipe and between the service-pipe and the drain-pipe, the pressure-chamber, its diaphragm, the main valve-stem connected to the diaphragm of the pressure-chamber, a water-passage leading from the main through the valve-stem to the pressure-chamber, a balanced valve for opening and closing said passage, and electro-magnetic devices for operating said valve, substantially as set forth.

4. The combination of the water-main, the valve for opening and closing the main, the pressure-chamber, its diaphragm, the hollow valve-stem connecting the diaphragm of the pressure-chamber to the main-valve, a water-passage from the main to the pressure-chamber, an electrically-controlled valve for opening and closing said passage, the frame carried by the valve-stem for supporting the electro-magnets, the electric circuit, and the electric contacts carried by the frame for making and breaking the electric circuit, substantially as set forth.

5. The combination of the water-main, the valve for opening and closing the main, the pressure-chamber, its diaphragm, the valve-stem connected to the diaphragm, a water-passage in the valve-stem leading from the main to the pressure-chamber, a valve for opening and closing said water-passage, the electro-magnets for operating said valve, the frame on which said magnets are supported, the contacts carried thereby, the contact-finger *f*, which alternately makes and breaks contact with the contacts on the frame, and the electric-circuit connections, whereby the shifting of the contacts will energize alternately the magnets for opening and closing the valve for controlling the admission of water to the pressure-chamber, substantially as set forth.

6. The combination of the main, the service-pipe, the drain-pipe, a valve for opening and closing communication between the main and the service-pipe and between the service-pipe and the drain-pipe, the pressure-chamber, the valve-stem operatively connected with the pressure-chamber, a passage in the valve-stem for admitting water from the main to the pressure-chamber, a valve for opening and closing said passage, the electro-magnets for operating said valve, their electrical circuit-connections, and the thermostat for automatically opening and closing the electric circuit, substantially as set forth.

7. The combination of the main, the main valve, the valve-chamber, the pressure-chamber, its diaphragm, the valve-stem connecting the main-valve with the diaphragm of the pressure-chamber, the drain-pipe, the valve between the drain-pipe and the main-valve chamber, the flanged disk opposite the opening between the valve-chamber and the drain-pipe, a water-passage leading from the main to the pressure-chamber, a valve for opening and closing said passage, and electro-magnetic devices for operating the valve.

In testimony whereof I have hereunto subscribed my name.

EDWIN A. NEWMAN.

Witnesses:
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C. M. NEWMAN.