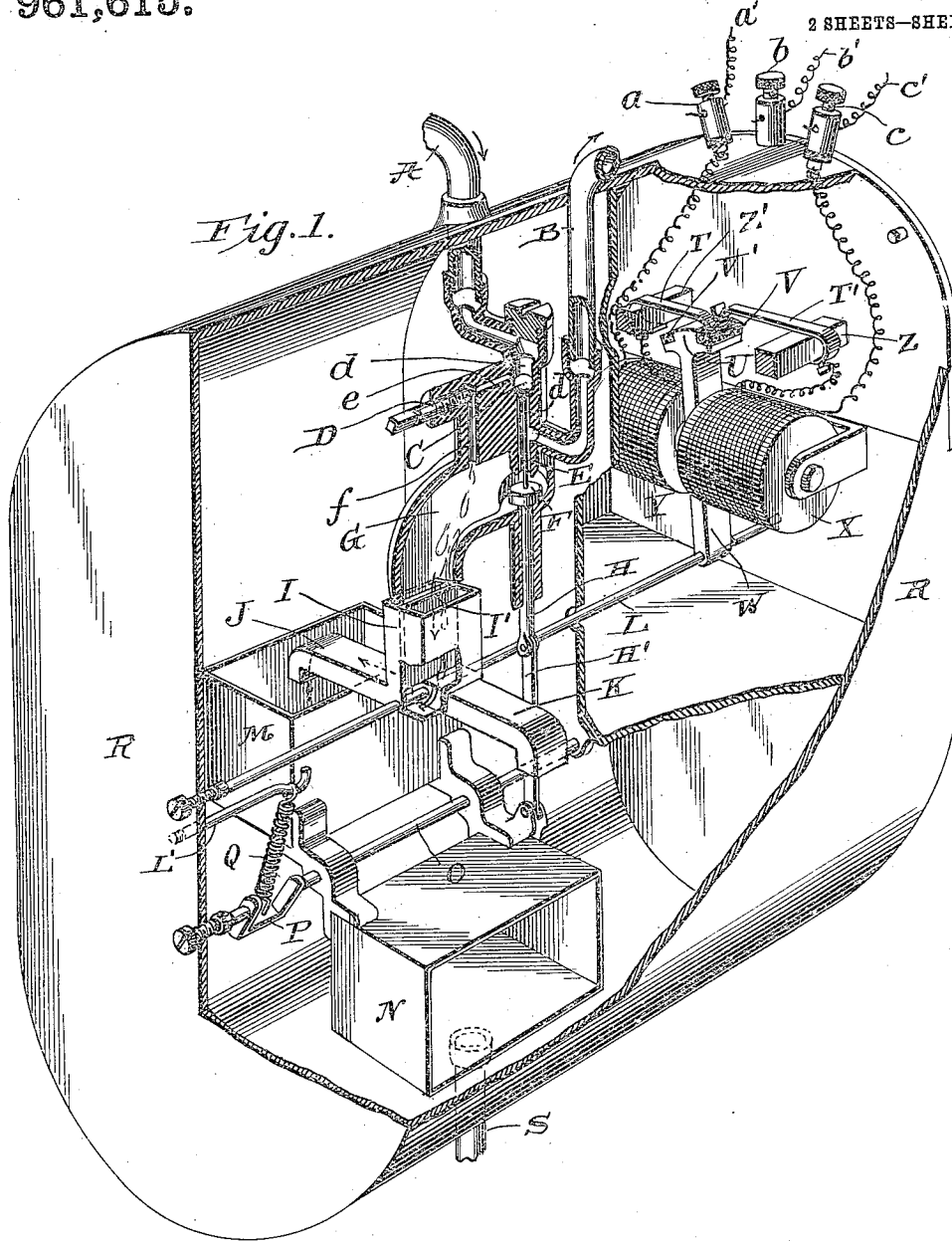


C. F. JOHNSON.
DAMPER OR DRAFT CONTROLLING DEVICE.
APPLICATION FILED NOV. 25, 1908.

961,615.

Patented June 14, 1910.

2 SHEETS—SHEET 1.



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334

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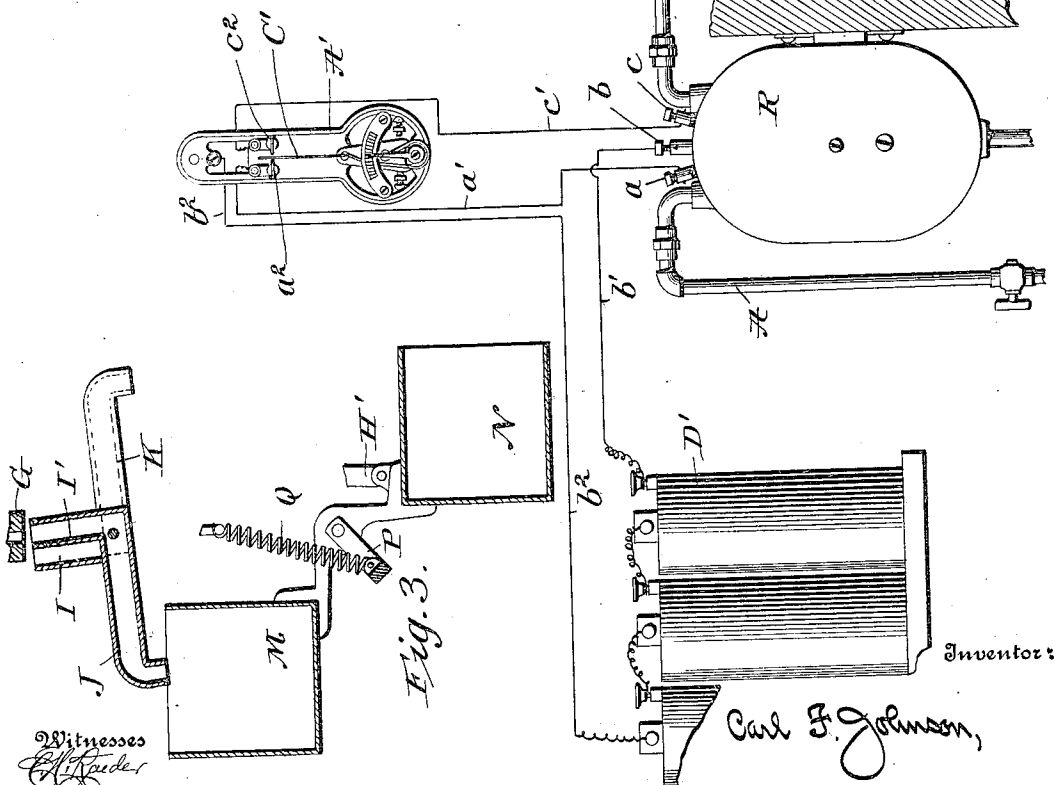
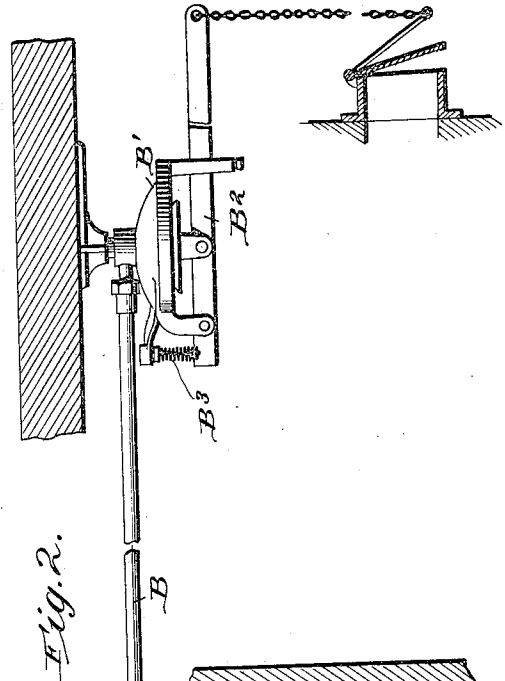
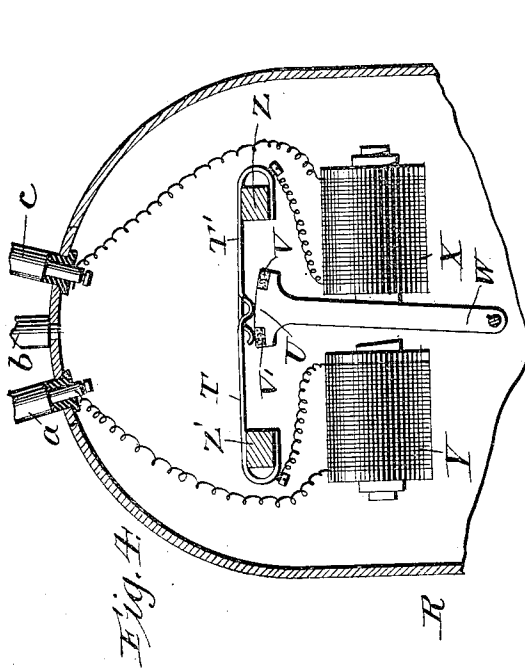
Attorneys

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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

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DAMPER OR DRAFT CONTROLLING DEVICE.

961,615.

Specification of Letters Patent. Patented June 14, 1910.

Application filed November 25, 1908. Serial No. 464,440.

To all whom it may concern:

Be it known that I, CARL F. JOHNSON, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Damper or Draft Controlling Devices, of which the following is a specification.

My invention pertains to that class of temperature controlling devices in which the requisite power for actuating the damper, or valve is furnished by the weight of a body of water. The delivery of water to one or the other of two receptacles, and the consequent operation of the apparatus, is controlled by electro-magnets in circuits including a thermostat, which thermostat causes said circuits to be momentarily closed, one at a time, the construction and arrangement being such that the circuit is promptly interrupted or opened again, and that the magnets perform but very light work.

By the improved construction, which embodies various novel features, details, and combinations hereinafter set forth, I am enabled to produce an exceedingly sensitive apparatus, involving a minimum use of electric current, and, though using a continuous water supply, using water in such limited quantity as to render the apparatus economical in water consumption.

The preferred embodiment of the invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a perspective view of the valve mechanism, the hydraulic motor which actuates the valves, and the magnetic controlling devices, portions being broken away or in section better to show their construction and arrangement; Fig. 2, a diagrammatic view, illustrating the relative arrangement of different parts of the complete apparatus or system; Fig. 3, a detail view of the tipping water buckets and supply spouts; and Fig. 4, a detail view of the magnetic spout-actuating and circuit-controlling devices.

In the form of apparatus here illustrated the check draft door or damper of a furnace is shown as the primary temperature-controlling means, and the door or damper is assumed to be open when the motor is vented or not subject to water pressure, and to be closed when the motor is operating under pressure, though the arrangement may obviously be reversed.

The general scheme of the apparatus con-

templates a thermostatic circuit closer which, on rise or fall of temperature to a predetermined point above or below the adopted normal, causes completion of one or the other of two circuits, the energization of a magnet in the circuit so closed, the attraction of an armature and consequent rocking of a shaft carrying water delivery spouts which deliver into one or the other of two buckets carried on opposite sides of a second rockshaft, the rocking of which latter causes a three-way valve to be actuated to admit water to a fluid pressure motor or to vent it therefrom, said motor when connected with the water supply lowering or closing a check draft door or closing a damper, and when vented lifting or opening the same.

Referring first to Fig. 1, A indicates a water supply pipe, which may be connected with the ordinary service main or other source of water under head or pressure, and B a pipe for conveying the water to a fluid pressure motor B', here represented as of the flexible diaphragm type, for which, however, any recognized equivalent may be substituted. Motor B' consists of a substantially hemispherical shell across the open side of which is stretched a flexible diaphragm, made air and water tight by a clamping ring or like means, as usual, and a lever B² pivotally connected near one end to the shell or casing and with the other end of which the draft or damper is connected by chain or equivalent means, and which carries an intermediate mushroom head or disk to bear against the diaphragm. A spring B³ acting upon the short arm of lever B², tends to lift the long arm of said lever, and hence to open the check door or damper. No claim is made to this construction, which is common and well known.

Pipes A and B communicate with a casting or valve body having a vertical passage *d* open at its lower end, and containing a seat for a gravitating valve C, here represented as a ball. Within the vertical passage *d* beneath the ball valve, and extending below the open lower end of the passage, is a loose wire or stem E of smaller diameter than the passage *d*, the lower end of which wire rests upon a valve disk F, which disk at certain times closes the lower end of said vertical passage *d*. At a point above the valve C and its seat there is provided a lateral passage *e*, which opens into a vertical passage *f*, which in turn communicates with

a delivery spout G of the valve shell or casting. The discharge opening of spout G is in the form of a narrow slit, so that the water shall be delivered therefrom in a thin sheet or stream, or in mere drops when insufficient in quantity to produce a stream. Lateral passage *e* is controlled by a pin valve or pointed screw stem D, whereby its discharge capacity may be nicely regulated, and the escape or leakage through it may be reduced to drops; but said passage is always open to a limited extent.

Directly beneath or in vertical plane with the delivery opening of spout G is a rockshaft L, journaled in the shell or casing R of the structure, and carrying at or near one end an arm W, the upper end of which is broadened out into a T-head, and curved concentrically with the axis of rockshaft L. At its midlength the upper face of the T-head is left of full height to form a contact rib or face U, while at each side thereof it is cut away, and provided with blocks V, V', of suitable insulating or non-conducting material such as gutta-percha, indurated fiber, or the like. The blocks V, V' may obviously be omitted, but it is deemed advisable to use them to guard against accidental contact of the conducting fingers T and T' therewith, and to give easy action. Arm W is of iron or steel, preferably soft iron, and serves as an armature or keeper for two electro-magnets X and Y arranged on opposite sides of the arm W, and in such proximity thereto that the latter is always within the range or field of their attraction.

The contact springs or fingers T, T', above mentioned, are carried upon insulating supports Z and Z', and each is in circuit with the winding of the electro-magnet beneath it. Upon the metallic shell or casing R are mounted three binding screws *a*, *b* and *c*, of which *a* and *c* are insulated from the shell or casing, while *b* is in metallic and electrical connection or communication therewith, and consequently with rockshaft L journaled in the casing, and with arm W carried by said rockshaft. From the binding screw *a* wire or conductor *a'* passes to an insulated contact screw or stem *a*² of a thermostat A' (Fig. 2) located in the apartment in which the temperature is to be controlled, the screw being on that side of the bimetallic bar C' of the thermostat toward which the bar moves on fall of temperature. From binding screw *b* a wire or conductor *b'* passes to one pole of a battery D', the other pole of which is connected by a wire or conductor *b*² with the metallic frame of the thermostat or directly with the bimetallic bar C'. Binding screw *c* connects by a wire or conductor *c'* with a contact screw or stem *c*², on that side of bimetallic bar C' toward which said bar moves on rise of temperature.

Contact springs or fingers T and T' are so

positioned that when bearing surface U is in its medial position both fingers shall bear thereon, but as the throw of arm W is completed in either direction, U will pass out of contact with one finger, and remain in contact with the other. This will place the armature under the command of either magnet when in medial position, leaving the apparatus in condition to act in one or the other direction, according to the completion of one or the other magnet circuit.

Rockshaft L carries above it a box or receptacle I, having a central upright partition I' in alinement with the rockshaft, dividing it into two compartments from the right hand one of which a spout or conductor J extends laterally to the left, and from the left hand one of which a like spout or conductor K extends to the right, as plainly seen in Figs. 1 and 3. The rocking or tipping of the shaft L is limited by stops. The parts are so proportioned and adjusted that in tipping from one to its other position, box I shall bring the right hand or the left hand compartment directly and fully beneath the outlet opening of the spout G so as to insure delivery of all the water then passing from said spout into the compartment so positioned.

The weight of the bar W, thrown to one or the other side of the vertical plane of its axis of motion, holds the box I and its spouts or conductors J, K, in the position to which they are moved through the movement of said bar. The weight of any water in either arm will tend to hold the arm in correct position. Beneath the rockshaft L is a second rockshaft O parallel therewith, and journaled at one end in the outer wall of the casing R and at the other end in a cross partition which, together with a horizontal partition or floor, separates the magnet-containing space from the space in which the hydraulic portions of the apparatus are located, this provision being made better to protect the magnetic apparatus from rust incident to the moisture in the hydraulic chamber.

Rockshaft O is formed with a crank P from which a spring Q is carried to arm or rod L', or other convenient point of attachment, said spring serving to pull upon the crank P and rock the shaft O in one or the other direction, according as the crank pin is carried to one or the other side of the vertical plane of the axis of said rockshaft. On opposite sides of the rockshaft, and carried by suitable brackets secured to the shaft, are two water receptacles or buckets M and N having one open side, which side, when the bucket is raised to its highest position, stands horizontal and constitutes an open top, as will be seen upon referring to Figs. 1 and 3 in which the bucket M is raised to its receiving position. When the bucket

M is raised as shown, bucket N is turned to discharge position as shown in the same figures; that is to say, its open top or side then stands in vertical or substantially vertical plane.

Pivotaly connected with the bucket N, or with one of its supporting brackets, is a bar H', the upper end of which is pin jointed or otherwise pivotaly connected with a stem H passing vertically through a tubular neck depending from the shell or casting containing the valve C, passages *d, e, f*, and spout G. Said stem H carries at its upper end the valve disk F hereinbefore referred to as sealing at times the lower end of passage *d* in the valve shell or casting. It will be seen that this disk F will, when the bucket N is lowered, fall to the floor or bottom of the interior space of the spout G, and tend to seal the passage or opening through which stem H moves. Conversely, when the bucket M is lowered, disk F will be pressed against the lower end of the nipple at the lower end of passage *d*, thus sealing said passage.

S indicates a waste pipe connected with the bottom of the shell or casing R, and serving to carry off therefrom the water delivered into it.

The apparatus being constructed as above set forth, and connected up in the manner shown in Fig. 2 and above described, the operation is as follows: Bar or armature W is shown in Fig. 1 drawn over to the left, or toward electro-magnet Y, which would indicate that it was last actuated through a fall of temperature. It will be noted that in thus moving to the left the bar or armature W carries its conducting rib U out of contact with spring contact finger T, which finger is electrically connected through binding screw *a* and conductor *a'* with contact screw or stem *a*² of the thermostat on the "cold" side of the bar C'. Hence it is impossible again to complete the circuit through the "cold" side, or through contact *a*² at which the circuit was last completed to energize magnet Y and cause attraction of the armature or bar W. In thus breaking contact between finger T and bar U, contact is established between said bar U and finger T'; hence upon rise of temperature to a predetermined degree, the bimetallic bar C' swinging into contact with stem or screw *c*² will establish the electric circuit from battery D', by conductor *b*², the frame or body of thermostat A' and bimetallic bar C', contact screw *c*², conductor *c'*, binding screw *c*, the winding of electromagnet X, contact finger T', rib U, bar W, rockshaft L, casing R, contact screw *b*, and conductor *b'* back to the battery, thus making a complete or closed circuit including magnet X, which being thus energized will draw the bar W to the right, tip the box I in like direction, destroy the contact between rib U or bar or

armature W and spring finger T', and establish contact between said rib U and finger T preparatory to completion of the circuit through falling of temperature and reversal of operation.

It has been above stated that there is a constant flow of water from spout G due to the by-pass *e, f*. Assuming that bucket M is in receiving position, the water will gradually accumulate therein until its weight is sufficient to overcome the resistance offered by spring Q, whereupon it will begin to descend and in doing so will rock the shaft O, this operation continuing until the crank P passes to the opposite side of the vertical plane of the axis of rockshaft O, when said spring acting to turn the shaft in the same direction as does the weight of the water in bucket M, will suddenly turn the shaft the distance necessary to complete the dumping of bucket M. As the bucket M descends, bucket N will rise and through the connecting link H' will lift stem H and disk F, causing the latter to seal the lower end of passage *d*, to lift stem E, and thereby to unseat the valve C. Said valve being unseated, water will flow through supply pipe A to pipe B, and thence to the water chamber of fluid pressure motor B', where it will force out or distend the diaphragm of said motor, and overcoming the force of the spring lower the long arm of its lever, thereby dropping the draft door or closing the damper, and thus checking the fire.

So long as the temperature of the apartment does not rise above a predetermined limit, the parts will retain the positions thus described, the water from spout J merely falling upon the closed side of the then lowered bucket M and running off therefrom into the bottom of the casing R, and finally by waste pipe S to the sewer or waste receptacle. Should the temperature rise to the predetermined point at which the bimetallic bar C' will make contact with the screw or stem *c*² on the "hot" side, electro-magnet X will be energized, and will move bar or armature W from the left hand position indicated in Fig. 1 to the right hand position indicated in Fig. 4, thereby immediately breaking or destroying the circuit of the magnet X and reestablishing within the casing R the circuit connections of the magnet Y which, however, will be broken in the thermostat by reason of the bar C' having swung toward the "hot" side and away from "cold" contact *a*². The movement of armature W to the right will, however, tip or turn rockshaft L, causing the left hand compartment of box I to be brought beneath the spout G, and consequently spout K will deliver water into the then elevated bucket N. As said bucket falls it will gradually descend until crank P swinging past the vertical plane of the axis of shaft O, will cause

said bucket to discharge and bucket M to be raised to receiving position.

In descending bucket N will draw down the valve stem H and valve disk F, thus venting the fluid pressure motor B' through pipe B and passage *d* into spout G, at the same time permitting valve C to descend and seal the upper end of passage *d*, thereby cutting off the flow of water from the supply pipe A to the fluid pressure motor B'. The pressure fluid chamber of motor B' being thus vented and relieved of pressure, the lever of said motor will be raised through the action of its spring, and the check draft will be opened or the damper closed so as to check the fire and lessen the supply of heat.

It will be seen from the foregoing description that the electric circuit is at no time completed for more than an instant, being immediately interrupted through the action of the electro-magnet in the circuit which it thus completes; hence current consumption is reduced to a minimum. It will also be observed that the parts moved by the magnet are small and light, and offer no material resistance; hence a very light battery current is sufficient to actuate them. It will further be observed that the power required to actuate valves C and F is afforded by the weight of water received in one or the other of the buckets M, N, and that this force acts wholly independent of the electric or magnetic devices, which serve merely to determine in which direction or into which bucket the water shall be delivered. So, too, it will be seen that whether the buckets M and N and the parts connected therewith make a full movement or only a partial movement; whether they function or fail to function, the electric circuits will not be thereby affected, but will be momentarily completed and almost instantly interrupted or broken when the thermostat establishes contact or connection with either branch thereof.

It will be noted that under the above described construction the draft or damper will not be instantly moved upon the shifting of the thermostatic bar into contact with one or the other of its contact screws, but that one or the other bucket must fall before such action takes place. The time required for such falling is controllable by the pin valve D, and may be further controlled or determined by the dimensions or capacity of the buckets M and N, which will preferably be made of aluminium or other light and thin material, requiring in themselves but little power to move them. They may be quite small, and yet the time required for them to fill may be made quite long owing to the minute quantity of water permitted to find its way through the by-pass when the stem D is set close to its seat. This comparatively slow action prevents too sudden

or rapid fluctuation in temperature, but, as indicated, the changes may be made as prompt as desired. If the range of movement of the thermostat represent a considerable variation in temperature, the buckets should be made to fill quite promptly, but if very slight range of temperature is represented in the extreme movements of the thermostat, more time should be allowed for the filling of the buckets. In this way a double means of control is afforded.

The power necessary to actuate the valve or damper is afforded by the pressure of the water entering the pressure fluid chamber of the motor B', which latter may be made of any dimensions necessary to insure prompt and proper movement of the draft, damper, or other device.

While I have in the foregoing description set forth the employment of a spring Q to give a quick action of the buckets, this is not essential, and the quick action can be secured without its aid. It will be observed that by reason of the relative location and arrangement of the valves C and F and their actuating devices, there is a position of parts in which both of said valves are open at the same time, and that at such time water will rush from inlet A into the passage G, and into whichever of the buckets M or N may at the time be in its elevated position. Thus, starting with the buckets in the positions indicated in Fig. 1, as the bucket M begins to fill with water from the by-pass *e f* it begins to lower, and as it does so the connecting rods H' and H lift valve C from its seat before valve disk F closes the mouth or lower end of passage *d*. Water will consequently rush through the passage *d*, past the valve disk F, and through passage G into bucket M, causing said bucket to fill very rapidly thereafter and to drop quickly. Similarly, when bucket N is in its elevated position and is being slowly filled by the water entering through the by-pass *e f*, valve disk F will move away from and open the mouth of passage *d* before valve C closes the passage G. Hence the water rushing through the passages *d* and G and flowing into bucket N, will speedily fill said bucket, and cause it to tip quickly. Under these conditions only the quantity of water necessary to fill the bucket will be used, and hence although the action may be made as quick as desired, no greater amount of water will be used than would be were the filling of the buckets carried on slowly throughout. In this way there is produced a device which may be made to operate with suitable promptness without necessitating a large flow of water through the by-pass *e f*. It is what may appropriately be termed a "step-up" device, or a form of water relay.

As above pointed out, the fingers T and T' both bear upon the conducting surface

U of armature W when the latter is in its medial position, hence there is no time when the magnets lose control of the armature and parts connected therewith. No harm can result, and no material loss of current can occur, by reason of the simultaneous contact of both fingers with the armature, for the reason that but one magnet can be in circuit through the thermostat at any given time. In other words, whenever one circuit is completed through the thermostat the other is broken at that point.

In speaking of a draft or damper, and in illustrating the check draft door, I have used these terms and selected this example merely for purposes of illustration, it being obvious that a ventilating valve or damper, a check draft or damper, an air inlet door to admit air beneath the grate for brightening the fire, or a valve controlling steam, vapor, or hot water supply, may at will be connected with and operated by the apparatus here described, the connection being varied, of course, according to the purpose and operation of the member controlled. In other words, the ultimate object or purpose of the apparatus is to control temperature, and any valve, damper or like device, controlling the inlet of air above or below the fire, or the supply of heating agent or medium, may obviously be actuated and controlled by the apparatus herein set forth. In the claims, I shall therefore employ the generic term "temperature controlling" apparatus, as covering and including valves and dampers generally, as applied to temperature regulation or control.

Having thus described my invention what I claim is:

1. In a temperature-controlling apparatus, the combination of a fluid pressure motor for actuating the draft or damper; a valve for controlling the supply and exhaust of pressure fluid to and from said motor; a hydraulic motor for actuating said valve provided with an oscillating shaft having buckets on opposite sides of its axis; an intermediate delivery device adapted to deliver water to either bucket at will; an armature connected with and serving to move the delivery device to cause it to deliver to either bucket at will; electro-magnets adapted to move said armature in reverse directions; a thermostatic device adapted to close a gap in the circuit of each magnet in alternation; and a circuit closer carried by the armature and adapted when moved by either magnet to break immediately the circuit of said magnet and close a gap in the circuit of the other magnet.

2. In a temperature-controlling apparatus, the combination of a fluid pressure motor; a valve controlling said motor; an oscillating hydraulic motor having a pair of buckets, for actuating said valve; a water

conductor independent of the hydraulic motor for delivering water to one or the other bucket thereof as required; an armature connected with and serving to move said conductor; electro-magnets adapted to move said armature in opposite directions; and circuit closing devices included in circuit with the respective magnets and the armature, and serving to interrupt the circuit of whichever magnet is energized, immediately after such energization.

3. In a temperature-controlling apparatus, the combination of a valve, and a hydraulic motor for controlling the same; a water conductor movable to different positions to determine the direction of operation of said hydraulic motor; an electro-magnetic controlling and actuating device for said conductor, comprising a battery or source of electric energy, an armature constantly in electrical circuit with the battery or source of power, and two electro-magnets for moving said armature in opposite directions, electrically connected with said battery; contact springs or fingers in circuit with the respective electro-magnets and battery, positioned substantially as described, so that when the armature is attracted by one magnet said armature shall be carried into electrical contact with the finger of the second magnet, and then out of electrical contact with the finger of the first magnet; and a thermostatic circuit closer included in circuit with the battery or source of energy, and having two contacts through one or the other of which the circuit of one or the other electro-magnet will be closed, when the temperature falls below or rises above predetermined degrees.

4. In a temperature-controlling apparatus of the character described, the combination of an oscillating hydraulic motor, an oscillating feed spout therefor provided with an armature W having conducting surface U and non-conducting surfaces V, V', magnets X, Y, adapted to move the armature in opposite directions, and contact springs or fingers T, T', in circuit with the respective magnets and having overlapping ends, whereby one or the other of said contact springs will rest upon the conducting surface and the other upon a non-conducting surface in whichever extreme position the armature may stand, and the movement of the armature to either position is caused promptly to break the circuit of the magnet by which it is attracted.

5. In a temperature-controlling apparatus of the character described, the combination with the metallic shell or casing R, of an oscillating hydraulic motor, an oscillating supply spout for said motor, provided with a rockshaft L in electrical connection with the casing, and provided with an armature W having conducting surface U and non-

conducting surfaces V, V'; electro-magnets X and Y located on opposite sides of said armature; contact springs T and T' insulated from the shell or casing R, overhanging the conducting and non-conducting faces of the armature, and respectively included in the independent circuits of said magnets; a battery or source of electrical energy; a thermostat; wires or conductors, one extending from a pole of the battery to the shell or casing R and the other to the thermostat; and conductors extending from contact points of the thermostat to the respective magnet windings, the movable member of the thermostat being adapted to make contact with one of the contact points of the thermostat upon a fall of temperature and with the other of said contact points upon a rise of temperature.

6. In a temperature-controlling apparatus, the combination of a heat-controlling valve; a fluid pressure motor connected with said valve; a supply pipe connected with a source of pressure fluid; a three-way valve interposed between the supply pipe and the fluid pressure motor; a by-pass on the supply side of said valve; a hydraulic motor comprising a rockshaft and buckets carried thereby; a valve connected with said hydraulic motor and adapted, when the rockshaft moves in one direction, to lift from its seat, and thereby to open communication between the supply and the fluid pressure motor, and thereafter to seal the outlet from said motor; and thermostatically-controlled means, independent of the hydraulic motor, for directing water delivered through the by-pass to either bucket of said motor at will.

7. In a temperature-controlling apparatus, the combination of a metallic shell or casing R; a water supply pipe A; a water delivery pipe B; a fluid pressure motor B' connected with said pipe B, and serving to move the draft or damper; a valve shell or casing interposed between the pipes A and B and provided with a passage *d*, by-pass *e*, *f*, and spout G; valve C serving to open and close the passage *d* between the pipes A, B; valve F serving to open and close the lower end of passage *d*; rockshaft O provided with buckets M and N and having crank P; spring Q connected with said crank; connections H, H', between the rockshaft O and valve F; stem E interposed between valves C and F; rockshaft L provided with divided box I having spouts J, K; armature W carried by

rockshaft L and provided with conducting surface U and non-conducting surfaces V, V'; electro-magnets X, Y, on opposite sides of said armature; contact spring T in circuit with the winding of magnet Y; contact spring T' in circuit with the winding of magnet X, said springs being insulated from shaft L being in electrical contact with the containing shell or casing R; battery D'; thermostat A' provided with contacts *a*², *c*², and bar C'; conductors connecting one pole of the battery with the thermostat and the other pole with the shell or casing of the apparatus; and conductors connecting the contact points *a*², *c*² of the thermostat respectively with the windings of the magnets Y and X.

8. In a temperature-controlling apparatus of the character described, the combination with a valve to be actuated, of rockshaft O provided with crank P and buckets M, N; spring Q connected with said crank P; a delivery spout G; a rockshaft L carrying a box I with vertical partition I' beneath said spout, and having spouts J, K, extending in opposite directions from the box I; and means, substantially as described, for rocking shaft L to carry the partition I' to one or the other side of the delivery spout.

9. In a temperature-controlling apparatus of the character described, the combination of a fluid pressure motor for actuating a valve, damper, or like heat-controlling device; a valve shell or casing having an inlet for water, an outlet for water in communication with the fluid pressure motor, and a by-pass opening into a discharge spout; an oscillating hydraulic motor arranged to receive water from said spout; and valves actuated through the oscillation of said hydraulic motor, and adapted to first open communication simultaneously between the inlet and the fluid pressure motor and between the inlet and the discharge spout, and then to close communication between the inlet and discharge spout, whereby water is delivered through said spout in quantity sufficient to promptly fill and cause the descent of the receiving bucket of the hydraulic motor.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CARL F. JOHNSON.

Witnesses:

I. M. TITUS,
E. NEUBURGER.