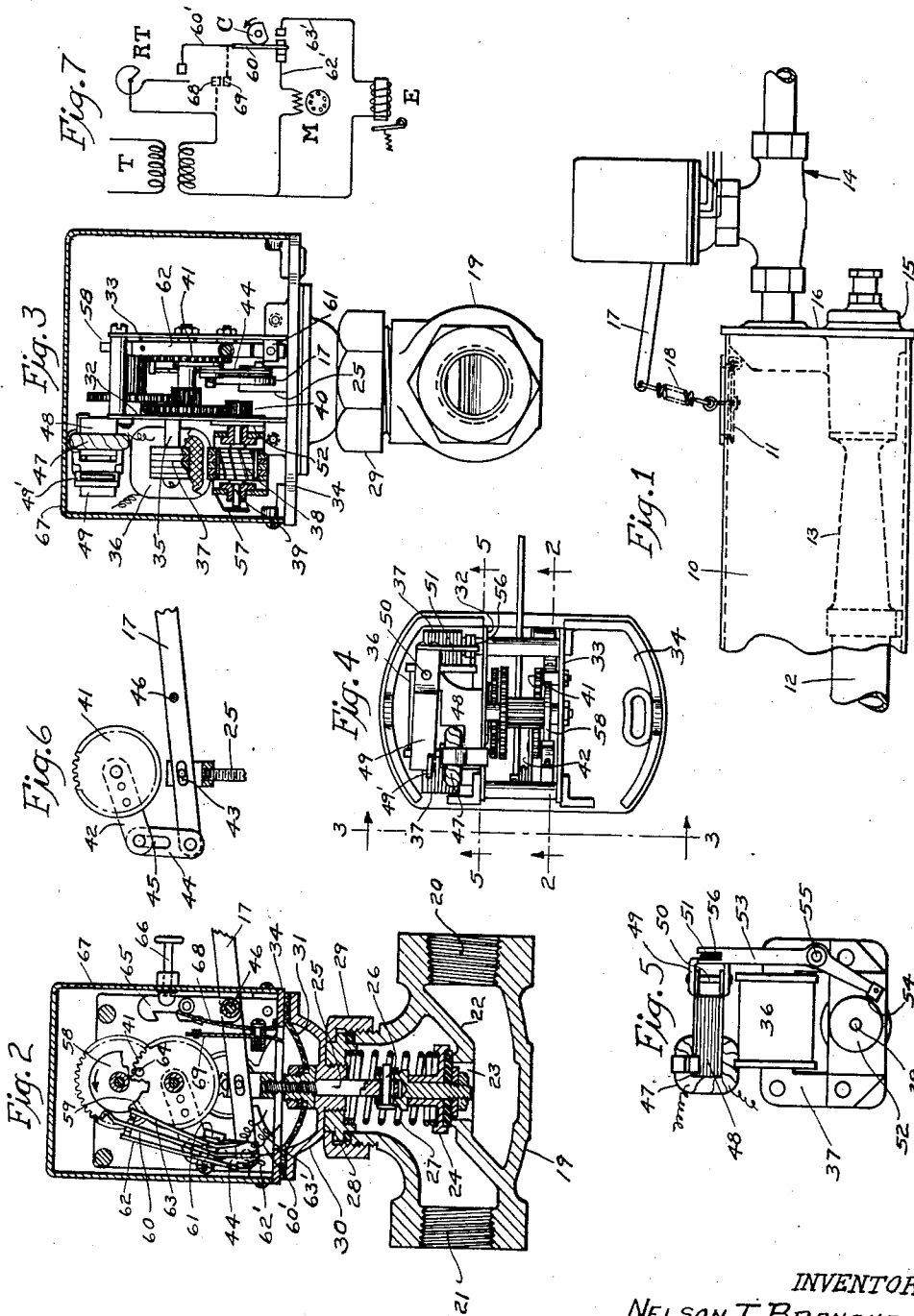


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N. T. BRANCHE
MOTOR OPERATED VALVE
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INVENTOR:
NELSON T. BRANCHE
BY
Charles A. Lind
ATTORNEY.

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MOTOR OPERATED VALVE

Nelson T. Branche, Toledo, Ohio, assignor, by
mesne assignments, to Minneapolis-Honeywell
Regulator Company, Minneapolis, Minn., a
corporation of Delaware

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17 Claims. (Cl. 137—139)

This invention relates to improvements in motor-operated valves and more particularly to valve-operating mechanism for valves which are biased toward closed position. Valves of this type have special utility with gas burning apparatus for house heating furnaces under the control of a room thermostat. The invention has among its objects to provide power-operated means independent of the valve-opening motor for holding the valve open after the motor has opened the valve, and to provide other improvements hereinafter more fully set forth.

Referring to the drawing wherein the preferred embodiment of the invention is shown:

Fig. 1 is a fragmentary side elevation of a gas burning unit showing how the improved valve is associated therewith;

Fig. 2 is a sectional elevation of the valve and operating mechanism therefor, the section being taken on line 2—2 of Fig. 4;

Fig. 3 is an elevation of the valve with a side wall removed, the view being taken on line 3—3 of Fig. 4;

Fig. 4 is a plan view of the valve operating mechanism with the housing removed;

Fig. 5 is a view of a detail of the device, the view being taken on line 5—5 of Fig. 4;

Fig. 6 is an enlarged detail view of parts shown in Fig. 2, and

Fig. 7 is an electrical diagram showing a simple circuit for connecting the device for operation with a domestic house heating unit.

In the drawing, 10 indicates a box-like conduit forming part of a gas burner and having a secondary air opening normally closed by damper 11. Combustible mixture is supplied to the burners (not shown) by a pipe 12 which leads from a mixing tube 13, gas being delivered to the mixing tube from the gas valve generally indicated at 14. Air for mixing with the gas is controlled by an air shutter 15 at the front of the conduit, said front being closed by a casting 16 having formed therein appropriate passages for delivering the air and gas to the mixing tube. The burner apparatus itself forms no part of the present invention but has been briefly described merely to indicate the environment wherein the invention finds special utility.

The gas valve is either fully open or closed, depending upon heat requirements. When the gas valve is open, the secondary air damper 11 is also open and vice versa, appropriate connections being provided between the damper and valve operating mechanism to effect this result. The connection preferably comprises a lever 17 one end

of which is connected to the damper by a spring 18 and the other end of which is suitably connected to the valve operating mechanism hereinafter described. The lever 17 is also utilized for manually opening the valve in case of current failure to the valve opening motor.

The gas valve comprises a valve casing 19 having inlet and outlet connections 20 and 21 and having a dividing partition 22 provided with the passage 23 forming a valve seat. The valve is indicated at 24 and its valve stem at 25, the valve being hinged to the stem as indicated at 26. A spring 27 interposed between the valve and a body 28 at the top of valve casing serves to normally hold the valve to its seat. Said body is removably secured to the valve casing by a collar 29. Supported by said body 28 is a bowl-like member 30 across the top of which extends a flexible diaphragm 31 through the center of which the valve stem passes in a gas tight manner, the diaphragm providing an effective seal between the valve chamber and the exterior operating mechanism.

The valve-operating mechanism is mounted upon two spaced upright plates 32 and 33 secured to a base plate 34 supported by the member 30. The valve-operating motor is secured to the plate 32 by laterally extending members 35. The motor field is indicated at 36, the poles at 37, the rotor at 38, and the rotor shaft at 39. This shaft projects through the plate 32 and has secured there- to a pinion 40. This pinion drives a gear train which in turn actuates the valve stem 25 by means of a crank and lever arrangement. The final driven gear is indicated at 41. Secured to this gear is a crank arm 42. The lever 17 previously mentioned is connected with the valve stem 25 by a pin and slot connection 43. Connecting the crank arm 42 and lever 17 is a link 44 having a lost motion connection 45. The lever is pivotally mounted on a rod 46 which is supported by the side plates 32 and 33.

Delivery of current to the motor will cause its rotor 38 to revolve with resultant opening of the valve 24 as will now be readily understood. Since the lever 17 is part of the valve-operating mechanism and since this lever is connected to the damper 11, it follows that the damper will be operated in unison with the valve 24.

In the ordinary type of motor operated valve, current continues to flow through the motor after the valve has been opened, otherwise the spring 27 would immediately close the valve, the gear train being such as to permit the spring to rotate the gear train. The present invention, however, provides means for cutting off the current to the

motor after the valve has been opened and provides a magnetically operated brake for preventing the spring from closing the valve.

Referring to Figs. 3, 4 and 5 wherein the preferred form of braking mechanism is shown, 47 indicates an electro magnet, the core 48 of which is supported by the side plate 32. The armature is an arm 49 hinged at one end as at 50 to an extension from the core 48. The arm 49 is provided at its outer end with a piece of copper plate 49' which acts as a choke or dam in the lines of the magnetic force. Thus fluctuation of the magnetic force due to the pulsations of the alternating current is prevented, as will be readily understood by those skilled in the art, and chattering or vibrating of the arm is prevented. Secured to the arm 49 and projecting laterally therefrom is a spring blade 51. Secured to the rotor shaft 39 is a brake disk 52. A brake lever 20 is indicated at 53 and its shoe at 54, the lever being pivoted on a suitable support 55 between the plate 32 and the pole leg 37 of the motor. The upper end of the lever is slotted as indicated at 56 and the spring blade 51 extends into the slot. When the armature arm 49 is attracted by the magnet the free end of the blade 51 moves to the right as viewed in Figs. 4 and 5 and applies the brake by actuating the brake lever 53 as will now be understood. The spring blade 51 obviously provides a yielding connection between the armature arm 49 and the brake lever 53. When current to the electro magnet is cut off the brake automatically releases. Since the brake disk 52 is attached to the motor shaft 39, the motor is effectually kept from rotating and the valve is maintained in its open position when current to the motor is cut off.

As soon, however, as current is shut off from the electro magnet, the valve spring 27 will close the valve, the spring being sufficiently strong to overcome the inertia of the motor and train of gear and drive the valve down with considerable force, thereby insuring a complete seating of the valve. By providing a lost motion connection between the crank 42 and the valve stem as indicated at 45, rotation of the motor and gear train under the influence of the valve spring is not immediately stopped and consequently not only is there less strain on the mechanism but rebound of the valve incident to reversal of rotation of the gear train and motor following sudden stopping of rotation is effectually prevented. Means for exerting some frictional resistance on the rotating parts may also be provided as by a leaf spring 57 arranged to press on the end of the rotor shaft.

The means for cutting off the current to the valve operating motor and admitting current to the brake operating electro magnet will next be described. Mounted for rotation with the top-most shaft of the gear train is a cam 58 comprising a circular disk having a notch 59 in its periphery. Said shaft rotates approximately 300° during the opening of the valve. 60 indicates a leaf spring switch-arm the upper end of which always bears on the cam and the lower end of which is secured to a bracket 61. Also secured to said bracket are two spring switch arms 62 and 63. Arms 60 and 62 are in electrical contact when arm 60 is out of the cam notch 59 and arms 60 and 63 are in electrical contact when arm 60 is in said notch. Wires 60', 62', and 63' lead from the respective switch arms. The arrow on the cam indicates the direction of rotation in opening the valve.

Fig. 7 shows a wiring diagram for the apparatus in connection with a room thermostat. In the diagram, the valve operating motor is indicated at M and the brake-operating electro magnet at E. A room thermostat is indicated at RT and T 5 indicates the source of power which in the present case is a transformer. The equivalent of cam 58 is indicated at C. When the thermostat at RT closes, current will flow to the motor M to open the valve, it being noted that the cam C 10 meanwhile maintains the switch arm 60 at the left to keep the motor circuit closed. The cam rotates in the direction of the arrow adjacent thereto. When the valve has opened the cam will permit the switch arm 60 to move to the right to break the motor circuit and make the electro magnet circuit. When the thermostat opens the electro magnet is deenergized, whereupon the valve spring will close the valve as will now be readily understood.

In case there should be a failure of current, the valve may, nevertheless, be manually opened in the following manner and by the following described means. The outer end of the lever 17 is depressed whereupon the valve will open and the crank-carrying gear 41 given a partial rotation. On this gear is a latch pin 64 with which a latch arm 65 may be engaged by pushing on a push rod 66 mounted in a wall of the housing 67 wherein the operating mechanism is contained. A spring blade 68 normally holds the latch arm in retracted position. The pin 64 is so placed on the gear that when it is latched the gear may still be rotated a few degrees in a valve opening direction and consequently when current is again effective at the motor the gear will be rotated sufficiently to automatically release the latch. To put the matter in another way the pin 64 is so located that the switch arm 60 does not enter the cam notch 59. The spring 68 also serves as a switch arm which when the latch is closed makes contact with a switch blade 69. When this switch is closed the room thermostat is shunted out (see Fig. 7) with the result that even if the room thermostat should be in open position, current will flow to the motor and rotate it sufficiently to cause release of the latch 65 whereupon the motor circuit is broken and the valve spring will close the valve. In case the room thermostat is closed the motor will continue to operate until the switch arm 60 enters the cam notch 59 and thus transfers the current to the electro magnet which operates the brake.

What I claim is:

1. In a valve operating mechanism the combination of a valve which will automatically close unless positively held open, of a motor adapted to move the valve to open position when power is applied to the motor, holding means adapted when power is applied thereto to prevent reversal of the motor when power thereto is cut off, control means for said motor operable upon actuation thereof to apply power to said motor but not to said holding means to open said valve, further means operable upon movement thereof in one direction to first cut off power to the motor and then to apply power to the holding means, and means having an operable connection with said valve and movable therewith, said last named means being operative upon said valve moving to open position to operate said means for cutting off power to the motor and applying power to the holding means.

2. In a valve operating mechanism, the com-

5 combination with a valve which will automatically close unless positively held open, of a motor adapted to move the valve to open position when power is applied to the motor, means for preventing reversal of the motor when power thereto is cut off comprising a friction brake and an electromagnet for actuating the brake, and means for cutting off power to the motor when it has fully opened the valve and permitting power to be applied to the electromagnet.

10 3. In a valve operating mechanism, the combination with a valve which will automatically close unless positively held open, of a rotary electric motor adapted to open the valve when power is applied to the motor, of a friction brake adapted to prevent said valve from closing, an electromagnet adapted to actuate said brake, and means for simultaneously cutting off power to the motor after it has fully opened the valve and applying power to said electromagnet whereby the brake may be applied for the purpose specified.

20 4. In a valve operating mechanism, the combination with a valve which will automatically close unless positively held open, of a rotary electric motor adapted when energized to move said valve to open position, a power multiplying gear train connecting said motor and valve, a brake adapted to prevent said valve from closing, an electromagnet adapted when energized to apply the brake, and means for first cutting off power to said motor and then closing the circuit to said electromagnet following opening of the valve by said motor.

25 5. In the combination claimed in claim 4, said brake acting on the rotor of said motor.

30 6. In a valve operating mechanism, the combination with a valve which will automatically close unless positively held open, of a rotary electric motor adapted when energized to open the valve, a brake adapted to prevent the valve from closing following opening thereof by the motor, an electromagnet, means for cutting off power to said motor after it has opened the valve, means for supplying power to the electromagnet when power to the motor is cut off, means connecting said brake and electromagnet comprising a pivoted armature, a spring blade extending from the armature, and a brake lever adapted to be moved by said blade to apply the brake.

35 7. In a valve operating mechanism, the combination with a valve which will automatically close unless positively held open, of an electric motor adapted when energized to open the valve, electrically operated means adapted when energized to hold the valve open after power to the motor is cut off, control means for said motor operable upon actuation thereof to apply power to said motor but not to said holding means to open said valve, means operable upon said valve reaching open position to first cut off power to the motor and to then apply power to said valve holding means, means permitting manual opening of the valve in the event power is not available for the motor, means for latching the valve in less than maximum open position following manual opening, a main switch adapted to close the power circuit to the motor, a second switch operable by said latching means to shunt out said main switch and establish the power circuit to the motor whereby when power is again available the motor will be energized irrespective of whether the main switch is closed, the motor when energized through the circuit embodying the second switch completing the maximum opening of the

valve, and means for automatically releasing said latching means and opening said second switch when the valve is additionally opened by said motor.

5 8. In a valve operating mechanism, the combination with a valve which will automatically close unless positively held open, said valve having a stem, of a rotary electric motor adapted when energized to open the valve and means connecting said motor and valve stem comprising 10 a crank, a lost motion connection connecting the crank and valve stem, and a gear train connecting the motor and crank.

9. In a valve operating mechanism, the combination with a valve which will automatically close unless positively held open, said valve having a stem, of a rotary electric motor adapted when energized to open said valve, and means connecting said valve and motor comprising a gear train, a crank operated by the gear train 20 and operatively connected to said valve stem, the connection between said crank and valve stem including a lever for opening the valve by hand in the event of current failure to the motor, and means operable to latch the valve in open position following manual opening thereof.

25 10. In a valve-operating mechanism, the combination with a valve which will automatically close unless positively held open, of a motor adapted to open the valve when power is applied thereto, a lost motion connection between the motor and the valve, means adapted when power is applied thereto to prevent reversal of the motor when power thereto is cut off, and means for cutting off power to the motor when it has fully 35 opened the valve and permitting power to be applied to the means for preventing reversal of the motor.

11. In a valve operating mechanism, the combination with a valve stem which projects from 40 a housing wherein the valve to be operated is contained, of means biasing said valve to a closed position, a support mounted on the housing, a motor and reduction gear train mounted on said support, a lever pivoted to said support and extending crosswise of the valve stem and pivoted thereto, and a connection between the gear train and lever comprising a link pivoted to and extending upwardly from the lever and a member 50 carried by the last driven gear of said train for turning the lever in a valve opening direction upon energization of said motor, said biasing means being effective upon deenergization of said motor to move said valve, with said motor and said gear train in the opposite direction to closed 55 position.

12. A device of the class described, comprising in combination, a fluid flow controlling element biased to one flow controlling position, a lever, means pivotally mounting the same, means connecting said lever to said fluid flow controlling element at a point spaced from the pivot point of said lever, a power operated actuator, a reduction gear train connected to said actuator, means connecting said gear train to said lever at a point 65 spaced from the point at which said fluid flow controlling element is connected to said lever so that upon power being supplied to said actuator said fluid flow controlling element is moved to a second flow controlling position, said lever being 70 provided with a portion adapted to be manually operated to permit said fluid flow controlling element to be manually moved to substantially said second flow controlling position upon power failure, and manually operated latching means 75

for maintaining said element in said last named position upon being so moved.

13. A device of the class described, comprising in combination, a fluid flow controlling element biased to one flow controlling position, a lever, means pivotally mounting the same, means connecting said lever to said fluid flow controlling element at a point spaced from the pivot point of said lever, a lower operated actuator, a reduction gear train connected to said actuator, means connecting said gear train to said lever at a point spaced from the point at which said fluid flow controlling element is connected to said lever so that upon power being supplied to said actuator said fluid flow controlling element is moved to a second flow controlling position, said connecting means permitting relative movement between said reduction gearing and said lever, said lever being provided with a portion adapted to be manually operated to permit said fluid flow controlling element to be manually moved to substantially said second flow controlling position upon power failure, and manually operated latching means for maintaining said element in said last named position upon being so moved.

14. A device of the class described, comprising in combination, a valve casing having an inlet and an outlet, a partition wall therebetween having a valve opening therein, a valve adapted to close said valve opening and biased to valve closing position, operating means connected to said valve and movable upon operation thereof in one direction for opening said valve against its bias, the bias of the valve being sufficient to move said operating means during the valve closing operation in the opposite direction at such a speed and through a large enough range that the resulting momentum would be sufficient to cause the valve to rebound from valve closing position upon reaching the same, and means for preventing such rebounding of the valve due to the momentum thus imparted to the operating means during valve closing movement, said means comprising a friction brake acting on said operating means and effective to retard the movement thereof in valve closing direction.

15. A device of the class described, comprising in combination, a valve casing having an inlet and an outlet, a partition wall therebetween having a valve opening therein, a valve adapted to close said valve opening and biased to valve closing position, operating means connected to said valve and movable upon operation thereof in one direction for opening said valve against its bias, the bias of the valve being sufficient to move said operating means during the valve closing operation in the opposite direction at such a speed and through a large enough range that the re-

sulting momentum would be sufficient to cause the valve to rebound from valve closing position upon reaching the same, and means for preventing such rebounding of the valve due to the momentum thus imparted to the operating means during valve closing movement, said means comprising a lost motion connection between said operating means and said valve and a brake acting on said operating means and effective to retard the movement thereof in valve closing direction.

16. A device of the class described, comprising a valve casing having an inlet and an outlet, a partition wall therebetween having a valve seat formed therein, a valve normally biased against the seat to obstruct fluid flow from the inlet to the outlet, a rotating actuator for the valve, a gear train between said actuator and valve whereby the latter may be opened against its bias by the former upon operative energization thereof, the bias of the valve being sufficient to close the valve and rotate the actuator and gear train in the reverse direction at such a speed and through a large enough range that the resulting momentum built up in the gear train and actuator would be sufficient to cause the valve to rebound from its seat upon striking the same, and means for preventing such rebounding of the valve from its seat due to the momentum thus imparted to the actuator and gear train during valve closing movement, said means comprising a brake effective to retard the movement of said actuator and gear train in valve closing direction.

17. A device of the class described, comprising a valve casing having an inlet and an outlet, a partition wall therebetween having a valve seat formed therein, a valve normally biased against the seat to obstruct fluid flow from the inlet to the outlet, a rotating actuator for the valve, a gear train between said actuator and valve whereby the latter may be opened against its bias by the former upon operative energization thereof, the bias of the valve being sufficient to close the valve and rotate the actuator and gear train in the reverse direction at such a speed and through a large enough range that the resulting momentum built up in the gear train and actuator would be sufficient to cause the valve to rebound from its seat upon striking the same, and means for preventing such rebounding of the valve from its seat due to the momentum thus imparted to the actuator and gear train during valve closing movement, said means comprising a lost motion connection between said actuator and said valve and a brake effective to retard the movement of said actuator and gear train in valve closing direction.

NELSON T. BRANCHE.

CERTIFICATE OF CORRECTION.

Patent No. 2,052,918.

September 1, 1937

NELSON T. BRANCHE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 9, claim 13, for the word "lower" read power; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of January, A. D. 1937.