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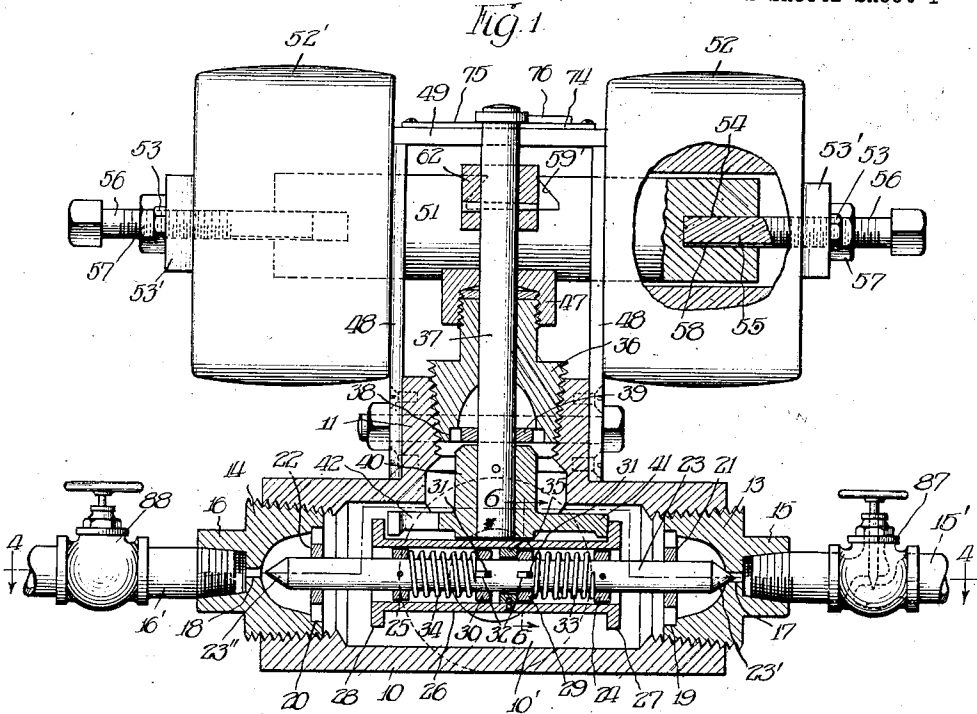
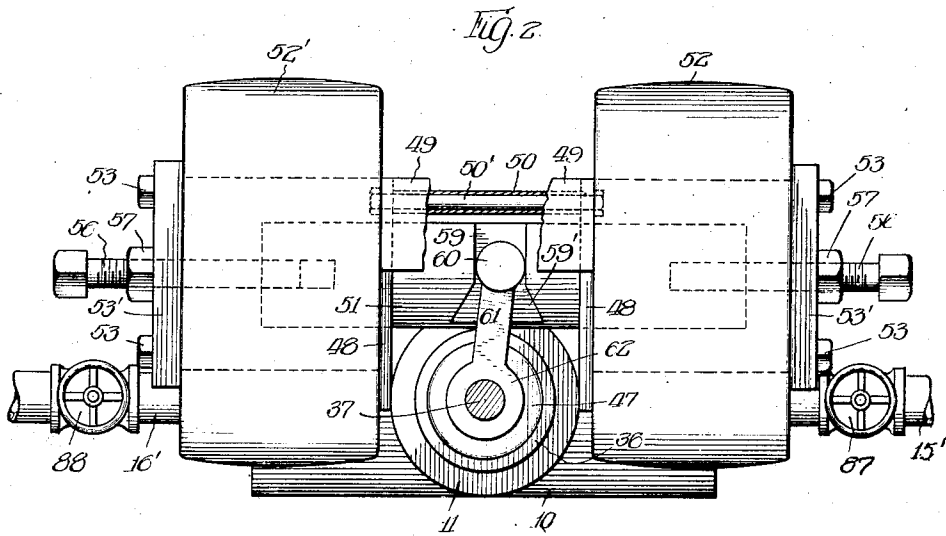
M. DEAN

1,640,537

VALVE AND OPERATING DEVICE THEREFOR

Filed March 4, 1926

2 Sheets-Sheet 1



Witness:
A. Burkhardt.

Inventor:
Mark Deari,
By Samuel N. Bond,
att'y.

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M. DEAN

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2 Sheets-Sheet 2

Fig. 3.

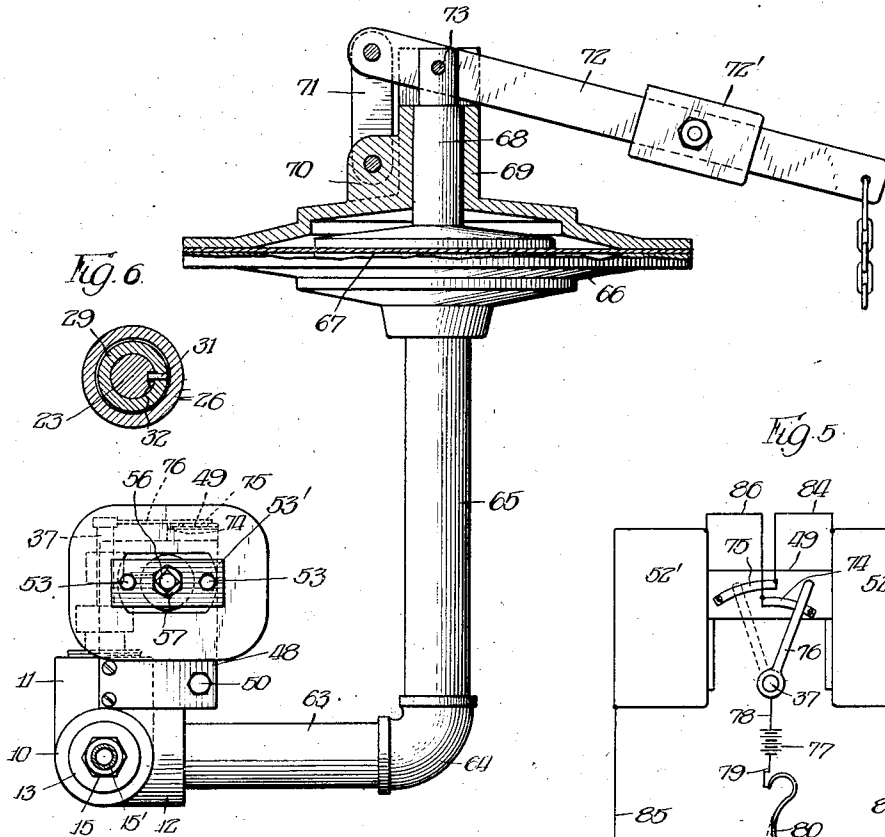
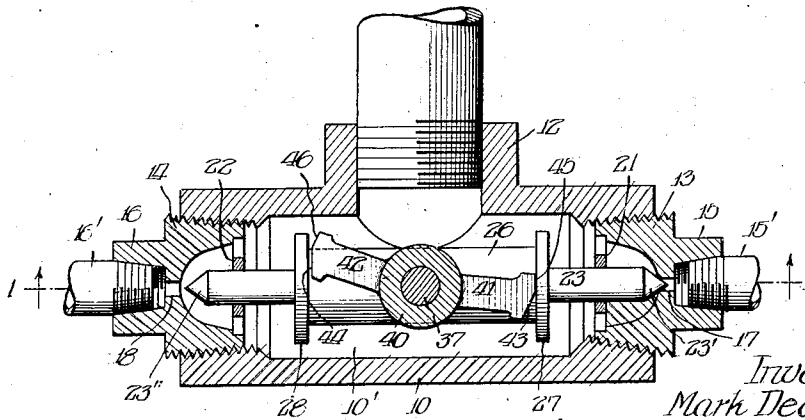


Fig. 4.



Witness:
R. Burkhardt.

Inventor:
Mark Dean,
By Samuel N. Ford atty

UNITED STATES PATENT OFFICE.

MARK DEAN, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO MICHAEL FARRELL,
OF CHICAGO, ILLINOIS.

VALVE AND OPERATING DEVICE THEREFOR.

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This invention relates to valves and valve operating mechanisms, and in its chief intended use or application relates to valves of the electrically operated and thermostatically controlled type which are employed to admit and exhaust a motive fluid to and from a diaphragm or other motor for opening and closing the draft controlling elements of a boiler, furnace or the like, although the invention is capable of useful employment in many other situations and relations where intermittently supplied fluid pressure is used.

One object of the invention is to provide a simple, compact and inexpensive appliance of the type above mentioned that shall be reliable and sensitive and require but a small amount of fluid pressure for its operation. Other objects are, to provide a simple, improved valve mechanism wherein a single valve member may be used to simultaneously open the supply port and close the exhaust port of the motor, and vice versa, without at any time leaving both ports open, thereby avoiding waste of power; to provide an improved valve-actuating mechanism through which the valve shall be elastically pressed to its seat so as to take up wear and insure a tight closure; to provide an electrically operated valve-shifting mechanism wherein the current is automatically cut off as soon as the valve is shifted, thus avoiding waste of current; to provide in the valve-shifting mechanism an automatic lock for holding the valve against accidental opening; and to provide a structure the parts of which may be very easily assembled and disassembled.

Other objects and attendant advantages of the invention will be apparent to persons skilled in the art as the same becomes better understood by reference to the following detailed description, taken in connection with the accompanying drawings, wherein I have illustrated one practical and approved embodiment of the principle of the invention, and in which—

Fig. 1 is a view of the device partly in front elevation and partly in vertical section on the line 1—1 of Fig. 4;

Fig. 2 is a top plan view, partly broken out, omitting the magnet switch;

Fig. 3 is a side elevation viewed from the right of Figs. 1 and 2, showing also a dia-

phragm motor communicating with the valve casing;

Fig. 4 is a horizontal section on the offset line 4—4 of Fig. 1;

Fig. 5 is a diagrammatic plan view of the thermostat-controlled magnet switch; and

Fig. 6 is an enlarged transverse section on the line 5—5 of Fig. 1.

Referring to the drawings, the valve casing, in the preferred form herein shown, is a tubular casting comprising a horizontal body 10, a central vertical branch 11, and a short central horizontal branch or boss 12. The ends of the body 10 are internally tapped to receive threaded plugs 13 and 14 that are formed on their outer ends with reduced internally tapped extensions 15 and 16 respectively, one of which, as 15, receives a pipe 15' from a boiler or other source of pressure fluid, and the other of which receives an exhaust pipe 16'. The plugs 13 and 14 are formed with small central valve controlled passages or ducts 17 and 18 respectively, both communicating with the chamber 10' of the hollow valve casing.

The inner ends of the plugs 13 and 14 are hollowed out, as shown, and formed with annular seats 19 and 20 in which are tightly fitted centrally apertured spiders 21 and 22 that form supports for a sliding valve 23. This valve consists of a straight rod or bar formed with pointed ends 23' and 23'' that serve to open and close the supply and exhaust ducts 17 and 18 respectively. Fastened to the valve rod 23 are a pair of collars 24 and 25 on which is slidably supported a thrust sleeve 26 formed with annular flanges 27 and 28 on its ends. Encircling the valve rod 23 between collars 24 and 25 are a pair of collars 29 and 30 non-rotatable on the valve rod by means of an internal key 31 (Fig. 6) occupying short slots 32 in the rod to limit the inward sliding movements of said collars. Between the collars 24 and 29 and encircling the valve rod is a compression spring 33; and similarly encircling the valve rod between the collars 25 and 30 is a compression spring 34. Fastened to the interior of the sleeve 26 between the collars 29 and 30 is a thrust collar 35 which, through thrust engagement with the collars 29 and 30, acts to shift the valve rod endwise by an elastic thrust transmitted through one or the other of the compression

springs, to thereby close the pressure or exhaust duct, and open the other.

The thrust sleeve 26 is actuated in both directions by mechanism actuated by a motor, preferably consisting of a solenoid magnet. Referring to this thrust sleeve actuating mechanism, in the tapped end of the vertical branch 11 of the valve casing is entered a threaded plug 36 formed with a longitudinal bore to receive a vertical shaft 37. The inner end of the plug 36 is hollowed out and formed with an annular seat 38 for a spider 39 which latter is apertured to form an additional bearing for the shaft 37. Fast on the lower end of the shaft 37 is a hub 40 integral with which are a pair of oppositely extending rocker arms 41, 42 (Fig. 4), the outer ends of which arms are somewhat widened and formed with cam contact faces 43, 44 and, beyond the latter, with short locking faces 45, 46, that are at right angles to radii of shaft 37. When the shaft is turned in one direction, the cam face 43 slidably engages with the sleeve flange 27 to shift the sleeve to the right, viewing Figs. 1 and 4, and cause the valve to close the pressure inlet duct 17 and simultaneously open the exhaust duct 18. When the shaft is rocked in the reverse direction, the cam face 44 similarly engages with the opposite sleeve flange 28, and causes the valve to close the exhaust duct 18 and simultaneously open the pressure supply duct 17. In the fully turned position of the shaft and rocker arms, corresponding to the limits of the valve movements, the locking faces 45 and 46 of the rocker arms are engaged with the sleeve flanges at points in the vertical plane of the longitudinal axes of the valve, thrust sleeve and vertical shaft, so that the valve is held locked in closed position at one end and open position at the other. The outer end of the valve plug 36 is reduced and equipped with a suitable stuffing box 47.

Attached to opposite sides of the vertical branch 11 of the valve casing are a pair of parallel plates 48 rigidly connected and spaced at their upper ends by a cross strip 49 of fiber-board or other insulating material, and adjacent to their lower ends by a spacing sleeve 50 and bolt 50'. The side plates near their upper end are apertured to form bearings for the armature 51 of a double-acting solenoid magnet, the spools 52 and 52' of said magnet being attached to the side plate 48 as by long screws 53 and clamp plates 53'. With a view to cushioning the strokes of the armature I preferably form in the ends of the latter chambers or sockets 54 to receive plungers 55 (Fig. 1), the screw threaded stems 56 of which may be screwed through the clamp plates 53' and secured in adjusted position by lock nuts 57. Each plunger has a sliding fit in the cylinder 54 and is formed with a minute periph-

eral groove 58 or other air vent. The upper side of the armature 51 is formed with a transverse slot 59 (Fig. 2) one end of which is flared as shown at 59', and within the said slot is located the rounded free end or knob 60 of a rocker arm 61, the hub 62 of said arm being pinned or otherwise secured on the upper end of the valve-actuating shaft 37. It is manifest that with this construction the sliding movements of the magnet armature serve to rock the shaft 37 and, through the latter, actuate the valve; the flaring sides of the slot accommodating the swinging movements of the arm.

Connected into the horizontal branch or boss 12 of the valve casing is a pipe 63 (Fig. 3) communicating, through an elbow 64, with a vertical pipe 65, on the upper end of which latter is mounted a diaphragm casing 66 containing a diaphragm 67. Resting on the center of the diaphragm is a vertically slidable rod 68 guided in a vertical bearing 69 on the upper side of the diaphragm casing. On one side of the bearing member 69 is an apertured lug 70 to which is pivoted the lower end of a link 71; and to the upper end of link 71 is pivoted one end of a lever 72. The upper end of the rod 68 is forked to straddle the lever 72 and is pivoted to the latter at 73. On the lever 72 is an adjustable weight 72', and the free end of the lever 72 is connected, as usual, by a chain or other connection to a draft door or valve, damper, or other regulating member or members of the article with which the device is used.

Where, as herein shown, the valve is actuated through the agency of an electromagnet, it is desirable, in order to avoid waste of current, to de-energize the magnet the instant the armature has been shifted in either direction; and in Figs. 1 and 5 I illustrate a simple thermostat-controlled circuit and magnet switch for doing this. On the insulation board 49 are attached a pair of arcuate contact strips 74 and 75, the inner ends of which preferably extend slightly beyond each other as shown to provide current for the magnet until the armature has fully thrown the arm 61 on rock-shaft 37. The rock-shaft 37 extends upwardly above the level of the plate 49, and on the upper end thereof is fastened a switch arm 76, the free end portion of which is adapted to have wiping contact with the strips 74, 75. 77 designates a source of current, one side of which is connected by a line 78 to the switch 76, and the other side of which is connected by a line 79 to a thermostat switch 80 which lies between and alternately engages with a pair of contacts 81, 82. Contact 81 is connected by a line 83 with one end of the winding of magnet spool 52, and the other end of the winding of said magnet is connected by a line 84 with the contact strip 130

75. Contact 82 is connected by a line 85 with one end of the winding of magnet spool 52', and the other end of said winding is connected by a line 86 with the contact strip 74.

In the full line position of switches 76 and 80 shown in Fig. 5, the switch 76 has just been shifted from the dotted line position to the full line position through the closing of the thermostat switch at 80, 81, this having energized the magnet spool 52 and shifted the valve to the pressure shut-off position shown in Figs. 1 and 4, and at the same time opened the circuit through spool 52 and thus de-energized the magnet, the valve being held in its closed position by the locking face 45 of the rocker arm 41 (Fig. 4). When the thermostat switch 80 swings into engagement with contact 82, magnet spool 52' is energized, which shifts the valve to open the pressure duct and close the exhaust duct, and at the same time switch 76 is shifted to the dotted line position indicated in Fig. 5 overlying contact strip 75, and thus de-energizing the magnet. At this time the locking face 46 of rocker arm 42, through engagement with the flange 28 of the thrust sleeve, locks the valve in its shifted position.

It will thus be seen that the valve is at all times, except for the instantaneous period of shifting, in a position cutting off either the pressure supply or the pressure exhaust, so that only a very small amount of pressure fluid is used, and none is wasted.

By reference to Fig. 1 it will be observed that the supply and exhaust pipes 15' and 16' are equipped with regulating valves 87 and 88, respectively, preferably of the needle valve type shown, by which, through the throttling effect of said valves on the supply and exhaust of the pressure fluid, the period through which the motor operates either to raise or lower the lever 72 may be varied, so as to effect a comparatively quick movement, or a comparatively slow gradual movement, as desired.

From the foregoing it will be seen that my invention provides a simple, compact, sensitive and efficient thermostat-controlled valve mechanism for admitting and exhausting pressure fluid to and from a diaphragm or other motor for actuating a regulating member, which requires but a small amount of fluid, actuates the supply and exhaust controls simultaneously, and is of a structure permitting facile assembling and disassembling of the parts. The valve member is actuated in both directions by an elastic thrust which insures full closing of the valve and a stored pressure on the latter to maintain it closed, as well as automatically taking up wear between the valve and valve seat; and the described actuating mechanism also includes means by which the valve is securely

locked in both positions against accidental opening or closing, making it unnecessary to maintain the actuating magnet of the valve energized during the periods between successive movements of the valve.

While I have herein shown and described one simple embodiment of the invention which satisfactorily effectuates the stated purposes and objects thereof, it is manifest that the specific details of structure and arrangement may be changed to a considerable extent without involving any departure from the principle of the invention or sacrificing any of its utilities and advantages. Hence, I reserve all such variations and modifications as fall within the spirit and purview of the appended claims.

I claim—

1. In a mechanism of the character described, the combination of a valve casing formed with a chamber and pressure inlet and exhaust ducts at opposite ends of said chamber respectively, a valve in said chamber consisting of a rod formed with pointed ends adapted, under endwise movements of said rod, to close either of said ducts and simultaneously open the other, spiders in said chamber in which said rod is slidably supported, a fluid pressure motor having a pipe connection with said chamber between said ducts, a magnet having its armature located exteriorly of said chamber, and operating connections from the armature of said magnet to said valve.

2. In a mechanism of the character described, the combination of a valve casing formed with a chamber and pressure inlet and exhaust ducts at opposite ends of said chamber respectively, a valve rod slidably mounted in said chamber the ends of which rod are adapted to close either of said ducts and simultaneously open the other, a fluid pressure motor having a pipe connection with said chamber between said ducts, a magnet, and operating connections, including a pair of oppositely acting thrust springs in the train of mechanical action, between said magnet and said valve.

3. An electrically actuated valve mechanism for controlling the supply and exhaust of pressure fluid to and from a diaphragm or the like, comprising, in combination, a tubular valve casing having pressure inlet and exhaust ducts at its opposite ends respectively, a slidably mounted valve rod in said casing the ends whereof are adapted to open and close said ducts, a sleeve slidably mounted on said valve rod, oppositely acting spring thrust connections in the train of mechanical action between said sleeve and said rod, a double-acting magnet, and means actuated by the armature of said magnet for moving said sleeve endwise in either direction.

4. A specific embodiment of the subject-

matter of claim 6, wherein the oppositely acting thrust connections between said sleeve and said valve rod include coil thrust springs encircling said rod, fixed collars on said rod
5 against which said springs abut at their outer ends, collars keyed on said rod with capacity of limited movement endwise of the latter against which the inner ends of said springs abut, and a central internal collar on
10 said sleeve adapted to thrustingly engage with said last-named collars.

5. In a device of the character described, an electrically actuated valve mechanism for controlling the supply and exhaust of pressure fluid to and from a diaphragm or the like, comprising, in combination, a tubular valve casing having pressure inlet and exhaust ducts at its opposite ends respectively, a slidably mounted valve rod in said casing
15 at its ends adapted to open and close said ducts, a vertically disposed rock shaft journaled in said casing, mechanism intermediate the lower end of said rock shaft and said valve rod whereby the latter is moved
25 endwise in opposite directions under opposite turning movements of said rock shaft, a double-acting solenoid magnet, and means actuated by the armature of said magnet for effecting opposite turning movements of said
30 rock shaft.

6. A specific embodiment of claim 5

wherein the mechanism intermediate the lower end of the rock shaft and the valve rod comprises a sleeve on and in thrust engagement with said valve rod and having
35 radial flanges at its ends, and a pair of oppositely extending rocker arms on the lower end of said rock shaft formed with cams adapted to alternately engage with said flanges and shift said sleeve in opposite di-
40 rections respectively.

7. A specific embodiment of claim 5 wherein the mechanism intermediate the lower end of the rock shaft and the valve rod
45 comprises a sleeve on and in thrust engagement with said valve rod and having radial flanges at its ends, and a pair of oppositely extending rocker arms on the lower end of said rock shaft formed with cams adapted to alternately engage with said flanges and
50 with squared portions adapted in cooperation with said flanges to lock the sleeve in shifted position.

8. A specific form of claim 5 wherein the means actuated by the armature of the
55 magnet for effecting turning movements of the rock shaft comprises an arm fast on said rock shaft with its free end lying in and crosswise of a flaring transverse slot in the armature of the magnet.

MARK DEAN.