H. G. GEISSINGER.

ELECTRICALLY CONTROLLED VALVE.

APPLICATION FILED JULY 12, 1912.

1,143,530.

Patented June 15, 1915.

4 SHEETS—SHEET 2.

Fig. 3.

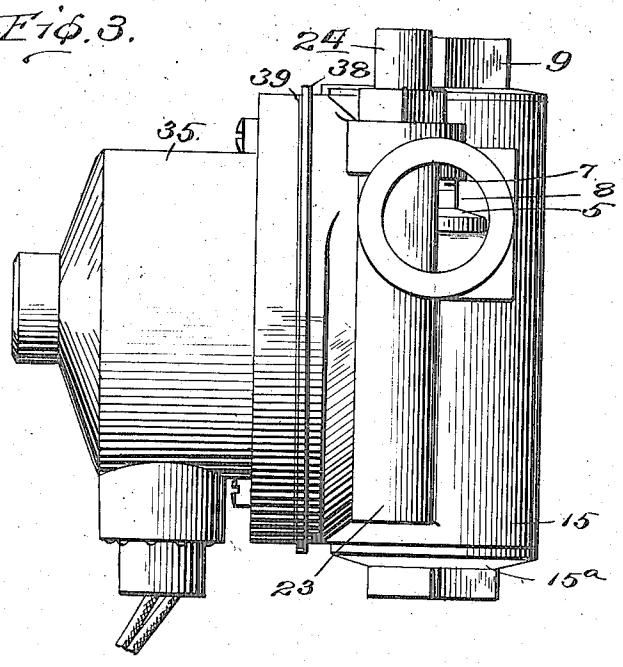


Fig. 4.

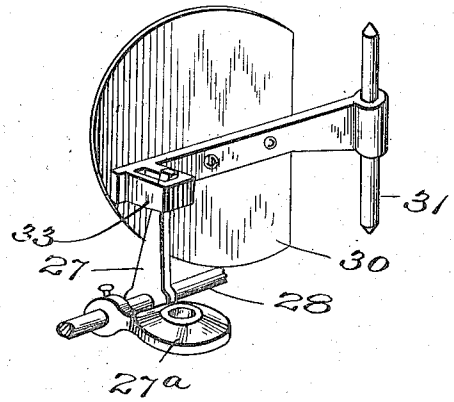
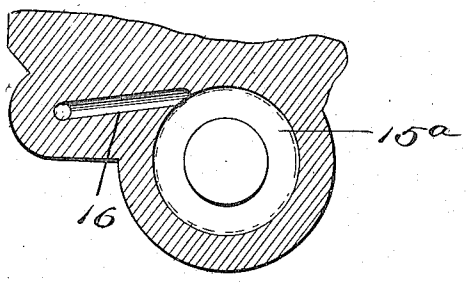


Fig. 5.



Witnesses

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4 SHEETS—SHEET 3.

Fig. 7.

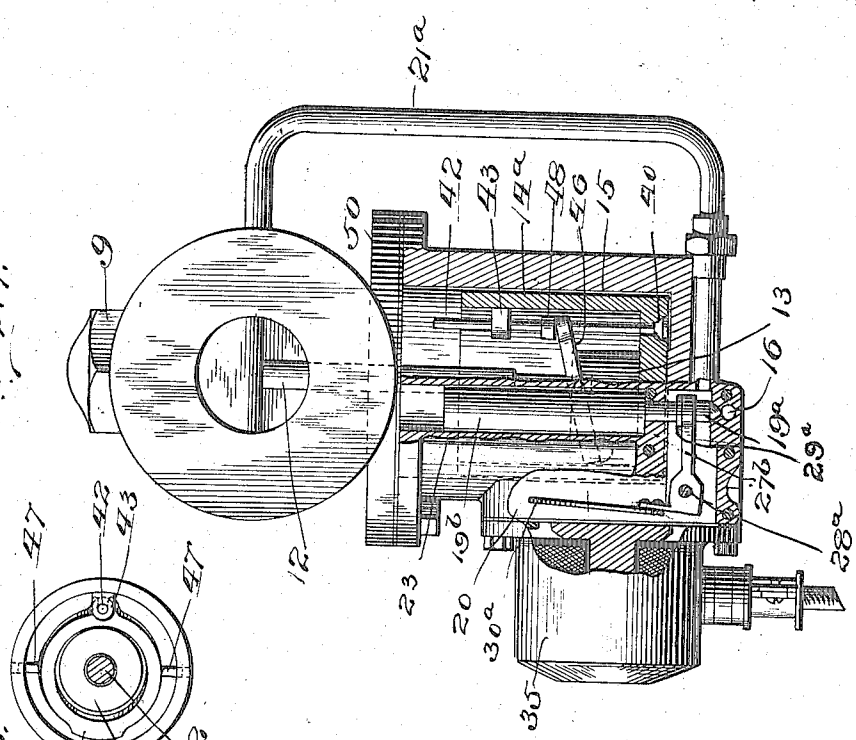


Fig. 8.

Fig. 6.

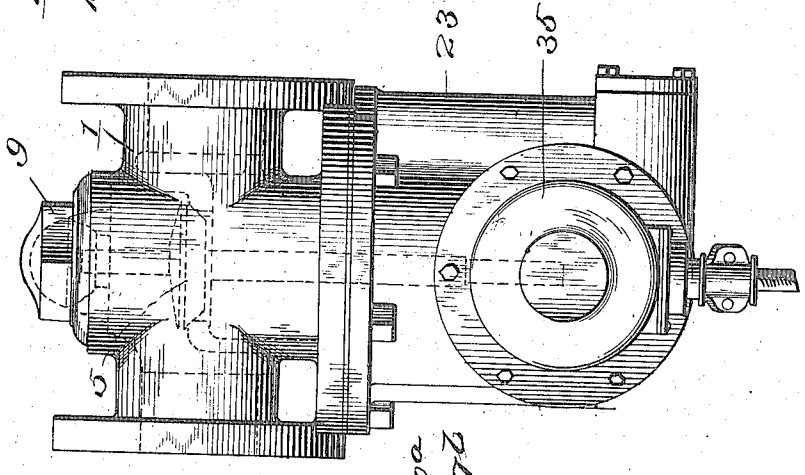
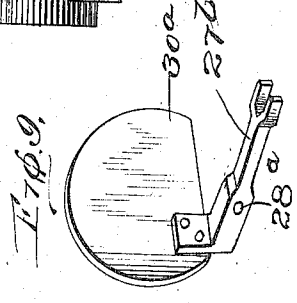


Fig. 9.



Witnesses

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4 SHEETS—SHEET 4.

Fig. 11.

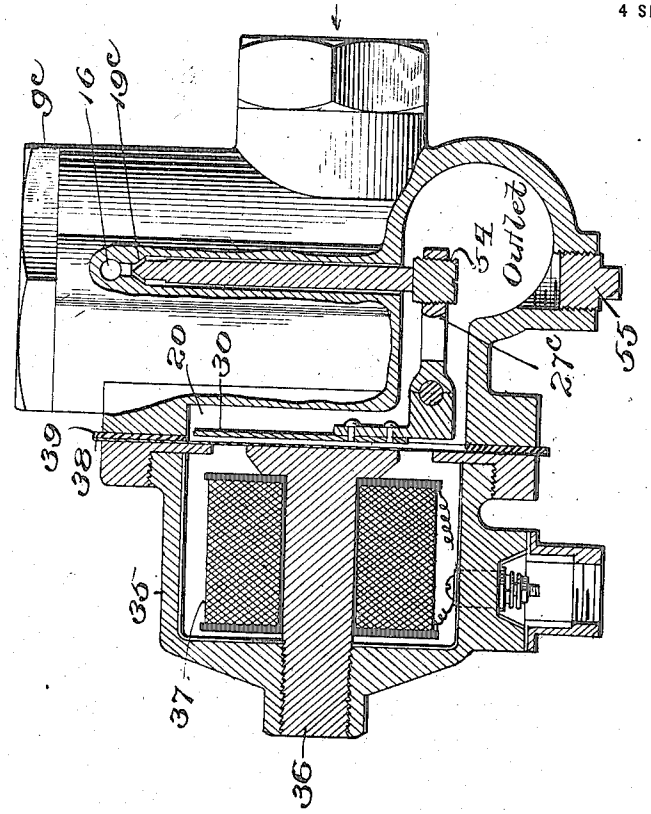
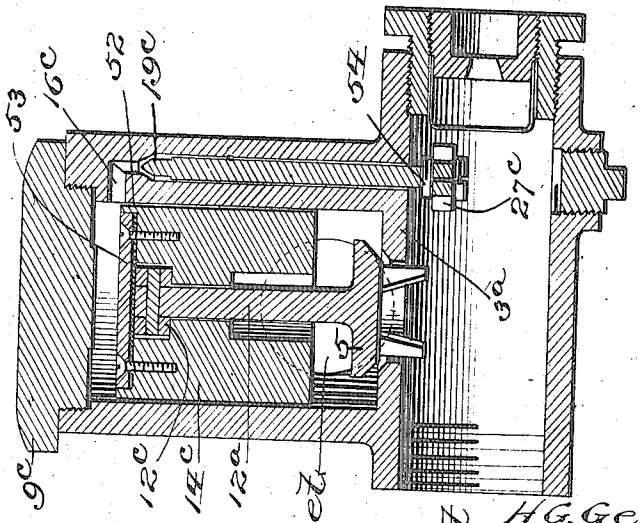


Fig. 10.



Witnesses

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UNITED STATES PATENT OFFICE.

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ELECTRICALLY-CONTROLLED VALVE.

1,143,530. Specification of Letters Patent. Patented June 15, 1915.

Application filed July 12, 1912. Serial No. 709,056.

To all whom it may concern:

Be it known that I, HARRY G. GEISSINGER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Electrically-Controlled Valves, of which the following is a specification.

This invention relates to electrically-controlled valves for controlling fluids under pressure and wherein the valve is opened by the pressure of the medium under control operating upon a piston in opposition to the thrust upon the valve disk.

One of the objects of my invention is to provide valve-operating mechanism which will open the valve without shock and which will assume a position of equilibrium as long as the valve remains open. It has been proposed to balance single-seating valves and to operate them by control of a fluid-pressure derived from the main conduit but it has been more or less difficult to reconcile the balancing and operating functions without introducing undue complications.

It is my purpose to provide a valve without packing in connection with the moving parts, the valve stem and piston fitting loosely within their housings. I further provide means to prevent the hammering of the piston upon the completion of its stroke or the chattering of the valve upon closing, thereby reducing the wear and prolonging the life of the valve mechanism. The structural arrangement is such that all of the principal movable parts are readily accessible for adjustment. The valve may be easily ground to its seat and can be removed if necessary without difficulty.

Other objects of my invention will be apparent from the following description while its scope is defined in the appended claims.

In the accompanying drawings, Figure 1, is a longitudinal section through a valve and the operating piston showing one embodiment of my invention; Fig. 2, is a vertical sectional view of the same taken substantially at right angles to Fig. 1, but passing through two planes to show the structure of the electro-magnetic actuating mechanism and of the pilot valve; Fig. 3, is an end elevation of the valve casing; Fig. 4, is a detail view of the armature and lever mechanism; Fig. 5, is a cross-section on the line V—V of Fig. 1; Fig. 6, is a longitudinal elevation of a modification of my valve-operating mechanism adapted to large size valves; Fig. 7, is a transverse elevation, partly in section of the arrangement shown in Fig. 6; Fig. 8 is a top plan view of the piston and parts connected therewith; Fig. 9, is a detail view of the armature and yoke-arm connected thereto; and Figs. 10 and 11, are longitudinal and transverse sectional views of a modification showing my invention applied to a normally open valve.

The valve shown in Figs. 1 and 2, is the normally closed type. The casing 1, is divided by a diaphragm 3 having a valve-seat 4, normally closed by the valve-disk 5. An upper guide-plunger 7, adjustably secured to the threaded guide-stem 8, slides in the cavity of the screw-cap 9. A flexible disk 10, is adapted to cushion the shock against the cap. By removing the cap the valve may be manipulated to grind it to its seat or it may be lifted from the casing.

The valve-stem 12, projects loosely into a central guiding hole or cavity in the piston 14, the latter fitting loosely in the piston cylinder 15, closed by the plug 15ª. The bottom of the cylinder 15 is connected by means of a channel 16 with the port 18, which is controlled by the pilot valve 19. When the pilot valve is lifted the channel 16 is connected through port 18 with the chamber 20 which communicates with the inlet or pressure side of the valve casing through an opening 21.

The stem of the pilot valve extends within the cavity of a tubular portion 23 of the casing, closed by the cap 24 and is normally held to its seat by the spring 25. For the purpose of lifting the pilot valve, I provide a lever 27, pivoted at 28, and having a cam-faced arm 27ª bearing against a nut 29, threaded upon the pilot valve stem. A disk-shaped armature 30, having a pintle 31, mounted in bearings 32, is provided with a lug 33, which engages the end of the lever 27. The electro-magnet actuating the armature 30, consists preferably of a cylindrical magnetic casing 35 and a central core 36, carrying a coil 37, the magnet casing being threaded to an annular boss on the valve casing and separated from the cham-

ber 20 by a non-magnetic diaphragm 38 and a gasket 39. When the magnet is energized, the armature 30 is attracted, rocking the lever 27 and raising the pilot-valve 19, thereby opening communication and forming a direct channel between the inlet side of the casing and the piston cavity 15, through the opening 21, the port 18 and the channel 16. Inasmuch as the area of the piston 14 is larger, approximately three times, than the area of the valve-disk 5, the piston will be lifted, carrying the valve-disk upward and thereby opening communication between the inlet and outlet sides of the casing 1.

In Figs. 6 and 7, I have shown a modification which is adapted to operate large valves. The piston chamber 15 is connected with the chamber 20 in the manner previously described by a channel 16, which is normally closed by a pilot valve 19^a, shown in this case as provided with a weighted steam 19^b. The actuating armature 30^a carries a yoke arm 27^b, pivoted at 28^a and bearing upon the nut 29^a. The live steam is conveyed from the inlet to the chamber 20 by means of a tube 21^a.

The cup-shaped piston 14^a, is provided with a central projection or boss 13 having a guiding cavity into which the lower end of the valve-stem 12 loosely projects so that a slight lateral play is permitted. The bottom of the piston is provided with a port normally closed by a relief or balancing valve 40 having a stem 42, passing through a guide 43. The valve is lifted by an annular weighted lever 46, pivoted at 47, 47; and bearing against a lug or nut 48 on the valve stem.

When the armature 30^a is attracted by the magnet, the pilot valve 19^a is lifted and live steam flows from the inlet side of the casing, through the tube 21^a, and the channel 16 to the bottom of the piston cavity. The piston 14^a is thereby forced upward, lifting the valve-disk 5, from its seat. It will be observed that the stem 42 of the cushioning valve extends above the piston and when this strikes the bottom of the flange 50, the valve 40 is opened, thereby equalizing the pressures upon both sides of the piston and arresting the upward stroke. The valve-disk and operating piston are thus lifted without shock. As soon as the valve begins to descend, the weighted lever 46 begins to lift the valve 40 toward its seat, but does not completely close the valve-port because the pressure below the piston immediately increases. The ports, therefore, arrive at a position of equilibrium where the leakage through the partially closed port of valve 40, together with the normal leakage around the walls of the piston, proportion the pressure below the piston to equal the downward thrust of the valve-disk. The ports will remain in a position of equilibrium with the valve lifted as long as the magnet is energized.

Upon deënergizing the magnet, the pilot valve 19^a closes the port of the channel 16 and the pressure below the piston rapidly falls by reason of the leakage about the valve 40 and the normal leakage around the piston and accordingly the downward pressure exerted upon the valve-disk 5 causes the valve to close upon its seat.

By providing for a slight lateral play of the lower end of the stem 12, in the guiding hole or cavity in the piston, the loose fit of the piston to permit leakage cannot cause a binding action upon the stem and consequently the valve always seats properly.

In the forms of my electro-magnetic valve operating mechanism previously described the valve is normally closed. In Figs. 10 and 11, I have shown the manner in which my invention may be applied to a normally open valve. The operating piston 14^c is placed above the valve-disk 5, which it lifts by means of the collar 12^c secured to the stem 12^a. The recess in the top of the piston is closed by a steam-tight gasket 52 and a plate 53. The piston cavity is closed by a removable cap 9^c. A channel 16^c connects the upper portion of the piston cavity or cylinder with the outlet side of the casing and is controlled by pilot valve 19^c having a stem supported by the end of the armature-lever 27^c. It is important that the pilot valve should be adjusted very accurately with respect to the lever 27^c and also that means should be provided for taking up wear. I therefore provide an adjusting nut 54 in the end of the lever and place an aperture in the casing to give access thereto, which is closed by the cap 55.

Normally the pilot-valve 19^c is in its lowermost position, leaving the channel 16^c open. The upward pressure of the steam upon the piston raises the valve-disk 5 and maintains it in open position. The lift or travel of the valve is arrested when the piston covers the port or opening of the channel 16^c, and the piston and valve are held in equilibrium. It is obvious that the arrangement of balancing or relief valve shown in Fig. 7 could be employed with this type of normally open valve, if desired. When the magnet 37 is energized and the armature 30 is attracted the pilot-valve 19^c closes the channel 16^c, and the pressure above the piston accumulates, by reason of the leakage around the piston, until said pressure together with that upon the valve-disk is sufficient to seat the disk.

It will be observed that I have avoided the use of any packing or stuffing boxes for the movable parts, thereby reducing the friction and wear to a minimum. The operative

parts are exceedingly simple in construction and are not liable to get out of order. The bell-crank lever and the actuating armature connected therewith are located in a chamber which is in direct communication with the passage or channel leading from the casing to the piston cylinder and, in fact, this chamber 20 forms a part of said passage which conducts the fluid pressure from the casing 1 to the rear of the piston when the pilot-valve is lifted from its seat. This construction enables me to make an exceedingly compact valve mechanism.

By pivoting the armature at one side, as shown in Fig. 4, and connecting the bell-crank to the opposite side, the armature is enabled to exert a very powerful lifting force upon the pilot-valve within the confined space of the narrow chamber 20. The nearly circular disk-armature forms a path for the circular air-gap between the annular pole or shell of the magnet and the central core, which produces a magnetic pull over the entire surface of the armature. I have shown the armatures in the form of circular disks with a segment removed adjacent the hinge. By constructing the armature in this form, I am enabled to enhance the efficiency of the magnetic system and to secure a very strong pull for the size of the magnet employed. Any magnetic flux which might pass from the magnet poles through the armature near the hinge would exert a very small pull because of its small leverage and by reason of its nearness to the poles it would divert a large amount of flux and, therefore, by removing a segment of the metal of the armature near the hinge, the magnetic flux is caused to traverse the magnetic circuit more advantageously thus causing a considerable gain in the performance of the magnetic structure.

I have described in detail the particular construction illustrated in the accompanying drawings for the purpose of disclosing embodiments of my invention, but it will be evident to engineers that various other modes of operation and changes in the structure may be made without departing from the spirit of my invention and principles herein set forth.

I claim:—

1. Valve apparatus comprising a casing having inlet and outlet chambers connected by a port, a main valve controlling said port, a cylinder having a piston reciprocable therein and operatively connected to said valve, a channel connecting said cylinder and said casing and having an enlarged chamber, the outer wall of said chamber comprising a non-magnetic plate, a pilot-valve controlling said channel, an operating lever connected to said pilot-valve and having an armature located in said chamber and positioned adjacent said non-magnetic plate, and an electro-magnet inclosed in a magnetic shell or housing and secured to the outside of said plate and exerting its magnetic influence therethrough upon said armature.

2. Valve apparatus comprising a casing having inlet and outlet chambers connected by a port, a main valve controlling said port, a cylinder having a piston reciprocable therein and operatively connected to said valve, a channel connecting said cylinder and said casing and having an enlarged chamber, the outer wall of said chamber comprising a non-magnetic plate, a pilot-valve controlling said channel, a bell-crank lever having one arm adjustably connected to said pilot-valve, an armature connected to the other end of said lever and located in said chamber adjacent said non-magnetic plate, and an electro-magnet inclosed in a magnetic shell or housing, and secured to the outside of said plate so that the magnetic flux passing through said shell when the magnet is energized will exert an attractive force upon the armature.

3. Valve apparatus comprising a casing having inlet and outlet chambers connected by a port, a cylinder in open communication with said casing, a piston reciprocable in said cylinder and having a central guiding hole, the bore of said cylinder being of a size to permit leakage around the piston, a main valve controlling said port and having a stem extending within said recess, the diameter of said hole being of a size to permit a slight lateral movement of said stem, a passage connecting said cylinder and said casing, a pilot-valve controlling said passage, a chamber connected with said passage, a lever pivotally mounted in said chamber and adjustably connected to said pilot-valve, and an electro-magnetic device operatively connected to said lever.

4. Valve apparatus comprising a casing having inlet and outlet chambers connected by a port, a cylinder in open communication with said casing, a piston reciprocable in said cylinder and having a central recess, a main valve controlling said port and having a stem extending loosely within said recess, a passage connecting said cylinder and said casing, a pilot-valve controlling said passage, a chamber connected with said passage, a lever pivotally mounted in said chamber and adjustably connected to said pilot-valve, an electro-magnetic device operatively connected to said lever, and a relief valve carried by said piston having a stem extending above the piston.

5. Valve apparatus comprising a casing having inlet and outlet chambers connected by a port, a cylinder in open communication with said casing, a piston reciprocable in said cylinder and having a central recess, a main valve controlling said port and having

a stem extending loosely within said recess, a passage connecting said cylinder and said casing, a pilot-valve controlling said passage, a relief valve carried by said piston having a stem extending beyond the piston, and means for normally holding the relief valve in closed position.

6. Valve apparatus comprising a casing having inlet and outlet chambers connected by a port, a cylinder communicating with the outlet chamber of said casing, a piston reciprocable in said cylinder, a main valve controlling said port and having a stem cooperating with said piston to lift the valve, means for subjecting said piston to fluid pressure from said casing, a relief valve carried by said piston and having a stem extending beyond the same, and adapted to engage the casing at a predetermined point in the travel of the piston, and means normally holding said valve in lifted closed position.

7. Valve apparatus comprising a casing having inlet and outlet chambers connected by a port, a cylinder in open communication with said casing, a piston reciprocable in said cylinder and having a central guiding hole, the bore of said cylinder being of a size to permit leakage around the piston, a main valve controlling said port and having a stem extending within said guiding hole, the diameter of said hole being of a size to permit lateral movement of said stem, a passage connecting said cylinder and said casing, a pilot-valve controlling said passage, and means for actuating said pilot-valve comprising an electro-magnetic device and an armature therefor adjustably connected to the pilot-valve.

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

HARRY G. GEISSINGER.

Witnesses:
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R. C. SMITH.