March 10, 1953 C. E. MILLER 2,630,827

CONTROL VALVE

Original Filed June 20, 1947

FIG. 1

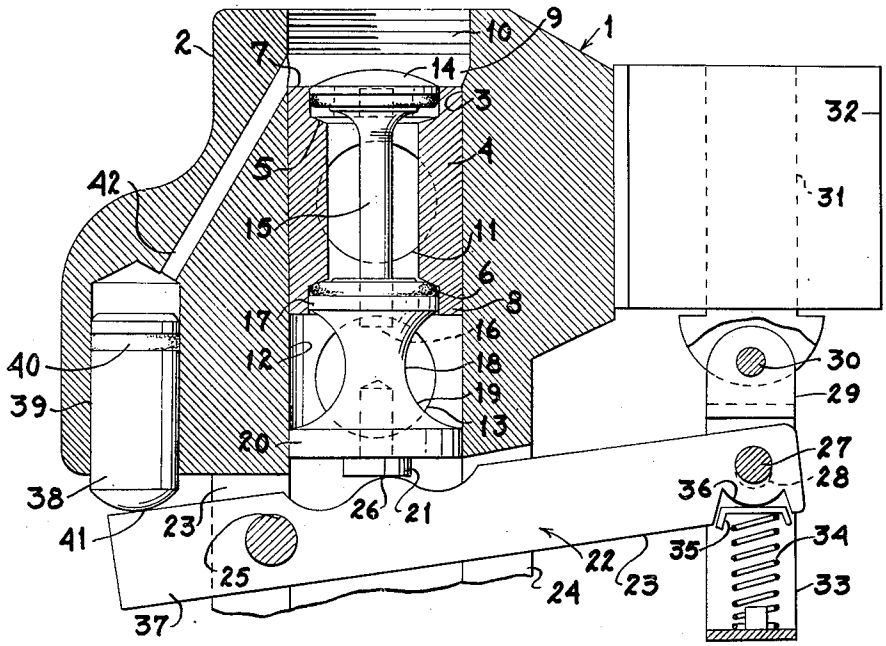


FIG. 2

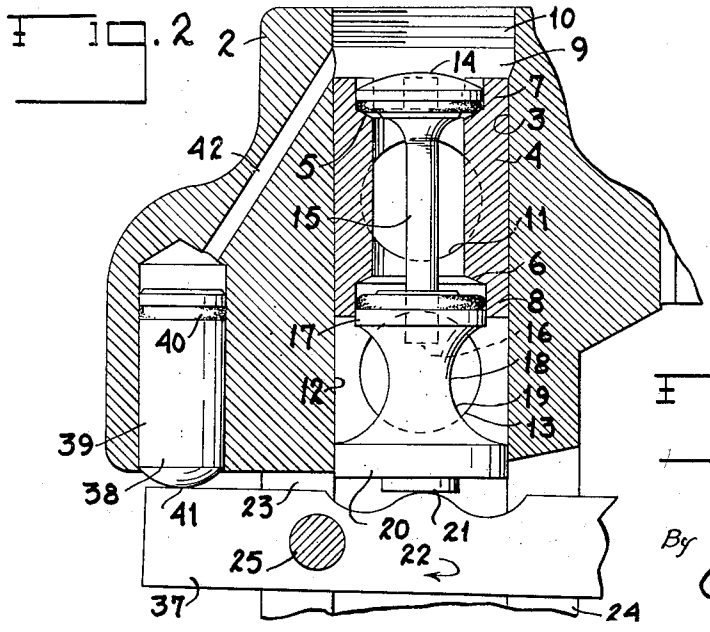
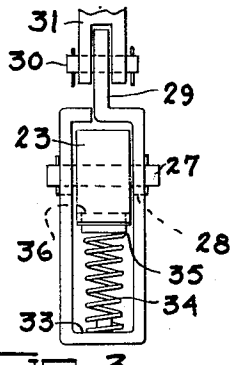


FIG. 3



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UNITED STATES PATENT OFFICE

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CONTROL VALVE

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2 Claims. (Cl. 137—620)

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This invention relates to control valves, and more particularly, to improved valves of this character designed for more simply and efficiently controlling pneumatically-operated mechanisms of a type employed in connection with machine tools and the like.

This application is a division of the co-pending application of Clarence E. Miller, Serial No. 755,967, filed June 20, 1947, for Control Valves.

An object of the invention is to provide control valve means in a pressure line, in which an actuating device is employed for moving the valve means, and wherein the arrangement is such that only a minimum of power is required for effecting this purpose.

A further object of the invention is to provide a valve structure in which valve means are electrically operated against pressure, and in which booster means are employed for relieving the electrical apparatus from exerting more than a minimum of power in carrying out its actuating function.

A still further object of the invention is to provide a more simple and sturdy control valve construction, having fewer parts than valves now used, which will maintain constant high pressures, and which is non-repeating unless reactuated, thereby providing a safety factor of considerable value.

Still another object of the invention is to provide in a valve of this character, mechanism of a balanced type, in which stresses and strains are almost entirely avoided during operation, and in which the actuating parts are constructed of mild steel and include a hardened inset between working parts.

Further objects and advantages will appear and be brought out more fully in the following specification, reference being had to the accompanying drawing, in which:

Fig. 1 of the drawing is a vertical sectional view of the valve mechanism, showing the inlet valve open and the exhaust valve closed;

Fig. 2 is a view similar to Fig. 1, showing the inlet valve closed and the exhaust valve open.

Fig. 3 is a fragmentary vertical sectional view taken on a plane normal to the showing of Fig. 1.

The invention, as shown in the drawings comprises a casting 1 having a body portion 2, through which extends a relatively large central bore 3. Pressed into the bore 3 is a cylindrical sleeve 4 having an upper valve seat 5, and a lower valve seat 6, the sleeve 4 outwardly of the seat 5 being cut out to form spaced guide lugs 7, and outwardly of the seat 6 to provide guide lugs 8.

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The sleeve 4 at its upper end communicates with an inlet chamber 9, and the body portion 2 at the upper end of the bore 3 is threaded, as at 10, for the reception of a pipe-securing nut (not shown), the pipe being adapted to communicate with a source of compressed air. Intermediate the length of the sleeve 4 is an inlet port 11 adapted to communicate with pneumatically operated mechanism associated with a machine tool or the like (not shown). At its lower end, the sleeve 4 communicates with an enlarged chamber 12, having an exhaust port 13.

Co-operating with the valve seat 5 is a poppet type valve 14, having a head guided in its movements by the guide lugs 7, and having its seating surface lined with "Neoprene" to effect a proper seal when the valve is closed. The head of the valve 14 is provided with an integral stem 15 which extends through the sleeve 4, and the end of which is slidable in a socket 16 in the head 17 of a valve member 18. The head 17 of the valve member 18 co-operates with the valve seat 6, and its contacting surface is also lined with "Neoprene" to insure proper sealing when the valve is closed. Formed integrally with the head 17 of the valve member 18 is an hour glass shaped extension 19 terminating in what in effect is a piston closure 20 reciprocable in, and closing the bottom of the bore 3. In the outer face of the extension 19 there is inset a hardened button 21 adapted to be engaged by an actuating lever 22.

The actuating lever 22 extends through slots 23 and 24 in the body portion 2, and is pivoted, as at 25, adjacent the slotted portion 23. The lever 22 is cut out along its upper edge to provide a rounded engaging surface 26 adapted to engage the hardened inset button 21. The lever 22 extends outwardly through the slot 24 to a considerable distance beyond the body portion 2, and at its outer end carries a pin 27 accommodated in slots 28 of a link 29, which has its upper end pivotally connected by a pin 30 with the armature 31 of solenoid 32, the latter being secured by suitable fastening means to the body portion 2. The outer end of the link 29 is bent into stirrup shape, as at 33, and carries a coiled spring 34, upon the upper end of which is disposed a seating member 35, upon which rests an arcuate portion of the lever 22.

Associated with the other end 37 of the lever 22 is boosting means for assisting in the movement of the lever 22. The boosting means preferably takes the form of a pneumatically actuated piston 38, accommodated in a cylindrical cavity or opening 39 formed in the body portion 2, the

area of the piston head 38 and the bore of the cylindrical cavity 39 being somewhat less in diameter than the diameter of the valves 14 and 17. The piston 38 is provided with a suitable sealing ring or member 40 disposed thereabout, and the outer end of the piston 38 is rounded, as at 41, and adapted to bear upon the end 37 of the lever 22. The upper end of the cylinder 39 is connected by an elongated duct 42 with the inlet chamber 9, so that the piston 38 normally is subjected to the full line pressure.

In operation, and referring first to Fig. 2, the valve 14 is held tightly to the seat 5 by pressure from the inlet chamber 9, while the valve 17 has dropped to an open position and restrained from leaving the bore 3 by engagement with the lever 22. The bottom of the socket 16 has, accordingly, also dropped away from the end of the stem 15 so that there is no resistance at any point against the seating of the valve 14. The end of stem 15, however, remains in the socket 16. Fluid pressure from the inlet chamber 9 is conducted by the duct 42 to the cylinder 39, and the head of the piston 38 is normally subjected to the line pressure. The armature 31, link 29 and lever 22 are at the outer limits of their movement. When electrical energy is supplied to the solenoid 32, the armature 31 is retracted, pulling with it the link 29 and the end of the lever 22 connected thereto. At the initiation and during movement of the lever 22, the piston 38 under influence of the line pressure bears upon the end 37 of the lever 22. It will be seen, therefore, that the power needed to be exerted by the solenoid is very small; since a large proportion of the work necessary to move the lever is done by the pressure actuated piston 38. Upward movement of the lever through contact of the arcuate portion 26 thereof with the hardened button 21 results in taking up the slack between the bottom of the socket 16, and the end of the stem 15 and in elevation of the valve 17 to contact with the seat 6, and through the stem 15 elevates the valve 14 to admit fluid under pressure to pass through the port 11, the exhaust port 13 of course being cut off from communication with the incoming pressure fluid by the valve 17. All parts are then in the position shown in Fig. 1. When the solenoid 32 is deenergized, the link 29 and lever 22 are freed, whereupon the fluid pressure, acting upon the valve 17, returns all parts to initial position, movement of the valve 17 freeing the stem 15, so that the valve 14 is again forced to its closed position.

It will be observed that a large part of the power necessary to move the valves to open position is provided by the fluid-pressure operated booster, and consequently the solenoid may be of a type having a very low power rating, and, furthermore, by reason of the balanced arrangement of the operating parts, they are relieved almost entirely of stresses and strains which might interfere with efficient operation of the device.

While I have illustrated and described the preferred form of construction for carrying my invention into effect, this is capable of variation and modification without departing from the spirit of the invention. I, therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

Having described the invention, I claim:

1. In a valve of the character described the combination of a body formed with a bore and having an inlet chamber at one end of said bore, an inlet port communicating with said bore and located adjacent to the end communicating with said inlet chamber and an exhaust port communicating with the bore adjacent the other end thereof, a sleeve in said bore having spaced opposed valve seats, one of said valve seats being located between said inlet chamber and said inlet port and the other seat being located between said inlet and exhaust ports, a valve member cooperating with the first said seat and having a stem extending through said sleeve, a second valve member cooperating with the other of said seats, and having a socket receiving said stem, said stem having a length that is so related to the distance between said valve seats and the depth of said socket that said second valve is in closed position on its seat when said first valve is in open position spaced from its seat, a piston head slidable in said bore and operatively connected to said second valve member, and means for moving said piston head against the influence of fluid in said bore.

2. In a valve of the character described the combination of a body formed with a bore and having an inlet chamber at one end of said bore, an inlet port communicating with said bore and located adjacent to the end communicating with said inlet chamber and an exhaust port communicating with the bore adjacent the other end thereof, a sleeve in said bore having spaced opposed valve seats, one of said valve seats being located between said inlet chamber and said inlet port, and the other of said seats being located between said inlet and exhaust ports, a valve member cooperating with the first said seat and having a stem extending through said sleeve, a second valve member cooperating with the other of said seats, and having a socket receiving said stem; said stem and socket providing a lost motion connection, said stem having a length that is so related to the distance between said valve seats and the depth of said socket that said second valve is in closed position on its seat when said first valve is in open position spaced from its seat, a piston head in said bore between said exhaust bore and the end adjacent thereto, means connecting said piston head to said second mentioned valve member, a pivotally mounted lever in operative engagement with said piston head and means for actuating said lever to move said piston head and valve carried thereby against the influence of fluid pressure within said bore.

CLARENCE E. MILLER.

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