Dec. 3, 1940. J. EATON 2,223,986

ELECTROMAGNETIC VALVE

Filed Aug. 28, 1939

Fig. 1.

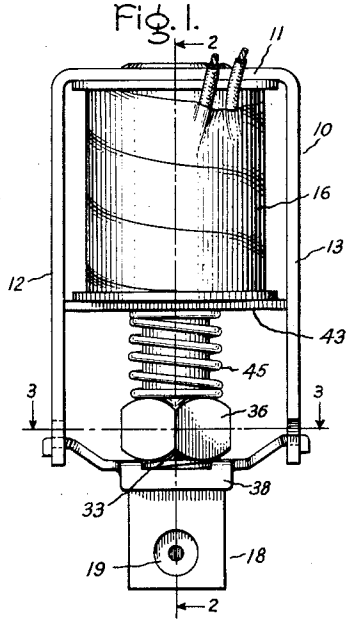


Fig. 2.

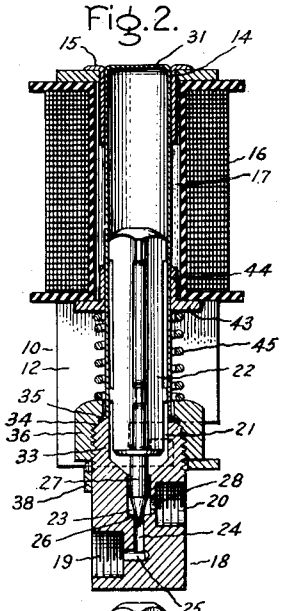


Fig. 3.

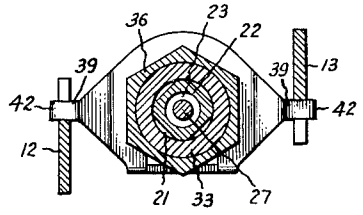
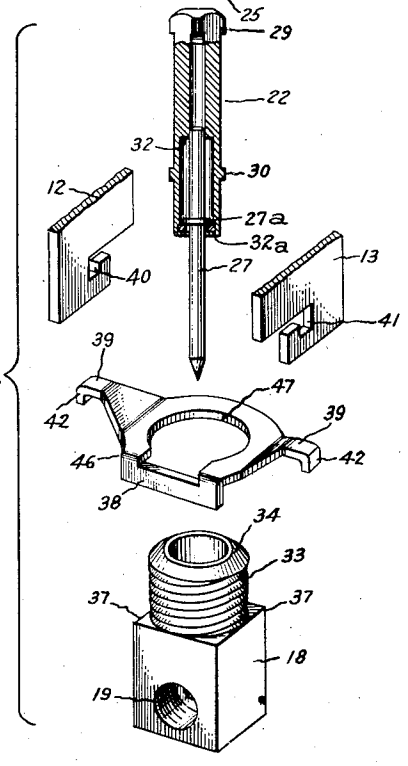


Fig. 4.



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Patented Dec. 3, 1940

2,223,986

UNITED STATES PATENT OFFICE

2,223,986

ELECTROMAGNETIC VALVE

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Application August 28, 1939, Serial No. 292,206

2 Claims. (Cl. 137—139)

My invention relates to electromagnetic valves and has for its object a simple and rugged device having a low manufacturing cost.

More specifically, my invention relates to electromagnetic valves of the type in which a valve and a magnet coil for operating the valve are secured together in a unitary structure. A particular object of my invention is a device of this character having relatively few parts which may be easily assembled in the manufacture of the device and also disassembled later, if desired, for repairs.

For a more complete understanding of my invention, reference should be had to the accompanying drawing in which Fig. 1 is a front elevation view of an electromagnetic valve embodying my invention; Fig. 2 is a sectional view along the line 2—2 of Fig. 1, looking in the direction of the arrows; Fig. 3 is a sectional view along the line 3—3 of Fig. 1 looking in the direction of the arrows, while Fig. 4 is an exploded view, partly in section, of the valve head, valve stem, operating plunger and other parts.

Referring to the drawing, in the form shown my invention comprises an inverted U-shaped frame member 10 made of magnetic material, preferably iron, having a base portion 11 and parallel spaced side portions 12 and 13. The base portion 11 is provided with a central aperture 14 and has secured to it a tubular guide member 15 which defines the aperture 14 and as seen in Fig. 2 extends downward to a position between the side portions. As shown, this tubular guide is secured in place in the member 10 by expanding it tightly against the walls of the hole 14 and by peening over the upper end. A magnet or operating coil 16 is positioned between the side portions 12 and 13 with its upper end in engagement with the base portion 11 and with the tubular guide extending into the central aperture 17 in the coil.

The device also comprises a valve head 18 which is preferably made from a block of suitable material such as brass. It is provided with tapped openings 19 and 20, one of which may be used as an inlet opening and the other as an outlet opening, the ends of the pipes forming the fluid circuit controlled by the valve being screwed into these tapped openings. To facilitate the boring of the passages connecting the openings 19 and 20, these openings are offset in the head, i. e., the opening 20 is higher as viewed in Fig. 2. The head is provided at the upper end as seen in Fig. 2 with a large circular opening or bore 21 which is large enough to receive loosely an operating plunger 22 made of magnetic material. At the bottom and center of the opening 21, a smaller circular opening or bore 23 extends downward to a point below the center of the opening 20. In the center of the opening 23 a still smaller bore 24 is formed, this hole communicating with a lateral opening 25 and leading to the opening 19.

The junction between the holes 23 and 24 forms a valve seat 26 for a valve stem 27 which extends loosely into the opening 23 and has its pointed lower end extending into the opening 24. A hole 28 is provided connecting the opening 20 with the opening 23.

As shown in Fig. 4, the plunger 22, lifted by the coil 16 when the coil is energized so as to lift the valve stem 27, is square with each corner ground off to leave two guide projections 29 and 30 which engage the inside of an enclosing sheath 31 made of a suitable high electrical resistance non-magnetic material such as an alloy of copper and bronze.

It will be observed that the bores 21, 23 and 24 are in concentric alignment with each other and can, therefore, be bored easily by using appropriately sized drills. Moreover, the openings 19 and 20 and their communicating holes 25 and 28 are bored at right angles with the axis of the bores 21, 23 and 24, which arrangement facilitates the boring of these holes.

This plunger 22 furthermore is hollow so as to provide for a lost motion connection with the valve stem 27 extending into the plunger and provided with a flange 27*a* loosely fitting in the cylindrical bore of the plunger. This bore is decreased in size, however, at a point some distance from the lower end to form a shoulder 32 against which the flange 27*a* comes to rest when the plunger is released and dropped by the magnet. The plunger then rests on the stem and secures it in closed position in the seat 26 as seen in Fig. 2. When the plunger 22 is lifted by the magnet, the lower flanged end 32*a* of the plunger engages the flange 27*a* to lift the valve stem with a hammer blow.

Moreover, the valve head 18 has an upper circular exteriorly threaded portion 33 around the bore 21 with its upper end beveled at 34 so as to fit tightly into the flanged lower end 35 of the sheath 31. The sheath is clamped tightly on the head by a clamping nut or collar 36 so as to form a tightly sealed joint between the lower end of the sheath 31 and the valve head. It will be observed that this sheath, having its upper end closed, serves to close the passageway between the two openings 19 and 20.

The various parts are secured in place by a laterally extending or cross member 46 having an opening 47 through which the threaded portion 33 of the head extends. This cross member is secured in place on the head between the nut 36 and the projecting corners 37 of the head. One side of the cross member 46 is provided with a down-turned projection 38 which engages one side of the head, which is preferably square, so as to secure the two parts together against relative rotation. Each end of the cross member is provided with a relatively narrow extension 39, which extensions fit into quickly detachable bayonet joints 40 and 41 in the ends of the side portions 12 and 13. Moreover, the ends of the parts 39 have downwardly turned portions 42 which engage the outer sides of the portions 12 and 13 and secure them in a definite spaced relation in engagement with the ends of a cross member 43 made of magnetic material and thereby form a closed magnetic circuit for the coil through the frame member and this cross member 43. The cross member 43 is provided with a central aperture defined by a tubular guide 44 extending into the coil 16.

As shown in Fig. 2, when completely assembled, the sheath 31 extends into the tubular guides 14 and 44 while these guides in turn extend into the coil 16 whereby these parts are held in their predetermined relative positions. A helical compression spring 45 surrounding the sheath 31 is provided between the cross member 43 and the nut 36. This spring forces the member 43 and the coil upward against the base portion 11 of the frame and forces the nut 36 and cross member 46 downward into secured relation in the ends of the frame member.

The parts can be disassembled easily by simply pushing the cross member 46 upward with respect to the frame and then turning it slightly to release it from the frame. Also the nut 36 can be removed to give access to the plunger 22, the valve stem 27 and the valve seat.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto, since many modifications may be made and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. An electromagnetic valve comprising a frame made of magnetic material provided with a base portion and two parallel spaced side portions, said base portion being provided with an aperture, a magnet coil mounted between said side portions having a central aperture, a cross member made of magnetic material engaging the opposite end of said coil with its ends respectively in abutting slidable relation with said side portions to form a magnetic circuit with said frame, said guide member being provided with an aperture, a valve head provided with inlet and outlet openings connected through an open passage provided with a valve seat, a valve stem cooperating with said seat, a plunger made of magnetic material secured to said stem, a sheath enclosing said plunger and said stem, means detachably securing said sheath to said valve head so as to form a closed passageway between said inlet and outlet openings, said sheath extending through said apertures in said base portion said cross member and said coil thereby to secure said base portion, said cross member and said coil in a predetermined relation with one another, a transverse supporting member carried by said head having its ends secured respectively in detachable relation with said side portions, and a compression spring surrounding said sheath having its ends bearing on said cross member and said valve head so as to secure said coil against said base portion and said cross member against said coil.

2. An electromagnetic valve comprising a U-shaped frame made of magnetic material provided with a base portion and two parallel spaced side portions, said base portion being provided with a central aperture, a tubular guide member secured to said base portion defining said aperture, and extending between said side portions, a magnet coil mounted between said side portions having a central aperture in which said guide member extends at one end of said coil, a cross member made of magnetic material engaging the opposite end of said coil with its ends respectively slidably engaging said side portions to form a magnetic circuit with said frame, said cross member being provided with a central aperture, a tubular guide member on said cross member defining said aperture in said cross member extending into said opposite end of said coil, a valve head member provided with inlet and outlet openings connected through an open passage provided with a valve seat, a valve stem cooperating with said seat, a plunger made of magnetic material secured to said stem, an enclosing sheath made of non-magnetic material enclosing said plunger and said stem, means detachably securing said sheath to said head so as to form a closed passageway between said inlet and outlet openings, said sheath extending through said tubular guide members and said coil thereby to secure said base portion, said cross member and said coil in a predetermined relation with one another, a transverse supporting member carried by said head having its ends secured respectively in bayonet joint relation with the ends of said side portions, and a compression spring surrounding said sheath having its ends bearing on said cross member and said head so as to secure said coil against said base portion and said head to said frame.

JOHN EATON.