

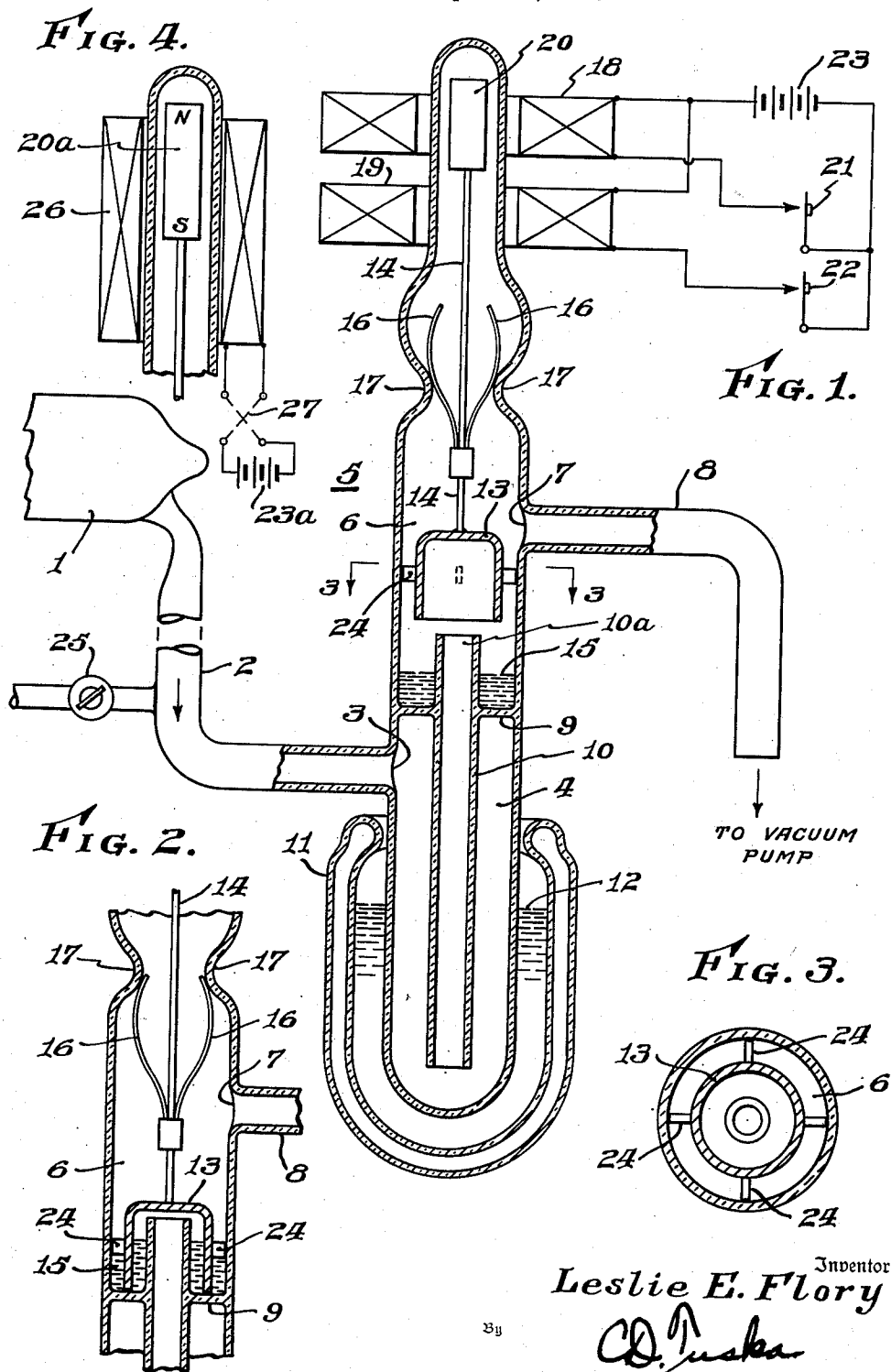
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ELECTRICALLY OPERATED VALVE

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ELECTRICALLY OPERATED VALVE

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1 Claim. (Cl. 137-139)

This invention relates to improvements in vacuum plumbing and has for its principal object to provide an improved cut-off valve for use in such systems.

Another and related object of the present invention is to provide a simple, yet reliable and trouble-free cut-off valve, and one which may conveniently be controlled from a remote point.

Still another object of the present invention is to provide an improved mercury-sealed valve of the general character described, and one characterized by the relatively small quantity of mercury required to ensure a perfect seal.

Other objects and advantages together with certain preferred details of construction will be apparent and the invention itself will be best understood by reference to the following specification and to the accompanying drawing, wherein:

Figure 1 is an elevational view partly in section showing a vacuum plumbing system incorporating the improved remotely controlled cut-off valve of the present invention, Figure 2 is a fragmentary sectional view showing the valve of Fig. 1 in the closed position, Figure 3 is a sectional view taken on the line 3-3 of Fig. 1, and Figure 4 is a schematic diagram of a modification of the magnetic actuating system.

In the vacuum plumbing system shown in Figs. 1 to 3, inclusive, 1 designates generally a tube or compartment which will be understood to be connected to, or to comprise, a device to be evacuated. The part 1 is connected as by a pipe 2 to a flow opening 3 in the lower chamber or "trap" 4 of a vertically mounted glass cylinder or case 5 whose upper or "cut-off" chamber 6 contains a flow opening 7 which is connected to a vacuum pump (not shown) through a pipe 8. The upper and lower chambers of the cylindrical glass case 5 are separated by a glass disc or base 9 which serves as a support for a centrally located hollow tube 10 which has an upper port 10a at a point beneath the flow opening 7 in the upper chamber 5 and which extends to a point adjacent to the bottom of the lower chamber 4. In agreement with standard practice the lower chamber 4 may be seated within a receptacle 11 containing a filling 12 of liquid air or dry ice which serves to condense any vapor which may enter the trap 4. Obviously, in the absence of any impediment to its flow, air or other gas will be drawn by the pump from the compartment or device 1 through the pipe 2 and flow opening 3 into the trap 4, thence through the central tube 10 and its port 10a to the upper or "cut-off" chamber 6 and then

out through the flow opening 7 to the exhaust pipe 8.

The upper chamber 6 of the glass case 5 contains a cut-off valve comprising an inverted cup-shaped member 13 fixed on the lower end of a rod-like valve stem 14 and which is adapted, in a manner later described, to be raised from and lowered into a pool of mercury 15 which is contained in the annular space surrounding the upper end or port 10a of the hollow tube 10 which connects the cut-off (upper) chamber 6 with the lower ("trap") chamber 4.

It will be observed upon inspection of Figs. 1 and 2 that the valve stem 14 has a number (say, three) of upwardly extending outwardly bowed resilient fingers 16 fixed thereon intermediate its ends and that the wall of the glass envelope, above the exhaust port 7 has a constriction 17 therein which serves as a latch for holding the valve stem 14 in the raised position when the said fingers are urged upwardly against the force of their bias, beyond the said constriction, as shown in Fig. 1.

In the embodiment of the invention shown in Fig. 1, magnetic forces or fields are employed for raising and lowering the valve stem assembly. These magnetic forces are supplied by separate coils 18 and 19 surrounding the upper end of the glass envelope 5 and are selectively applied to an iron slug or core 20 on the upper end of the valve stem 14 by means of switches 21 and 22 which are in circuit with a common source of current exemplified by the battery 23. The magnetic field generated by the upper coil 18 and applied to the iron slug 20 when the switch 21 is closed is of sufficient intensity to raise the valve stem 14 to a position whereat the resilient fingers 16 are compressed and passed beyond the constriction 17 in the glass envelope 5. When the valve is in the raised position, the iron slug 20 is in register with the upper or lifting coil 18 and is maintained there, against the forces of gravity, when the switch 21 is opened, by the resilient fingers 16 which now rest upon the constricted portion 17 of the envelope 5.

From the foregoing it is apparent that in order to lower end valve 13, some positive force must be employed to overcome the biasing force which maintains the resilient fingers 16 in their expanded position above the constriction 17. Such a positive force is applied to the iron slug 20 on the upper end of the valve stem 14 by the coil 19 when the switch 22 is closed. That is to say, the magnetic field generated by the said coil 19 attracts the slug 20 and drives the valve stem 14

downwardly with sufficient force to collapse the resilient fingers 16 and project them through the constriction 17 whereupon, as shown in Fig. 2, the cup-shaped valve 13 enters the pool of mercury 15 and effectively closes the otherwise open end of the tube 10.

Referring to the alternative embodiment of the invention shown in Fig. 4: By substituting a permanently magnetized or polarized core 20a for the iron slug 20 of Fig. 1, it is possible to employ a single actuating coil 26 for moving the valve stem assembly in both directions. In this case, a double pole double throw switch 27 in the circuit between the coil 26 and the battery 23a serves to reverse the current flowing in the coil when the direction of movement of the valve stem assembly is to be changed.

In order to prevent undesired tilting or lateral movement of the valve 13, it may be provided on its outer surface with a number of radially extending fins or spokes 24 which slidably engage the inner wall of the cut-off chamber.

The quantity of mercury required to ensure a perfect cut-off action in any given installation may be readily ascertained by reference to the maximum pressure difference to which this sealing fluid may be subjected. Thus, if subsequent to its evacuation, the device is to be provided with a filling of gas (which may be supplied thereto when the valve 13 is closed, through a stop cock 25 in the pipe 2) at a pressure of, say, 2 mm. of mercury, then, referring to Fig. 2, the difference between the level of the mercury inside and outside the cup 13 occasioned by the said difference in pressure, will be 2 mm. It is thus necessary to provide merely sufficient additional mercury (say, a few cubic centimeters) to prevent the gas

from being drawn under the periphery of the cup in the presence of the difference (2 mm.) in the inside and outside levels of mercury.

From the foregoing it will be apparent that the present invention provides an improved remotely controlled, magnetically actuated, mercury-sealed valve and one characterized by its simple construction and trouble-free performance.

What is claimed is:

10 A vacuum plumbing system comprising a glass valve chamber having a long vertical axis and containing a valve port adjacent to its lower end and a constriction in a wall of said chamber intermediate its ends, a valve stem mounted for movement along said axis entirely within said chamber, a closure element for said port mounted on the lower end of said valve stem beneath said constriction, magnetic core means mounted on the upper end of said valve stem above said constriction, a plurality of upwardly extending, outwardly biased resilient fingers mounted on said valve stem intermediate said closure element and said core means, said resilient fingers being adapted to be compressed and passed through said constriction upon movement of said valve stem, and upon cessation of said movement to retain said valve stem and hence said closure element in the raised or in the lowered position with respect to said port as determined by the direction of said movement, and magnetic coil means mounted about the upper end of said vertical axis exterior of said chamber for raising and lowering said core means and hence said valve stem and closure element against the retaining force of said resilient means.

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