Sept. 2, 1969 R. SCHMITZ 3,464,448

DIAPHRAGM VALVE

Original Filed Oct. 11, 1965

FIG. 1

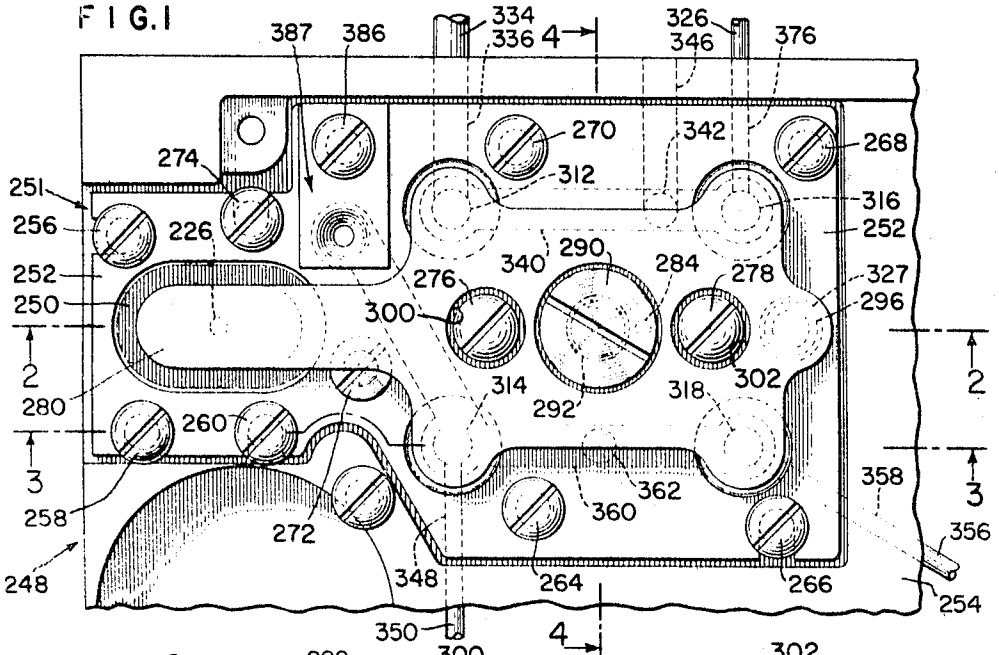


FIG. 2

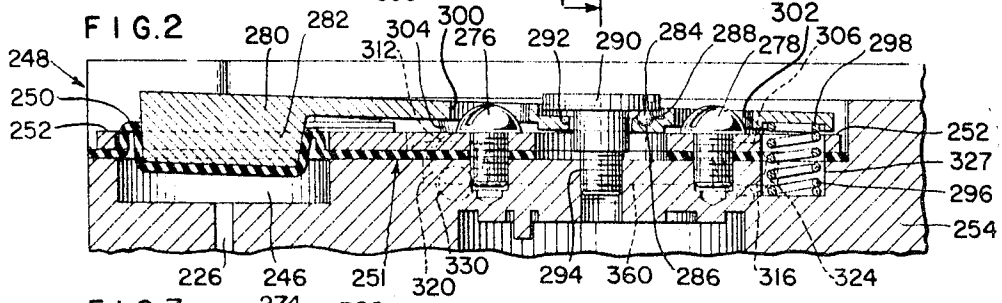


FIG. 3

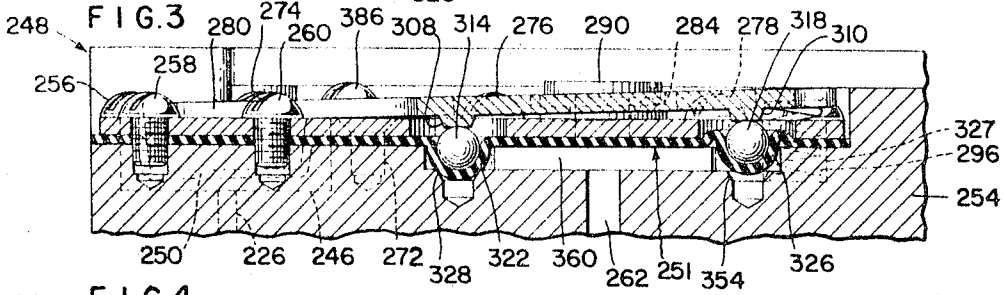
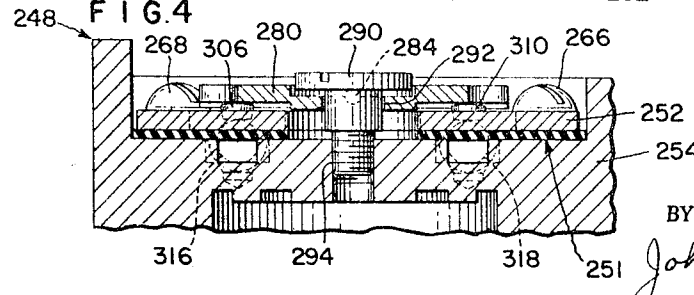


FIG. 4



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3,464,448

DIAPHRAGM VALVE

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Original application Oct. 11, 1965, Ser. No. 494,670, now Patent No. 3,390,697, dated July 2, 1968. Divided and this application Nov. 8, 1967, Ser. No. 698,081

Int. Cl. F16k *11/04, 31/145*

U.S. Cl. 137—625.18 2 Claims

ABSTRACT OF THE DISCLOSURE

A flexible diaphragm valve to control the flow of fluid between different selected ports formed in a manifold plate by employing a spring biased lever to force separate solid spheres against associated dimpled shaped seat portions formed in the diaphragm so that these dimple portions can be brought into sealed self-centered fluid tight engagement with a pair of the ports while another pair of associated sphere and dimple portions in the diaphragm are released from sealed engagement with their associated ports to thereby allow fluid under pressure to be passed between these open ports.

This application is a division of application Ser. No. 494,670, filed Oct. 11, 1965, now Patent 3,390,697, issued July 2, 1968.

It is an object of the present invention to provide a cut-out switch for a control system that has selected inlet and outlet ports that are closed by means of a spring-biased lever that applies a force to solid spheres which, in turn, apply this force to associated dimples formed in a flexible diaphragm to force these portions of the diaphragm against two selected pairs of the aforementioned ports and which closed ports can be opened by raising the fluid pressure within these closed ports.

It is another object of the present invention to provide a unique solid sphere and dimpled diaphragm construction of the aforementioned type that provides soft seats and whose construction also allows the valve to be always self-centered into alignment with its associated ports.

A better understanding of the present invention may be had from the following detailed description when read in connection with the accompanying drawings in which:

FIGURE 1 shows a plan view of a cut-off switch;

FIGURE 2 is a cross-sectional view of the cut-off switch in its automatic control position taken along section line 2—2 of FIGURE 1;

FIGURE 3 shows another cross-sectional view of the cut-off switch in its manual control position taken along section line 3—3 of FIGURE 1;

FIGURE 4 shows still another sectional view of the cut-off switch in its automatic control position taken along line 4—4 of FIGURE 1.

The conduit **226** in FIGURES 1, 2, is shown connected to a diaphragm capsule **246** of the cut-off switch **248**. This switch **248** is advantageously operatively connected with a controller disclosed in Patent No. 3,379,205, issued Apr. 23, 1968; and cut-off switch unit in the manner disclosed in the parent Schmitz et al. Patent No. 3,390,697 issued July 2, 1968. Under this condition, the preformed flexible portion **250** of the diaphragm **251** will be raised by the pressure of the cut-off signal applied thereto from the dotted-line position to the solid-line position. This action takes place while internal and external edges of the diaphragm are retained in position by the punched-out plate **252** that is retained in a fixed position on the manifold plate **254** by means of the screw connections **256–278**.

FIGURE 2 shows an arm **280** having an embossed portion **282** that is retained in contact with the flexible portion **250** of the diaphragm **251**.

An upper surface portion of the arm **280** to the right of the embossed portion **282** is shown in FIGURE 2 having the lower surface of a sphere **284** fixedly retained in a semi-circular dimpled portion **286** thereof by means of a suitable welding material **288**.

A flat head screw **290** is shown passing through a cylindrical slotted wall portion **292** in the arm **280** and retained in fixed engagement with the manifold plate **254** by means of a screw connection **294**. A flat portion of the undersurface of the flat head of the screw **290** is shown retained in point contact with the upper surface of the sphere **284** by means of a spring **296** which applies a spring force in an upward direction to a cupped-out portion **298** of the right end of the arm **280**. Apertures **300**, **302** are also formed in the arm **280** to prevent the head of their respective diaphragm-retained screw connections **276**, **278** from interfering with the seesaw pivotal action of the arm **280** which takes place when a cut-off fluid pressure signal is transmitted by way of conduit **226** to chamber **246**. This action moves the cupped-shaped portion **250** of the diaphragm **251** from its dotted-line manual control position as shown in FIGURE 3 to its solid-line automatic position shown in FIGURES 1 and 4.

The arm **280** shown in FIGURES 2–4 has four embossed portions **304**, **306**, **308**, **310** protruding from its lower surface and in contact with their associated spheres **312**, **314**, **316**, **318**. Each of these spheres **312–318** is, in turn, shown in contact with semi-circular dimples **320**, **322**, **324**, **326** formed in the diaphragm **251**.

The four (4) dimples **320**, **322**, **324**, **326** in the diaphragm **251** and the spheres **312**, **314**, **316**, **318** associated therewith together with the spherical ball pivot **284** about which the actuating arm **280** associated with these spheres is rotated provide a unique self-aligning soft seat valve construction. This is so because the flat plane portion of the arm **280** can be tilted laterally or longitudinally on the spherical fulcrum **284**. Another feature is that, since the top of the coil spring **296** is retained in the cupped portion **298** of the arm **280** and a cup portion **327** in the manifold **254**, there is no possibility for the arm **280** and its associated spherical fulcrum **284** to rotate about the screw head **290**.

When the controlling-indicating apparatus disclosed in the aforementioned Patent 3,390,697 is on manual control, the output fluid pressure from a regulator and an associated booster that is being transmitted to a controller cut-off switch unit which are all shown in the aforementioned Schmitz et al. Patent No. 3,390,697 will be exhausted to atmospheric pressure by way of an exhaust port in the automatic-manual transfer switch which is also shown in FIG. 1 of the parent Patent No. 3,390,697.

Under a manual control condition, the cut-off fluid pressure in **226** of the diaphragm capsule chamber **246** of the cut-off switch **248** will thus be exhausted to atmosphere and the capsule **250** will be moved by the action of the spring **296** acting on the arm to the dotted-line position shown in FIGURE 3 of the drawing. Under this manual control condition, the sphere **284** fixed to the arm **280** will act as a fulcrum about which the arm is pivoted to the aforementioned manual position as shown in FIGURE 3. In this position, the spheres **312**, **314** will be forced by the associated portions **304**, **308** of the arm **280** against the dimples **320**, **322** that are associated with these spheres to seal off the ports **328**, **330**. Under this condition, the fluid pressure being transmitted through conduit **336** of the FIGURE 1 from a pilot relay of the controller disclosed in the aforementioned Schmitz et al. Patent 3,390,697 and the Schmitz Patent 3,379,205 will be cut off by the dimple valve **312**, **320** from the cut-off

switch passageway **340**, **342**, **346**. This fluid pressure is also cut off from being applied to the manual regulator output control conduit associated with the aforementioned regulator.

When the aforementioned controller is placed in automatic, the introduction of the cut-off signal into the chamber **246** will cause the arm **280** to be tilted so that the spheres **312**, **314** and dimples **320**, **322** will be moved off of their respective seats **330**, **328** and the spheres **316** and **318** will be moved into closed engagement with their associated ports **324**, **326**.

Because the rate and reset valve disclosed in U.S. Patent 3,390,697 are isolated from one another in the aforementioned manner, when the controller is on manual a bumpless shift can be made from manual to automatic or manual to cascade and without the output of the controller changing after this shift is made.

What is claimed is:

1. A valve, comprising a manifold plate containing four spaced apart ports and inter-connecting passages therein, a diaphragm mounted on a portion of the manifold plate and having a dimple portion formed therein protruding into each port, a sphere having a portion thereof mounted in each dimple, a spring supported at one end within and on another portion of the manifold plate, an arm having separate embossed portions thereof in contact with another opposite portion of each sphere, the arm having one end supported by the other end of the spring and an opposite embossed end in contact with a movable portion of the diaphragm that extends into a chamber formed in the manifold plate, a stationary member, the arm having a hemispherical pivot portion integral therewith and extending therefrom that is at a location positioned between its ends and between opposite pairs of the ports and being in point contact with the stationary member, and means to tilt ends of the arm about the pivot portion to force

two of the spheres on their associated diaphragm dimple portions into closed engagement with their ports and to open the other ports retained in closed position by the dimples and spheres.

2. A valve comprising a manifold containing at least two ports and interconnecting passageways therein, a flexible member mounted on a portion of a manifold and having an indented portion formed therein protruding into each port, a separate protuberance having a portion thereof mounted in each indented portion, a biasing means supported at one end within and on another portion of the manifold, a plate having a portion thereof in contact with other opposite portions of each protuberance, the plate having one end supported by the other end of the biasing means and an opposite embossed end in contact with a movable portion of the flexible member that extends into a chamber formed in the manifold, a stationary member, the plate having a curved surface pivot portion integral therewith and extending therefrom positioned at a location between two of its ends and opposite ports and being in point contact with the stationary member, and means to tilt the plate about the pivot portion to force one protuberance and its associated diaphragm indented portion into closed engagement with its port and to open the remaining protuberance retaining the indented portion of the flexible member against the other ports.

References Cited

FOREIGN PATENTS

Ad. 76,575 10/1961 France.

HENRY T. KLINKSIEK, Primary Examiner

U.S. Cl. X.R.

137—612.1, 625.44; 251—59