Dec. 18, 1951 G. E. NICHOLSON ET AL 2,578,730

DIAPHRAGM

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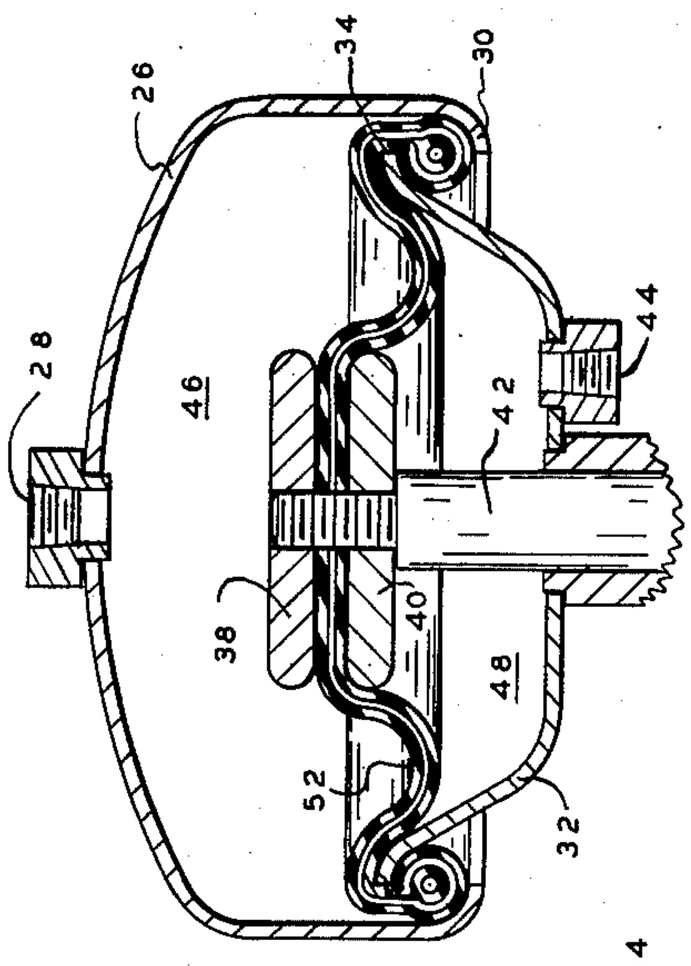

FIG. 3

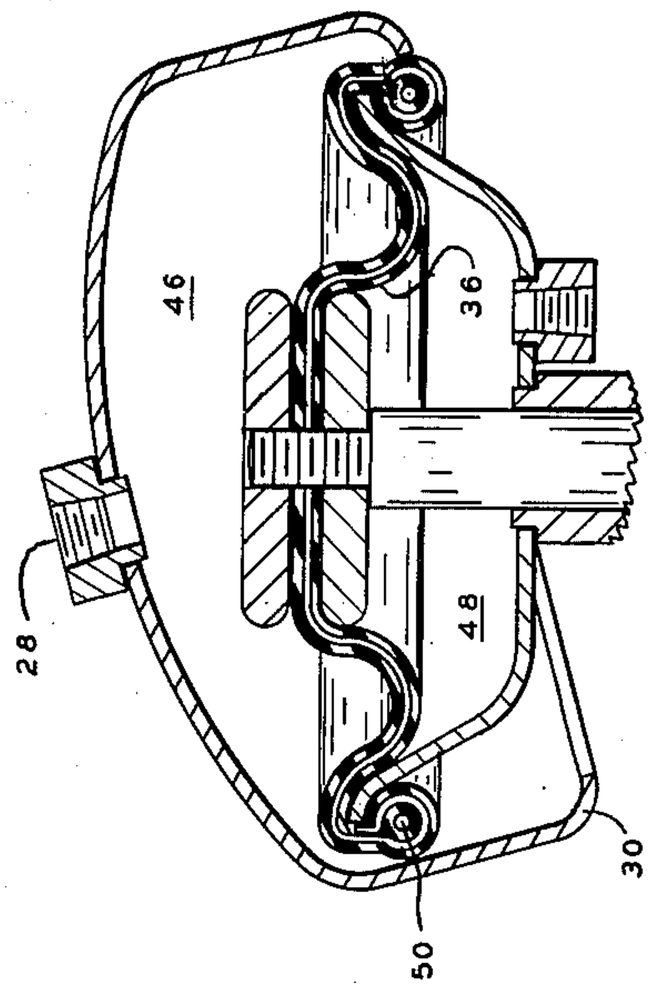

FIG. 4

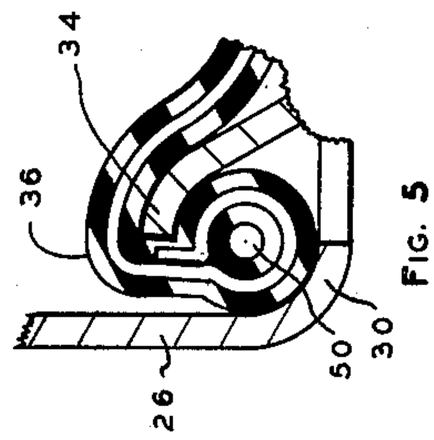

FIG. 5

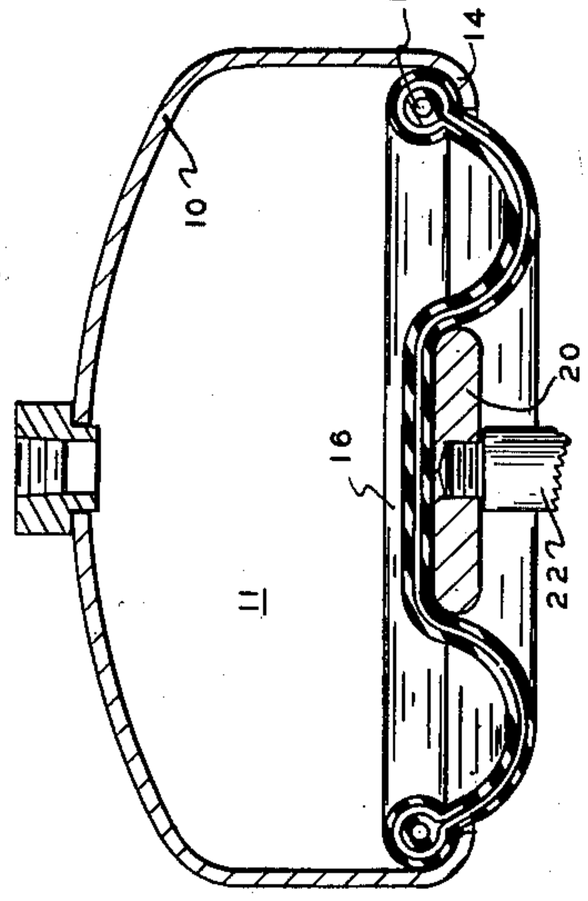

FIG. 1

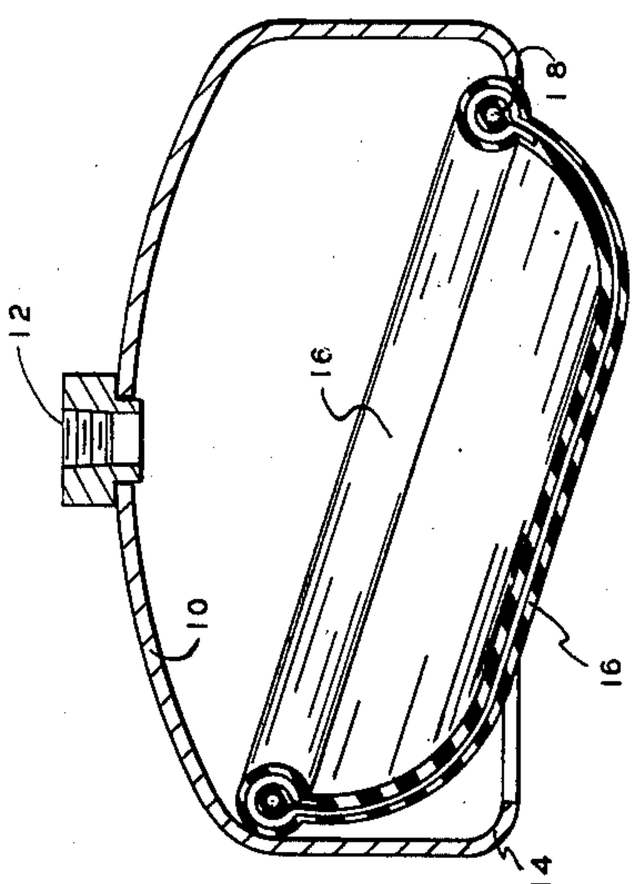

FIG. 2

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6 Claims. (Cl. 137—157)

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This invention relates to fluid pressure seals and more particularly but not by way of limitation, to a pressure seal diaphragm adapted to be utilized in pressure regulators, motor valves and liquid level controls or the like.

Flexible diaphragms have been utilized for various purposes and in the prior art it has been conventional to connect or seal the peripheral edges of the diaphragm to a cooperating shell or housing by the means of bolts or the like. However, with this method the exertion of pressure, in many instances, would have a tendency to pull the diaphragm away from the connecting sections of the housing thereby breaking the seal connection at the peripheral edges of the diaphragm.

This invention contemplates the use of the flexible diaphragm which is novel in that it is entirely self-sealing from the pressure of a fluid pressure instrument, and eliminates the use of a bolted connection with the peripheral edges of the diaphragm to the instrument housing along with the apparent disadvantages appertinent thereto.

It is an important object of this invention to provide a diaphragm for fluid pressure instruments wherein the seal of the diaphragm is entirely dependent upon the fluid pressure from the instrument.

And another important object of this invention is to provide a self-sealing pressure diaphragm for use with fluid pressure instruments which is capable of easy and rapid assembly and disassembly with the housing of the instrument.

And still another object of this invention is to provide an improved diaphragm seal for fluid pressure instruments wherein the diaphragm is so constructed to act as a stiffening agent upon the application of pressure in the housing of the instrument whereby the diaphragm is sealed to the walls of the instrument housing.

And still another object is to provide a self-sealing flexible diaphragm which is easy to manufacture, durable and facilitates ease of operation with a fluid pressure instrument.

Other objects and advantages of the invention will be evident from the following detailed description read in conjunction with the accompanying drawings which illustrate my invention.

Fig. 1 is a sectional elevational view of the improved diaphragm shown cooperating with the housing of a fluid pressure instrument.

Fig. 2 is a similar view showing the diaphragm being inserted into the housing.

Fig. 3 is a sectional elevational view of a modification showing the application of the diaphragm to interfitting housings.

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Fig. 4 is a similar view disclosing the insertion of the diaphragm into the housings.

Fig. 5 is a detailed view showing the sealing of the diaphragm in Fig. 3.

Referring to the drawings in detail, reference character 10 comprises a vessel or housing of a fluid pressure instrument such as a pressure regulator, liquid level control, motor valve, or the like. The housing 10 is provided with an inlet coupling 12 serving as an inlet for fluid pressure (from a source not shown) into the housing 10. The lowermost sides of the housing 10 are formed to provide an inwardly projecting internal lip 14 for a purpose as will be hereinafter set out.

A flexible diaphragm 16 is adapted to be utilized with the vessel 10 and provide a seal with lip 14. The diaphragm annulus 16 is substantially disc shaped and comprises a laminated structure of molded rubber having a canvas insert interposed between the outer layers of rubber. The peripheral rim of the diaphragm has embedded therein a resilient ring 18 of spring steel or the like. From Fig. 2, it will be apparent that insertion of the diaphragm 16 into the housing 10 is accomplished by laterally contracting the diaphragm rim to substantially elliptical shape and pushing a peripheral portion of the diaphragm upwardly into the chamber 11 of the housing 10 until the opposite peripheral edge of the diaphragm rides past its respective portion of lip 14. The diaphragm rim being then released, expansion of the spring 18 snaps the diaphragm substantially into its Figure 1 position where the rim is freely seated within the housing around lip 14. With the application of pressure through the inlet 12, the ring 18 acts as a stiffening agent and causes the diaphragm to firmly seal against the inner walls of the housing 10 and particularly the rim or lip 14.

The central portion of the diaphragm is connected with a diaphragm plate 20 in turn connected with an actuating rod 22.

Figs. 3 to 5 inclusive, disclose the application of the diaphragm in an instrument having interfitting housings. A substantially hemispherical upper housing 26 is provided with a pressure inlet coupling 28 and is constructed at its lowermost portion with an inwardly bent lip 30 surrounding an enlarged opening. The housing 26 cooperates with a somewhat similar lower housing 32 having its periphery bent outwardly to

form a horizontally disposed lip **34**. It will be apparent that the lip of housing **32** is disposed in the housing **26** in the assembly of Figure 3. A flexible diaphragm **36** is disposed in the housings **26** and **32** between two diaphragm plates **38** and **40**, in turn threadedly connected with an actuating rod **42** that is slidable through housing **32**.

A pressure inlet coupling **44** is disposed in the housing **32**. The diaphragm **36** is of similar construction to the diaphragm **16** in the preferred embodiment. From Fig. 3, it will be apparent that this construction provides a double acting self-sealing diaphragm wherein fluid pressure in either of the chambers **46** or **48** tends to seal the diaphragm rim to the lips **30** or **34** respectively. Furthermore, any differential of pressure between the two chambers will effect a self-sealing of the peripheral edges of the diaphragm **36** against one of the housings. The diaphragm **36** includes a metal ring **50** acting as a stiffening agent for the sealing effect. With the pressure acting against the diaphragm, it will be apparent that the upper housing **26** and the lower housing **32** will be pushed apart to their normal operating position thereby accentuating the seal of the diaphragm between the lips **30** and **34**.

Furthermore, it will be apparent that the greater the pressure in the chamber **11** of the preferred embodiment or either of the chambers **46** and **48** of the modification, the greater the sealing effect of the diaphragm against the respective lip portions of the housing. In both the preferred embodiment and the modification, the diaphragm annulus is shown with a dip portion **52** which is of conventional construction that allows for flexibility of motion or movement of the diaphragm without any unnecessary stretch of the diaphragm annulus, especially during the assembly and disassembly of the diaphragm to and from the instrument housings.

Fig. 4 shows an application of the diaphragm being inserted between the upper housing **26** and the lower housing **32**. The diaphragm annulus is disposed on the lower housing **32** with the peripheral edges enclosing the metal ring **50** overhanging the lip **34** of the housing **32**. The upper housing **26** is then directed from an angular or tipping position (as shown) over the diaphragm **36** and housing **32** allowing one portion of the lip **30** to ride past a respective portion of the annular diaphragm. The upper housing **26** is then arranged in an upright position and with the application of fluid pressure the diaphragm **36** effects a seal for holding the two housings in normal operating position.

From the foregoing it will be apparent that this invention contemplates the use of a diaphragm which is dependent entirely upon fluid pressure in a fluid pressure instrument to effect a positive seal of the diaphragm in the instrument, without the use of any extraneous elements such as bolts or the like, to provide the sealing effect. Furthermore the self-sealing pressure diaphragm can easily and rapidly be assembled and disassembled with fluid pressure instruments without necessarily disassembling the instrument for this operation.

Changes may be made in the combination and arrangement of parts as heretofore set forth in the specification and shown in the drawings, it being understood that any modification in the precise embodiment of the invention may be made within the scope of the following claims without departing from the spirit of the invention.

What is claimed is:

1. In a fluid pressure instrument, a relatively rigid housing having a fluid inlet and an enlarged opening surrounded by an internal annular lip, a preformed flexible diaphragm that has an annular rim about its outer periphery freely seated upon said lip internally of said housing, and a resilient ring imbedded in said diaphragm rim, said rim being larger than said opening but said ring permitting lateral contraction of said rim to clear said opening for insertion of the rim into said housing during assembly of the housing and the diaphragm, said ring expanding to substantially regain its shape to seat said rim on said housing all around said lip, and said inserted rim being forced into pressure sealing engagement with said housing all around said lip by fluid pressure within said housing.

2. In the fluid pressure instrument defined in claim 1, said opening and said rim being circular, with the outer periphery of the inserted rim engaging the inner side wall of the housing.

3. In the fluid pressure instrument defined in claim 1, said internal lip being formed by an inturned portion of said housing.

4. In a fluid pressure responsive instrument, a relatively rigid housing part having a fluid inlet and an enlarged opening surrounded by an internal annular lip, a second relatively rigid housing part movable relative to said first housing part and having a fluid inlet and an open end surrounded by an outwardly extending annular lip smaller than said opening, a preformed flexible diaphragm between said housing parts having an annular rim about its outer periphery larger than said opening and seated freely between said internal lip and said outwardly extending lip, and a resilient ring imbedded in said rim permitting lateral flexure of the rim to clear said opening for insertion of the assembled diaphragm and second housing part through said opening during assembly, said ring expanding to substantially regain its shape and seat said rim on said first housing part all around said internal lip, and fluid pressure within the housing parts urging said diaphragm rim and said lips into fluid tight contact.

5. A fluid pressure instrument comprising a pair of interfitting relatively movable housing members, an inwardly extending annular lip on one of said housing members, an outwardly extending annular lip on the other of said housing members, said lips extending generally toward each other so that their edges are adjacently disposed, and a flexible diaphragm disposed between the housing members so as to provide pressure chambers within said instrument between opposite sides of said diaphragm and said housing members and having a spring ring imbedded in the rim thereof, said diaphragm rim being freely seated between the lips of said housing members, and said diaphragm being responsive to fluid pressure in either or both of said chambers to urge said rim into sealing engagement with said housing member lips.

6. A fluid pressure instrument comprising a pair of relatively movable interfitting housing members having annular lips that extend oppositely so that their peripheral edges are adjacently disposed, a flexible diaphragm floatingly disposed between said lips and providing with said housing members a pair of pressure chambers, said diaphragm being responsive to a differential of pressure between said chambers to effect a self-sealing action with at least one of the

lips, and means in the diaphragm acting as a stiffening agent therefor.

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