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L. R. MYERS ETAL
FLUID PRESSURE SERVOMOTOR
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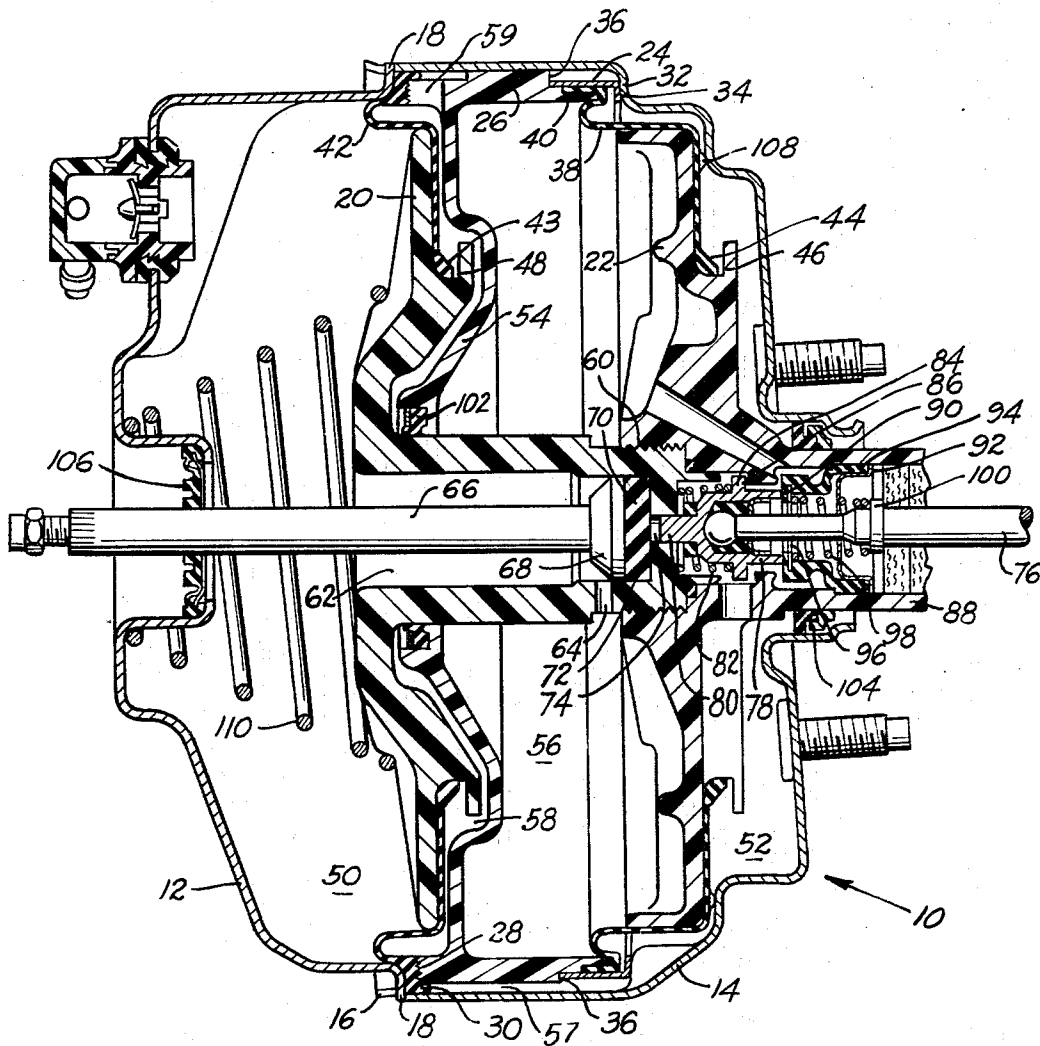


FIG. 1

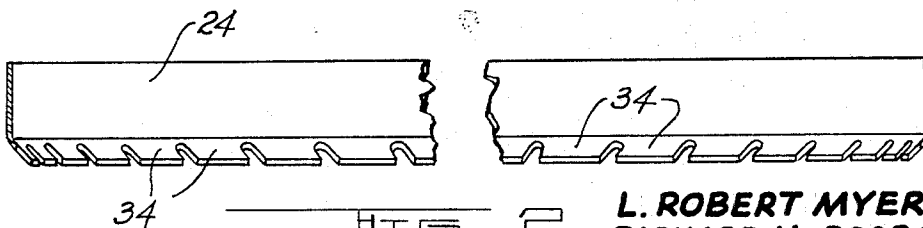


FIG. 2

L. ROBERT MYERS.
RICHARD H. ROSBACK.
INVENTORS

BY *Richard H. Heil*

ATTORNEY.

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FLUID PRESSURE SERVOMOTOR

Lawrence Robert Myers and Richard H. Rosback, South Bend, Ind., assignors to The Bendix Corporation, South Bend, Ind., a corporation of Delaware
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This invention relates to a fluid pressure servomotor, and more particularly, it is concerned with the construction thereof.

An object of the present invention is the provision of a new and improved arrangement for sealing a plurality of diaphragms within an internal housing of a fluid pressure motor; and which is simple in design, rugged in construction and inexpensive to manufacture.

A further object of the present invention is the provision of a new and improved arrangement for clamping the periphery of a plurality of diaphragms within a fluid pressure motor housing, in such manner as to prevent the diaphragms from being pulled out from between the clamping arrangement.

A still further object of the present invention is the provision of a new and improved multiple diaphragm servomotor unit whose housing is made in sections, and one section of which has an outwardly facing shoulder toward which one of the diaphragms and a spacer are biased by a spring-like retainer clamping another of the diaphragms to the retainer and being operatively connected with a shoulder of another section of the housing.

The invention resides in certain constructions and combinations and arrangement of parts; and further objects and advantages of the invention will become apparent to those skilled in the art to which the invention relates from the following description of the preferred embodiment described, with reference to the accompanying drawings forming a part of the specification, and in which:

FIGURE 1 is a cross sectional view of a fluid pressure servomotor embodying principles of the present invention; and

FIGURE 2 is a broken sectional view of a diaphragm retainer constructed in accordance with the principles of our invention.

With more particular reference to FIGURE 1, we show a fluid pressure servomotor 10 having a housing assembled from a front shell portion 12 and a rear shell portion 14 united by aligning notches within the portion 12 with the radially inwardly bent portions 16 of shell portion 14 and twisting the shell 12 until the ears 18 are locked behind the inwardly bent portions 16.

However, before assembling the housing, movable walls 20 and 22 are positioned within the shell portion 14 by means of an annular diaphragm retainer 24 and a plastic spacer 26 provided with a serrated edge 28. As seen, the spacer is interposed between a front diaphragm 30 and the diaphragm retainer 24, which are compressed against the radially outwardly extending ears 18 and a shoulder 32 of the front shell portion 12 and the rear shell portion 14, respectively.

The diaphragm retainer 24 is constructed with an axially extending member having rearwardly depending projections 34 formed with notches therebetween to provide a plurality of continuous and spaced, spring fingers. The body of the retainer 24 is also provided with an edge opposite the depending projections which is to abut a stepped shoulder 36 of the spacer 26 and overlies a rear diaphragm 38 having a peripherally thickened portion with a groove therein to receive a lip 40 of the spacer 26 with a forward edge of the radially thickened portions abutting the lower extremity of the stepped shoulder 36 and being compressed onto the lip 40 by the diaphragm retainer 24. Such com-

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pression can be easily accomplished by providing a bulbous radial projection adjacent the forward edge on the thickened portion immediately under the retainer 24 that is compressed by sliding the retainer 24 over the bulbous portion until it abuts the spacer stepped shoulder 36. In this position axial loading of one portion has a straight line of force through the retainer, spacer and forward diaphragm bead to the other portion.

Both the rear diaphragm 38 and rear diaphragm 42 having the peripherally thickened bead 30 are provided with central openings and beads 44 and 43, respectively, therearound which are undersize with respect to grooves 46 and 48 in movable walls 22 and 20, respectively, to provide an interference fit therebetween and thereby divide the servomotor into a plurality of chambers, i.e. 50 and 52; and an internally depending partition 54 from the spacer 26 further divides the servomotor into chambers 56 and 58 between the movable walls 20 and 22. The spacer 26 is provided with longitudinal grooves 57 which communicate with radial openings 59 adjacent the serrated edge 28 to provide fluid communication between chambers 52 and 58.

The movable walls 20 and 22 are formed of a similar hard plastic material and are united by a simple screw thread arrangement as at 60 to move in unison inside the servomotor 10. As seen, the wall 20 is provided with an axial opening or fluid passageway 62 opened to chamber 50 and by means of a radial passage 64 to chamber 56 behind the partition 54. Within the axial passage 62 there is placed a force transmitting rod 66 which is provided with a reaction plate 68 arranged to hold a reaction disc 70 against a shoulder 72 adjacent the threaded end of the tubular projection about the axial passage 62. As seen, the shoulder 72 is provided with a central opening 74 into which the disc 70 is extruded by force applied on the rod 66 to oppose movement of the walls 20 and 22. This opening 74 is appropriately sized to provide a proportional reaction of the force on the rod 66 to a valve operating control rod 76, by way of a valve poppet 78 having an end 80 slidably received within the opening 74. The end 80, and in fact the valve poppet 78, is biased by means of a return spring 82 that is compressed between the tubular projection of wall 20 and a radial flange 84 of the poppet 78 and a depending shoulder 86 of the movable wall 22, so as to be normally spaced from the reaction disc 72. Behind the valve poppet 78 and within a tubular portion 88 of the movable wall 22 extending rearwardly of the portion 14 of the servomotor 10 there is mounted a flexible poppet 90 held to the tubular portion 88 by a sealing washer 92 arranged to bias an outer thickened portion 94 of the flexible poppet 90 to the tubular portion 88. In addition, the flexible poppet 90 is provided with an annular washer 96 immediately behind a forward face of the poppet 90 on which a spring 98 bears, which spring is compressed between a flange 100 of the control rod 76 and the washer 96.

As seen, the tubular portion surrounding the passage 62 of the movable wall 20 and the tubular portion 88 are sealingly and bearingly supported by the partition 54 and the rear housing portion 14, respectively, as by means of bearing seals 102 and 104, and the push rod 66 is reciprocally supported and sealed by means of a seal 106 in the forward portion 12 of the servomotor housing. Furthermore, the movable walls 20 and 22 are biased to have a bulbous portion 108 on the rear face of diaphragm 38 abutting a radially interned portion of the rear shell 14 by means of a conical spring 110 within the chamber 50, so that upon release of the control rod 76 the spring 110 will return the movable walls to the inoperative rearward position shown in FIGURE 1.

It will thus be seen that the objects of our invention have been accomplished by the above-described structure.

More particularly, we have provided a means of assembling at least two diaphragms within a fluid pressure servomotor where a constant compressive load is maintained on but one of the diaphragms, and the other is clamped into operative position without exerting axial compression forces on same. In addition, our diaphragm retainer absorbs some of the compressive loads to provide a dual function of allowing for tolerance build-up in assembly while clamping one of the diaphragms in place.

Furthermore, the use of spaced fingers allows them to deflect without distorting the circumferential profile of the body, which allows narrow gauge material to be used. In more details, we have constructed a retainer 24 from a piece of narrow gauge sheet material that is strip rolled into a ring-like body placed within a brake to form angular projections while at the same time being welded, as by spot welding. Thereafter we stamped slots equidistantly about the angular projections to form uniformly spaced fingers continuously about the periphery of the ring. In one embodiment thus far manufactured, the spring fingers were formed on an angle between the range of 15° to 45°. With such an angle we have found that the line of force through the retainer 24 will act axially so as to prevent distorting of the circumferential profile of the body.

Finally, by using the retainer as an exterior clamp we have seen several other advantages of noteworthy interest. In detail, we have found such a clamp in a servomotor allows for a longer life span for our diaphragms in that the bead is less likely to take a set which in experience proves to be bad for members exposed to intermittent loads. Also, such a construction as ours provides an easy subassembly of the internal elements of a servomotor than heretofore thought possible and uses less parts in doing it.

It is to be understood that the present invention is susceptible of various modifications and adaptations other than herein described and shown and that it is only limited by the scope of the appended claims.

We claim:

1. A servomotor comprising:
 - a housing having two portions adapted to be joined together;
 - a spacer arranged between the two portions of said housing, said spacer having a serrated bearing surface on one edge and a narrow lip projecting from a stepped shoulder on another edge of said spacer;
 - a first flexible means having a peripheral bead placed between the serrated edge of said spacer and one of said portions of the housing;
 - a second flexible means having an annular groove in a peripherally thickened portion thereof arranged to receive the lip portion of said spacer, said peripherally thickened portion having a radially projecting bulbous portion at an end thereof which is arranged to abut the stepped shoulder of said spacer;
 - an annular diaphragm retainer surrounding said peripherally thickened portion of said second flexible means to compress said bulbous portion thereof and hold said second means to said spacer, said diaphragm retainer having an edge abutting said stepped shoulder

of said spacer and another edge having angularly disposed spring finger projections affixed thereto with openings therebetween which projections bear on the other portion of said housing opposite that on which the peripheral bead of said first flexible means bears.

2. A servomotor according to claim 1 wherein said spacer provides a fluid passage means between said spacer and said housing to communicate an area behind said second flexible means to an area behind said first flexible means.

3. A servomotor according to claim 1 wherein said second flexible means may be characterized as having stop means formed thereon for engaging the other portion of said housing to limit the rearward travel of said first and second flexible means within said housing in one direction.

4. A servomotor according to claim 1 wherein said first and second flexible means are, respectively, affixed to a first movable wall and a second movable wall on either side of said spacer which has an inwardly projecting portion to form four variable volume chambers within said housing.

5. A servomotor according to claim 1 wherein said diaphragm retainer is characterized as a ring-like body formed of sheet material having angular projections with slots therebetween to form spaced fingers continuously about the periphery of the ring, which fingers depend at an angle between the range of 15° to 45° so that forces tending to set the fingers normally with respect to the body of the ring will act axially through the ring body behind the fingers.

6. A servomotor according to claim 2 wherein said flexible means may be characterized as having stop means formed thereon for engaging the other portion of said housing to limit the rearward travel of said first and second flexible means within said housing in one direction.

7. A servomotor according to claim 6 wherein said first and second flexible means are, respectively, affixed to a first movable wall and a second movable wall on either side of said spacer which has an inwardly projecting portion to form four variable volume chambers within said housing.

8. A servomotor according to claim 7 wherein said diaphragm retainer is characterized as a ring-like body formed of a sheet material having angular projections with slots therebetween to form spaced fingers continuously about the periphery of the ring.

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MARTIN P. SCHWADRON, *Primary Examiner.*

I. C. COHEN, *Assistant Examiner.*