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FLUID MOTOR CONSTRUCTION FOR VALVES OR THE LIKE

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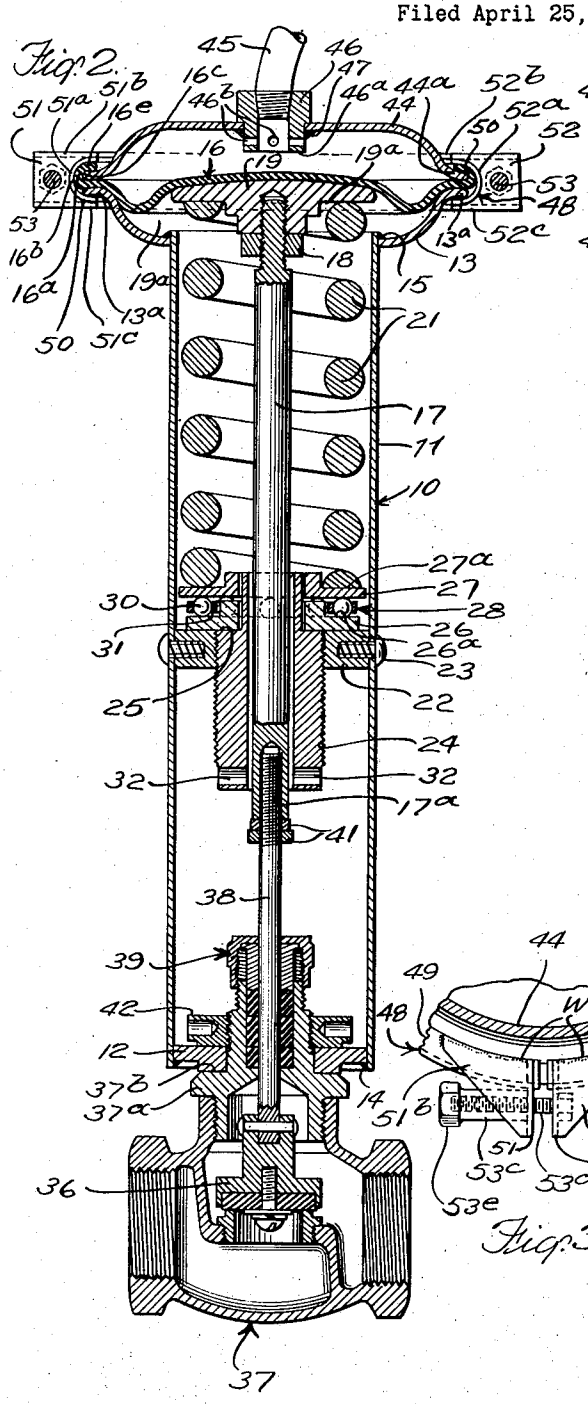
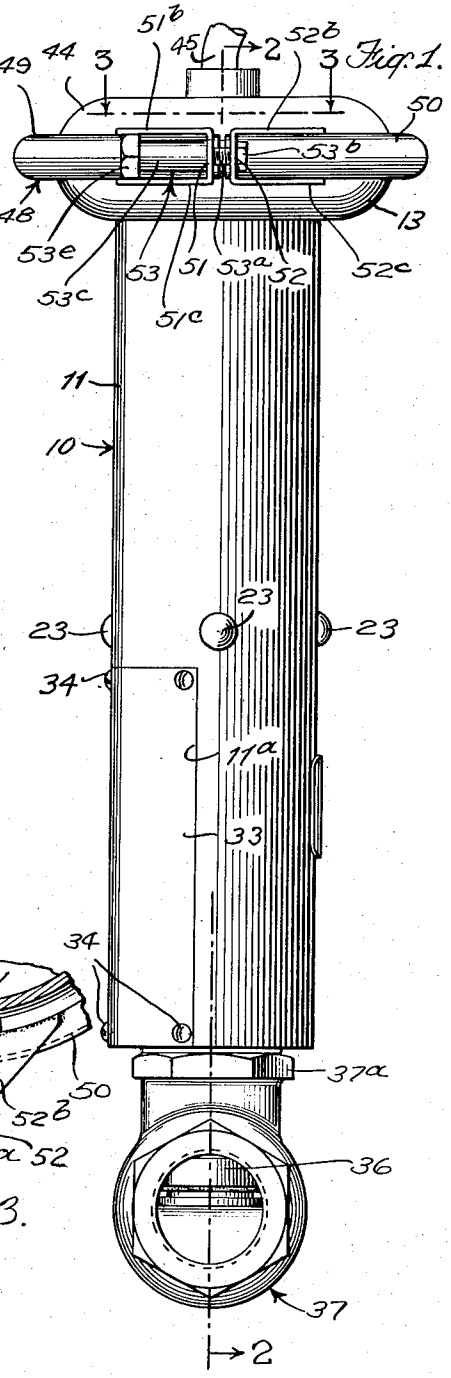






Fig. 3.




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## FLUID MOTOR CONSTRUCTION FOR VALVES OR THE LIKE

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15 Claims. (Cl. 137—157)

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This invention relates to diaphragm motor construction operable in response to fluid pressure.

One of the objects of this invention is to provide a simple, efficient, and practical fluid-responsive diaphragm motor that will be of dependable and long-lasting, efficient action.

Another object is to provide a motor of the above-mentioned character that can be constructed of readily fabricated and relatively inexpensive, individual parts capable of ease and dependability of assembly. Another object is to provide a motor of the above-mentioned character in which a dependable sealed junction between the flexible diaphragm and its companion chamber-forming casing part may be achieved in a simple, inexpensive, and thoroughly practical manner. Another object is to provide, in a pressure-responsive diaphragm motor of the above-mentioned character, a simple, practical, and inexpensive self-sealing mounting or assembly of the flexible diaphragm element that will be capable of dependable and long-lasting action. Another object is, in general, to provide an improved diaphragm motor construction of the above-mentioned type, and other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of application of which will be indicated in the following claims.

In the accompanying drawings, in which is shown illustratively a preferred embodiment of my invention:

Fig. 1 is a side elevation of a fluid-responsive diaphragm motor shown, by way of illustration, as related to a valve to operate the latter;

Fig. 2 is a vertical sectional view as seen along the line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary elevation, as seen along the line 3—3 of Fig. 1, showing certain features of the construction for achieving self-sealing assembly of the flexible diaphragm.

Similar reference characters refer to similar parts throughout the several views of the drawings.

The structure comprises preferably a frame, generally indicated by the reference character 10, which may be built up of several parts—illustratively a tubular frame part 11 conveniently made of relatively thin material, such as steel tubing, and, because of its cross-sectional form,

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having good rigidity, and having lower and upper annular members 12 and 13, of which the member 12 may be fitted internally of the tube member 11, and welded thereto, as at 14, and the upper frame member 13 is annular and fitted about the upper end of the part 11 to which it may be welded, as at 15. The upper part 13 may be in the form of a suitably heavy stamping and is flared outwardly and upwardly to provide an outer peripheral flange 13a which is to take part in forming a seat for a flexible diaphragm generally indicated by the reference character 16. The built-up frame 10 takes part in supporting and guiding for movement a main operating stem 17 positioned substantially along the axis of the tube part 11 and having threaded thereto, at its upper end, and locked by a lock nut 18, a disk-like plate 19, the upper circular face of which may be curved and rounded over peripherally, as indicated, so as to present an appropriate and large area against which a large central portion of the diaphragm 16 is seated to exert downward pressure or force, in a manner later described, under the action of fluid under pressure acting against the upper face of the diaphragm 16; the plate 19, on its under face, is suitably machined, as at 19a, to form an annular seat for the upper end of a helical spring 21 which biases the plate 19 upwardly against the action of the downward force of the fluid under pressure acting upon the diaphragm 16.

Suitable means are provided to support the lower end of the spring 21, as are also provided means for adjusting the compression of the spring so as thereby to set the standard at which the fluid pressure diaphragm motor is to operate, and, conveniently and preferably, these two means are combined. In the illustrative and preferred form I provide a relatively heavy, annular member or collar 22 that fits inside of the tube frame part 11 to which it is readily secured at a suitable point intermediate of the length of the part 11, as by screws 23 which may, if desired, be of the kind that are of large pitch of thread and, upon being driven home into suitable holes drilled in the collar 22, cut corresponding, high-pitch thread-ways into the metal of the collar 22. The latter is thus readily secured in place and can take part in enhancing the rigidity of the built-up frame 10.

The collar 22 is internally threaded to receive an elongated, hollow or annular screw 24 through the bore of which the vertically movable, operating stem 17 extends. The upper external part of the screw 24 is turned or otherwise machined

to provide a horizontal shoulder or seat 25 of substantial area, against which seats or rests an annular thrust plate 26 between which and an annular spring-supporting plate 27 is received an annular bearing structure 28, to reduce frictional resistance to relative rotary movement between the plates 26 and 27, and preferably this bearing structure is of the so-called anti-friction bearing type and may comprise balls 30 and a suitable annular cage 31 therefor.

The spring-supporting plate 27 is shaped, as at 27a, to provide a suitable annular seat for receiving the lower end of the spring 21 and for substantially aligning it coaxially of the structure. The upper face of the thrust plate 26 is also suitably shaped to provide it with an annular seat or raceway 26a, against one face of which the rolling members 30 of the anti-friction bearing 28 rest and the other face of which in effect centers the bearing structure 28 relative to the thrust plate 26 itself. The under face of the spring plate 27 rests against the rolling members 30, as appears from Fig. 2.

The lower end of the hollow, elongated screw 24 is provided with a suitable number of radially extending recesses 32, their axes extending like the spokes of a wheel, whereby, by the step-by-step insertion of a suitable rod or tool, the screw 24 may be threaded upwardly or downwardly to increase or lessen the compression of the spring 21, the tubular casing part 11 being cut away, as at 11a (Fig. 1), to provide access to the interior of the lower end of the tubular frame part 11, and the opening 11 may be normally closed over by a cover plate 33 suitably secured detachably, as by screws 34.

Rotary movement of the adjusting screw 24 will be seen to be facilitated by the anti-friction bearing structure 28, which also facilitates ease of rotary movement of the spring plate 27 to accompany rotary motion of the lower end of the spring during changes in compression of the latter during operation of the motor.

The motor stem 17 may be connected in any suitable or desired way to actuate any desired device or mechanism, illustratively the valve member 36 of a valve generally indicated by the reference character 37—and an illustrative operating connection may comprise a valve stem 38 connected to the valve member 36 and extending upwardly through a stuffing box construction generally indicated at 39, and, in such case, the casing of the valve structure 37 may also be made to support the entire motor structure, and this may be done in a manner so as to utilize the sliding bearing or stuffing box structure of the valve as the lower guide for the connected-together motor stem 17 and valve stem 38. The latter may be coaxially secured together in any suitable way, as by threading the valve stem 38 into a threaded hole 17a in the motor stem 17, thus forming also a connection of adjustable length which may be locked, as by one or more lock nuts 41. To facilitate such an arrangement, the annular end plate 12 of the frame 10 has an internal diameter to take over the stuffing box structure and to be slidably received about the cylindrical extension 37a of the valve casing, thus to insure concentricity of the parts, the end plate 12 of the frame 10 resting against a shoulder 37b of the valve casing against which it is securely clamped by a capstan nut 42 in threaded connection with the threaded upper portion of the cylindrical valve casing part 37a. The capstan nut 42 may be operated step by step through the casing opening 11a



above described, by the insertion therethrough of a suitable tool.

The diaphragm 16, which is preferably made of any suitable impervious, flexible material—such as suitably compounded and vulcanized natural rubber, synthetic rubber, or the like—is preferably preformed in any suitable way, as by molding the unvulcanized compound in a suitable mold, followed by vulcanization, to have a peripheral flange 16a that is turned, throughout its entire peripheral extent, back upon the diaphragm, though somewhat spaced therefrom, as is shown in Fig. 2. These portions of the diaphragm are preferably shaped so that externally the over- or inturned flange 16a presents a continuous peripheral face that is convex, as at 16b, and to present internally a continuous peripheral face or surface that is concave, as at 16c. The concave surface 16c receives therein the continuous peripheral flange portion 44a of what may be termed a diaphragm plate 44 which may be more or less disk or dome shaped and which is to form with the diaphragm a closed chamber to which the motor-operating fluid is supplied, as by a pipe or conduit 45 which may be threaded to a bushing 46 welded, as at 47, into sealed connection with the diaphragm plate 44, the lower, annular, end face 46a of the bushing 46 being coaxial with the frame structure 10 and being thus aligned with the axis of the motor stem 17 and serving as a stop limiting upward movement of the diaphragm thrust plate 19 under the action of spring 21. Such limiting movement is appropriated when the motor mechanism is at rest and the action of the spring 21 is unopposed by fluid under pressure in the chamber formed by the diaphragm 16 and end cap or dome 44; radial passages 46b in the bushing 46 maintain communication between the chamber and the conduit 45, and thus ready the structure for operation during such inactive or at-rest condition of the motor.

The upper and lower diaphragm plates 13 and 44, both of which may be in the form of pressed steel or stamped parts, have preferably similar outside diameters and are shaped to provide outermost portion 13a and 44a that are of substantial radial dimension and substantially parallel to each other so as to present relatively large, annular surfaces to the two faces of the diaphragm 16 which they respectively engage. The overturned flange portion 16a of the diaphragm materially overlies the flange 44a of the upper diaphragm plate 44, having in effect a radially inwardly extending lip portion 16e of suitable radial dimension for that purpose.

I now provide suitable means to maintain the assembly of the parts 44, 16, and 13 in a manner to form a dependable seal between the upper diaphragm plate and the diaphragm 16 which form the pressure-responsive chamber, and preferably do so in a manner to cause the pressure of the fluid in the chamber to take part in maintaining that sealed connection. A preferred and illustrative means for doing this comprises a readily contractible means, generally indicated by the reference character 48, which is of simple and inexpensive construction, easy to apply, and uniquely and dependably coacting to insure long-lasting mechanical assembly and sealing action. For greater convenience of manufacture and assembly I prefer to make up the means 48 of several parts, each preferably identically constructed and dimensioned—illustratively of two parts, indicated at 49 and 50 in Fig. 1, and of which one of those parts—namely, part 50—is

shown in Fig. 2. When made in two parts, each is of substantially 180 degrees extent so as to peripherally envelope completely the superimposed and overlying parts 13a, 16, 44a, and 16e. In cross-section the parts 49 and 50 are suitably shaped to encompass the just-named superimposed parts, and preferably do so with an action, when the several parts 49 and 50 are drawn together, to lessen their circumferential extent; that action draws or forces these superimposed parts together, the yieldability or resiliency of the portions of the diaphragm affected thereby coacting to permit these actions to take place.

Conveniently and preferably the parts 49 and 50 are curved in cross-section (see Fig. 2), and this curvature may be of any suitable character to effect compression of the above-mentioned superimposed parts one against the other, in a vertical direction, as seen in Fig. 2, in response to radial inward movement of the parts 49 and 50. This cross-section, by way of illustration, may be arcuate, facilitating manufacture of the parts out of heavy sheet metal or the like.

Adjacent ends of the several parts of the device 48 are provided with suitable means for drawing them together, or for forcing the several parts 49 and 50 radially inwardly so as to bring the wedge-like internal or convex faces thereof into action upon the superimposed parts of the two diaphragm plates 13 and 44 and of the diaphragm 16. Such means may comprise lugs or ears 51 and 52, at the adjacent ends of the parts 49 and 50, which extend outwardly from the parts 49 and 50 into substantial parallelism, being suitably apertured to freely receive therethrough the threaded shank 53a of a bolt 53 by which the adjacent ends of the parts 49 and 50 may be drawn toward each other. The lugs 51 and 52, for convenience in manufacture, are preferably separately constructed and then attached, forming preferably the cross-part of relatively heavy U-shaped metal parts which may be inexpensively pressed or stamped into the desired shape, the side arms of these U-shaped parts, as is better shown in Fig. 1, being spaced from each other sufficiently to receive therebetween the substantially parallel upper and lower portions of the part 49 or 50, as the case may be. Preferably, also, the lugs 51 and 52 are formed at their inner edges 51a and 52a (see Fig. 2) to match the external curvature of the parts 49 and 50 to which they may be welded or otherwise secured along their just-mentioned curved edges.

As better appears in Fig. 3, the spaced arm portions 51b and 51c, that are integral with the lug 51 and the spaced side portions 52b and 52c, that are integral with the lug 52, are given a suitable curvature to follow the curvature of the parts 49 and 50 to which they are secured in any suitable way, as by welding; thus, the welding may be effected where the curved edges of the spaced arms are respectively aligned with the curved edges of the parts 49 and 50, as indicated at W.

With such a construction, the lugs 51 and 52 are strongly supported against bending, and the tensional forces effected by the bolts 53—which are two in number, where the device 48 is made up of two parts 49 and 50—are thus dependably transmitted to the adjacent ends presented by the device 48, these ends, as shown in Fig. 1, preferably extending toward each other beyond the lugs 51 and 52.

The nut 53b of bolt 53 abuts against one of these lugs, being amply accommodated between the spaced arms, and preferably the bolt 53 is provided with a long, larger-diametered shank 53c—the one end of which abuts against the other lug, and the other end of which is conformed to provide a head 53e, so that a suitable tool, such as a wrench, may be applied thereto—the length of the shank 53c, in conjunction with the shape of the bracing arms 51b and 51c, bringing the head 53e, as is better shown in Fig. 3, well out into the clear where it may be easily manipulated by the wrench.

The device 48 is thus made contractible in a generally radial, inward direction upon manipulation of one or more of the bolts to bring adjacent ends closer to each other and thus to lessen the effective circumferential dimension of the device 48, which, if desired, can have sufficient springiness or yieldability to accommodate itself appropriately to change in radius of curvature. The device 48, when thus contracted suitably, causes the superimposed multiple parts 13a, 16, 44a, and 16e to be in effect wedged tightly together in a vertical or axial direction, thus effecting a dependable sealing of the fluid-responsive chamber where the diaphragm part of it and the rigid casing part of it are in engagement with each other. Thus a substantial annular area of the diaphragm 16 may be vertically compressed between the seat-forming portions 13a and 44a of the parts 13 and 44, respectively, and, where the diaphragm has an overturned peripheral lip, such as the lip 16e, that action of compression is accompanied by compression of the lip 16e between the part or parts of the device 48 and the portion 44a of the metal part 44, thus effecting another annular area of seal. These actions in turn can be accompanied by a compression radially inwardly of the substantially vertical portion 16a of the diaphragm 16 against the appropriately rounded-over and relatively thick peripheral edge of the part 44a, thus effecting another annular area of seal.

The fluid under pressure in the chamber formed by the diaphragm 16 and part 44 may thus be dependably maintained sealed throughout the action of the motor in actuating the operating stem 17—38 in response to the conjoint action of the pressure of the fluid in the chamber and of the spring 21. Where the construction employs the over-turned lip 16e to overlie the outer annular portion of the companion chamber-forming part, such as the flange 44a of the part 44, I am enabled, according to my invention, to utilize the pressure effect of the fluid in the chamber to achieve and maintain dependable seal. Referring to Fig. 2, the reaction of the fluid under pressure in the chamber 16—44 is not only in a desired direction upon the diaphragm 16, but also is an upper reaction upon the part 44 against the substantial area of which the fluid under pressure exerts its force, tending to raise or push upwardly the part 44 itself. Hence substantial upward force is transmitted through the flange portion 44a, in an upward direction against the diaphragm lip 16e to compress the lip against the internal walls of the device 48, the adjacent edges of which are brought closely together so as to form substantial or appropriate continuity of internal surface against which the lip 16e is supported. The tightness of the resultant sealing action is thus of a high order, the force available to insure its presence being a function of the product of the area of the part 44 by the pressure per unit area of the fluid in the chamber. Moreover, when the motor is in an at-rest posi-

tion, so that the spring 21 is unopposed by fluid under pressure—so that the inner end of the bushing 46 forms a limiting stop for upward movement of the stem 17 and the thrust plate 19—the force of the spring 21 in such expanded condition is exerted upwardly against the chamber plate 44 and the just-described sealing action is continued or maintained, holding the fluid chamber in readiness for the subsequent admission of fluid under pressure. These several actions are preferably made use of supplemental to one or more of the sealing actions otherwise effected by the construction, as earlier above described, and the resultant self-sealing makes for lessening maintenance and supervision and contributes toward long-lasting reliability of operation of the motor.

The construction, moreover, achieves numerous other practical advantages. For example, should it be desired to replace the diaphragm 16, the device 48 is easily and quickly dissembled and removed, whence the part 44 and diaphragm 16 may be simply lifted off, the diaphragm replaced, and the parts easily and quickly reassembled. In operations of assembly or dissembly, where the device 48 is made up of two or more parts, one or more of the detachable connections, such as the bolts 53, need not be dissembled and need only be appropriately loosened up. For example, where the device 48 comprises two parts—and, hence, has two connecting bolts 53—one of them, for purposes of assembly or dissembly, may be completely disconnected or removed and the other simply loosened up sufficiently so that, in coaction with some looseness of the bolt in the holes in the lugs 51 and 52, the loose connection can function somewhat as a hinge so as to open up the device 48 for removal from or assembly to the parts with which it normally coacts. The tightening up of the bolt or bolts, due to the coaction of the device 48 with the other parts, causes the articulated part 48 to be substantially self-aligning or self-centering with respect to its coacting parts and thus make for facility and ease of handling.

It will thus be seen that there has been provided in this invention a construction in which the various objects, together with many thoroughly practical advantages, are successfully achieved.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. A diaphragm motor construction comprising a flexible diaphragm adapted to form one wall of fluid pressure chamber, means complemental to the diaphragm adapted to form therewith said chamber, said complemental means having a peripheral portion overlying an outer portion of the diaphragm and the diaphragm having an overturned portion of non-metallic relatively yieldable material adapted under pressure to conform itself in sealing relation to an adjacent part and said overturned portion providing a lip overlying said peripheral portion, and means supporting said peripheral portion and said lip and having a part that overlies said lip and against which the force of fluid under pressure in said chamber, by its reaction upon said complemental means, causes said peripheral portion to press the lip into sealing relation therewith.

2. A diaphragm motor construction comprising a flexible diaphragm adapted to form one wall of a fluid pressure chamber, means complemental to the diaphragm adapted to form therewith said chamber, said complemental means having a peripheral portion overlying an outer portion of the diaphragm and the diaphragm having an overturned portion of non-metallic relatively yieldable material adapted under pressure to conform itself in sealing relation to an adjacent part and said overturned portion providing a lip overlying said peripheral portion, a support having a part providing a seat for said diaphragm in juxtaposition to said peripheral portion whereby said diaphragm extends between said seat-forming part and said peripheral portion, and means enveloping and holding against dissembly said last-mentioned three parts and said diaphragm lip.

3. A diaphragm motor construction comprising a flexible diaphragm adapted to form one wall of a fluid pressure chamber, means complemental to the diaphragm adapted to form therewith said chamber, said complemental means having a peripheral portion overlying an outer portion of the diaphragm and the diaphragm having an overturned portion of non-metallic relatively yieldable material adapted under pressure to conform itself in sealing relation to an adjacent part and said overturned portion providing a lip overlying said peripheral portion, a support having a part providing a seat for said diaphragm in juxtaposition to said peripheral portion whereby said diaphragm extends between said seat-forming part and said peripheral portion, whereby said lip, said peripheral portion, said seat-forming portion, and the interposed diaphragm are superimposed one upon another, and means clamping said superimposed parts together and placing said outer portion of the diaphragm and also said lip in sealing compression.

4. A diaphragm motor construction comprising a flexible diaphragm adapted to form one wall of a fluid pressure chamber, means complemental to the diaphragm adapted to form therewith said chamber, said complemental means having a peripheral portion overlying an outer portion of the diaphragm and the diaphragm having an overturned portion of non-metallic relatively yieldable material adapted under pressure to conform itself in sealing relation to an adjacent part and said overturned portion providing a lip overlying said peripheral portion, a support having a part providing a seat for said diaphragm in juxtaposition to said peripheral portion whereby said diaphragm extends between said seat-forming part and said peripheral portion, whereby said lip, said peripheral portion, said seat-forming portion, and the interposed diaphragm are superimposed one upon another, and means peripherally enveloping said superimposed parts and presenting a substantially wedge-shaped peripheral recess to the latter to receive them therein and having means to draw it inwardly to cause said wedge-shaped recess to clamp said superimposed parts together and to coact to draw said lip inwardly relative to said peripheral portion.

5. A diaphragm motor construction comprising a flexible diaphragm adapted to form one wall of a fluid pressure chamber, means complemental to the diaphragm adapted to form therewith said chamber, said complemental means having a peripheral portion overlying an outer portion of the

diaphragm and the diaphram having an overturned portion of non-metallic relatively yieldable material adapted under pressure to conform itself in sealing relation to an adjacent part and said overturned portion providing a lip overlying said peripheral portion, a support having a part providing a seat for said diaphragm in juxtaposition to said peripheral portion whereby said diaphragm extends between said seat-forming part and said peripheral portion, whereby said lip, said peripheral portion, said seat-forming portion, and the interposed diaphragm are superimposed one upon another, and means holding said superimposed parts against separation and operating to compress a portion of the diaphragm against and into sealing relation with the outer edge of said peripheral portion of said complemental means.

6. A diaphragm motor of the character described comprising a disk-like diaphragm of yieldable non-metallic material and peripherally turned over upon itself to provide an overlying annular lip, means adapted to form with said diaphragm a closed pressure-responsive chamber and presenting an annular peripheral flange received between said lip and an adjacent annular portion of the diaphragm whereby said flange is throughout its peripheral extent enveloped by a portion of the diaphragm, frame means having a part to be actuated by said diaphragm, said part having operative connection with said diaphragm to be actuated thereby and having means for supporting and holding together said flange and the enveloping portions of said diaphragm and providing annular means against which said lip is pressed by said flange in response to pressure exerted internally against said first-mentioned means thereby increasing the sealing engagement between said lip and said flange.

7. A construction as claimed in claim 6 in which said part to be operated by said diaphragm comprises means having a spring opposing action of the fluid under pressure upon said diaphragm, said first-mentioned means being positioned in the path of movement thereof under the action of said spring whereby, upon absence of fluid under pressure in said chamber, said spring exerts pressure internally upon said first-mentioned means and thereby effects compression of said lip by said flange.

8. A diaphragm motor of the character described comprising a disk-like diaphragm made of flexible non-metallic relatively yieldable material and peripherally turned over upon itself to provide an overlying annular lip, means adapted to form with said diaphragm a closed pressure-responsive chamber and presenting an annular peripheral flange received between said lip and an adjacent annular portion of the diaphragm whereby said flange is throughout its peripheral extent enveloped by a portion of the diaphragm, and supporting means having an annular portion to form a seat for said diaphragm on the other side from and in juxtaposition to said flange and having annular means overlying said lip and between which and said flange said lip is compressed.

9. A diaphragm motor of the character described comprising a disk-like diaphragm made of a flexible non-metallic relatively yieldable material and peripherally turned over upon itself to provide an overlying annular lip, means adapted to form with said diaphragm a closed pressure-responsive chamber and presenting an annular peripheral flange received between said lip and an adjacent annular portion of the diaphragm whereby said flange is throughout its peripheral extent enveloped by a portion of the diaphragm, and supporting means having an annular portion to form a seat for said diaphragm on the other side from and in juxtaposition to said flange and having means clamping said lip, said flange, annular portion of the diaphragm, and said annular seat-forming means together.

10. A diaphragm motor of the character described comprising a disk-like diaphragm made of a flexible non-metallic relatively yieldable material and peripherally turned over upon itself to provide an overlying annular lip, means adapted to form with said diaphragm a closed pressure-responsive chamber and presenting an annular peripheral flange received between said lip and an adjacent annular portion of the diaphragm whereby said flange is throughout its peripheral extent enveloped by a portion of the diaphragm, and supporting means having an annular portion to form a seat for said diaphragm on the other side from and in juxtaposition to said flange and having readily attachable radially contractible means enveloping the superimposed annular parts with means for radially contracting it to effect a seal between said flange and the diaphragm.

11. A diaphragm motor of the character described comprising a disk-like diaphragm made of a flexible non-metallic relatively yieldable material and peripherally turned over upon itself to provide an everlying annular lip, means adapted to form with said diaphragm a closed pressure-responsive chamber and presenting an annular peripheral flange received between said lip and an adjacent annular portion of the diaphragm whereby said flange is throughout its peripheral extent enveloped by a portion of the diaphragm, supporting means having an annular portion to form a seat for said diaphragm on the other side from and in juxtaposition to said flange and having means radially contractible and peripherally enveloping said overturned portion of the diaphragm and said flange received therein, with means for effecting radial contraction thereof, and means responsive to radial contraction for effecting compression between said flange and the diaphragm.

12. A diaphragm motor comprising a pressure chamber, a disk-like diaphragm of yieldable non-metallic material forming one wall of said chamber, a housing part overlying said diaphragm and cooperating with said diaphragm to form said pressure chamber, said housing part having an annular part engaging an annular portion of the diaphragm adjacent its periphery, a frame having an annular part forming a seat for the outer portion of said diaphragm adjacent its periphery, on the opposite side of the diaphragm from said housing part, whereby said annular portion of said diaphragm is interposed between two said annular parts, said diaphragm being turned over adjacent its periphery to form a lip that overlaps the periphery of the annular part of said housing part, means for wedging said overlapping lip and said annular part of said housing part and said annular frame part and said interposed annular diaphragm portion together, and means for introducing motor operating fluid into said chamber.

13. A diaphragm motor comprising a pressure chamber, a disk-like diaphragm of yieldable non-metallic material forming one wall of said cham-

ber, a housing part overlying said diaphragm and cooperating with said diaphragm to form said pressure chamber, said housing part having an annular part engaging an annular portion of the diaphragm adjacent its periphery, a frame having an annular part forming a seat for the outer portion of said diaphragm adjacent its periphery, on the opposite side of the diaphragm from said housing part, whereby said annular portion of said diaphragm is interposed between two said annular parts, said diaphragm being turned over adjacent its periphery to form a lip that overlaps the periphery of one of said annular parts, sectional means peripherally encompassing said frame member and said housing part and said interposed annular portion of the diaphragm and said overlapping lip to clamp them all together in sealing relation, the sections having means for connecting them together and for coacting to effect clamping action, and means for introducing motor operating fluid into said chamber.

14. A diaphragm motor comprising a pressure chamber, a disk-like diaphragm of yieldable nonmetallic material forming one wall of said chamber, a housing part overlying said diaphragm and cooperating with said diaphragm to form said pressure chamber, said housing part having an annular part engaging an annular portion of the diaphragm adjacent its periphery, a frame having an annular part forming a seat for the outer portion of said diaphragm adjacent its periphery, on the opposite side of the diaphragm from said housing part, whereby said annular portion of said diaphragm is interposed between two said annular parts, said diaphragm being turned over adjacent its periphery to form a lip that overlaps the periphery of the annular part of said housing part, means peripherally encompassing said assembled parts and presenting to the assembled parts cam-like means to press said overlapping lip and frame member and said housing part and said interposed annular diaphragm portion together, means for controlling said cam-like means, and means for introducing motor operating fluid into said chamber.



15. A diaphragm motor comprising a pressure chamber, a disk-like diaphragm of yieldable nonmetallic material forming one wall of said chamber, a housing part overlying said diaphragm and cooperating with said diaphragm to form said pressure chamber, said housing part having an annular part engaging an annular portion of the diaphragm adjacent its periphery, a frame having an annular part forming a seat for the outer portion of said diaphragm adjacent its periphery, on the opposite side of the diaphragm from said housing part, whereby said annular portion of said diaphragm is interposed between two said annular parts, said diaphragm being turned over adjacent its periphery to form a lip that overlaps the periphery of the annular part of said housing part, means adapted to peripherally encompass said assembled parts and presenting thereto a cam-like recess for receiving them, said means being contractible and having means for contracting it to cause the walls of said cam-like recess to compress said lip and the annular part which it overlaps and to cam said annular parts of said frame and said housing one toward the other and thereby also clamp the annular portion of the diaphragm between said frame and said housing, and means for introducing motor operating fluid into said chamber.

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