H. M. STEVENS.

DIAPHRAGM MOTOR.

APPLICATION FILED MAR. 18, 1909.

945,992.

Patented Jan. 11, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

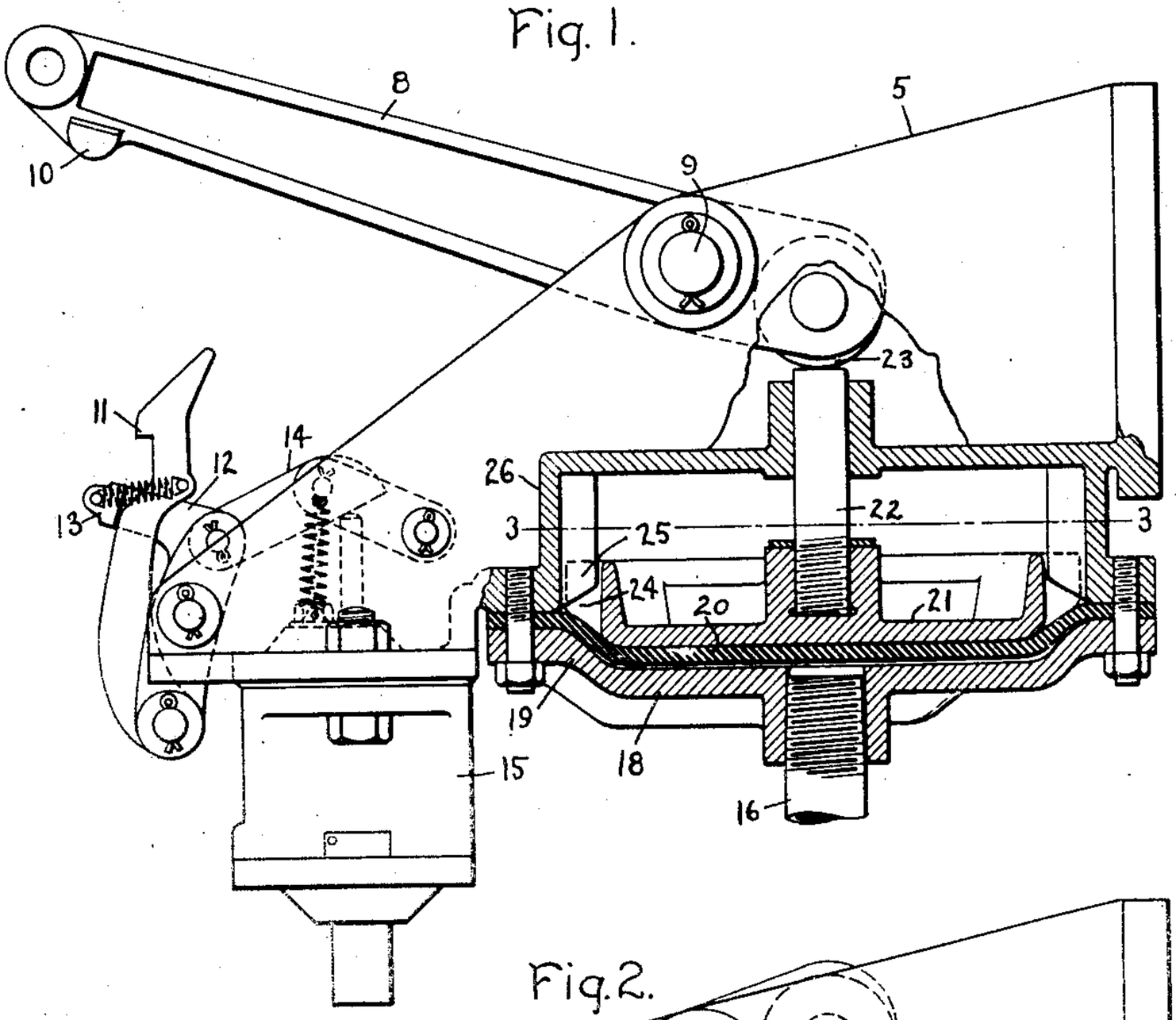
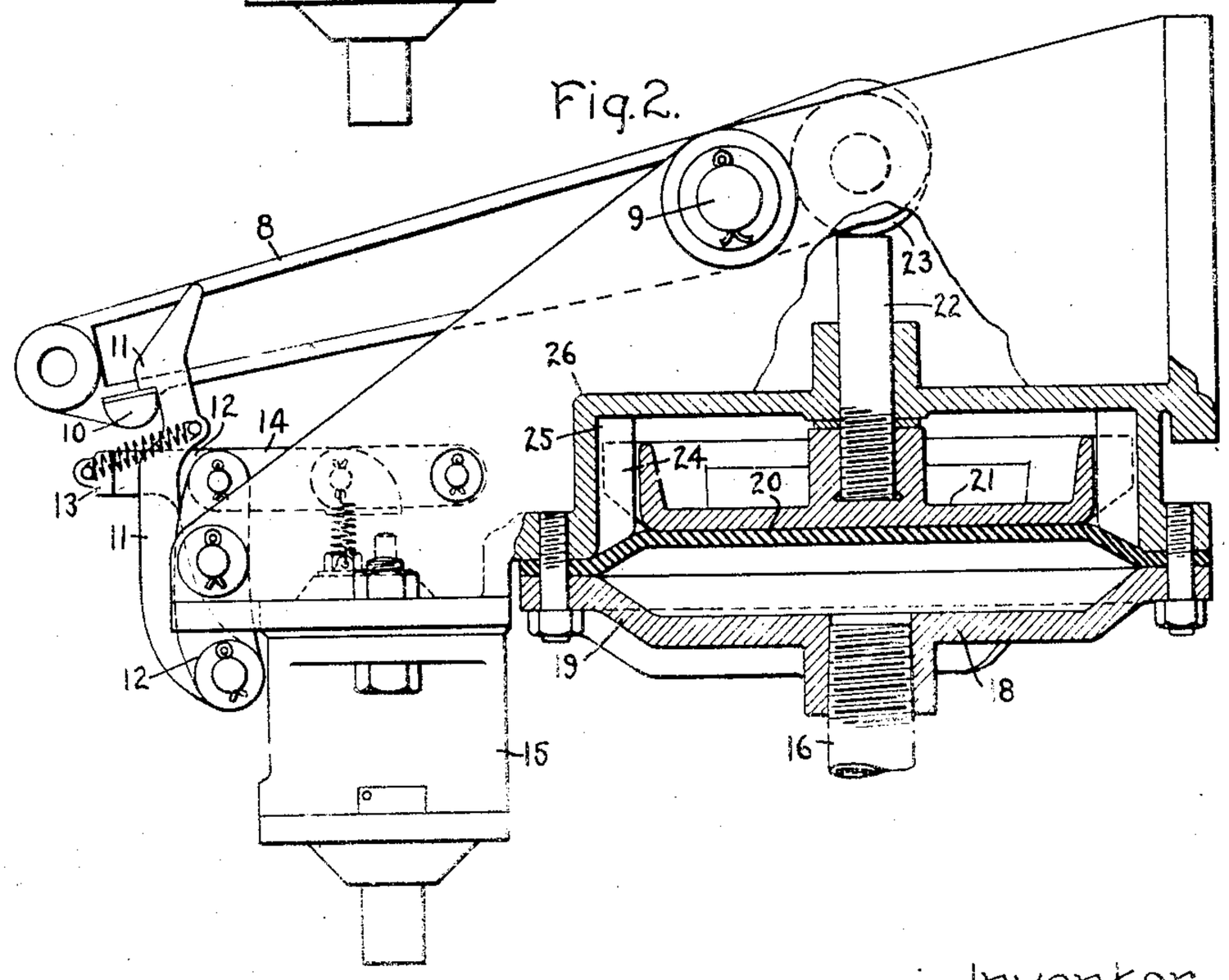


Fig. 2.



Witnesses:

Irving E. Peters.

J. Ellis Glen.

Inventor

Harry M. Stevens,

by Albert G. Davis

Atty.

H. M. STEVENS.

DIAPHRAGM MOTOR.

APPLICATION FILED MAR. 18, 1909.

945,992.

Patented Jan. 11, 1910.

2 SHEETS—SHEET 2.

Fig. 3.

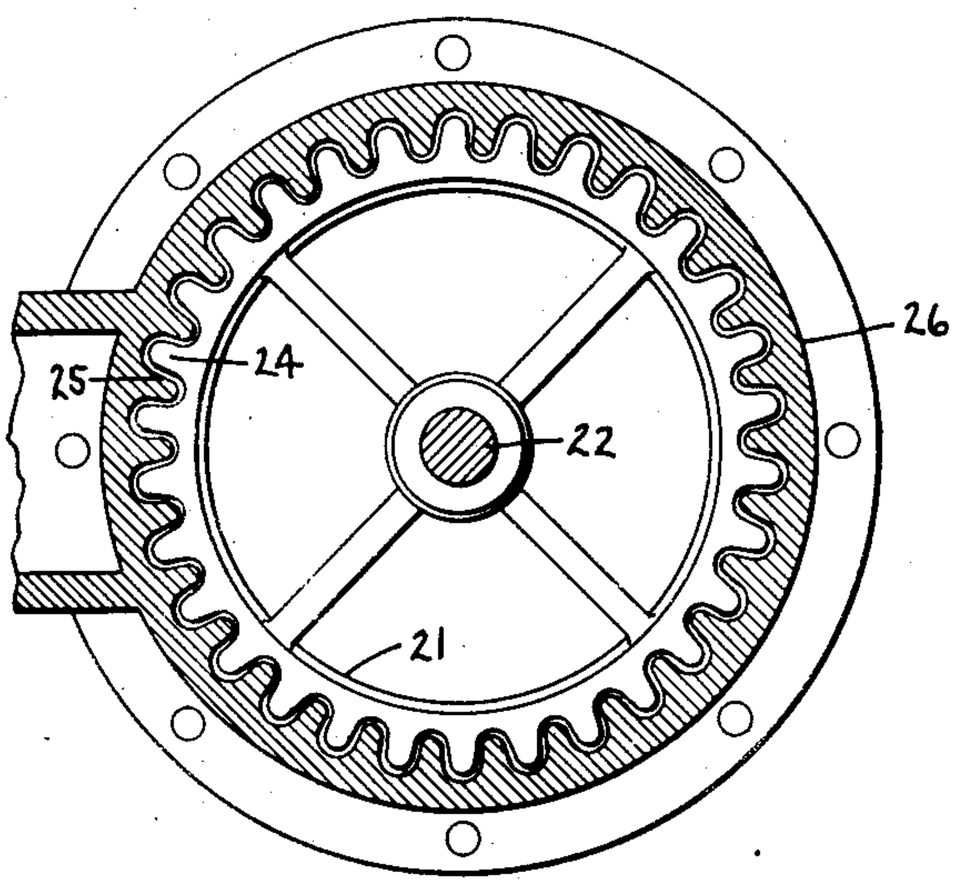
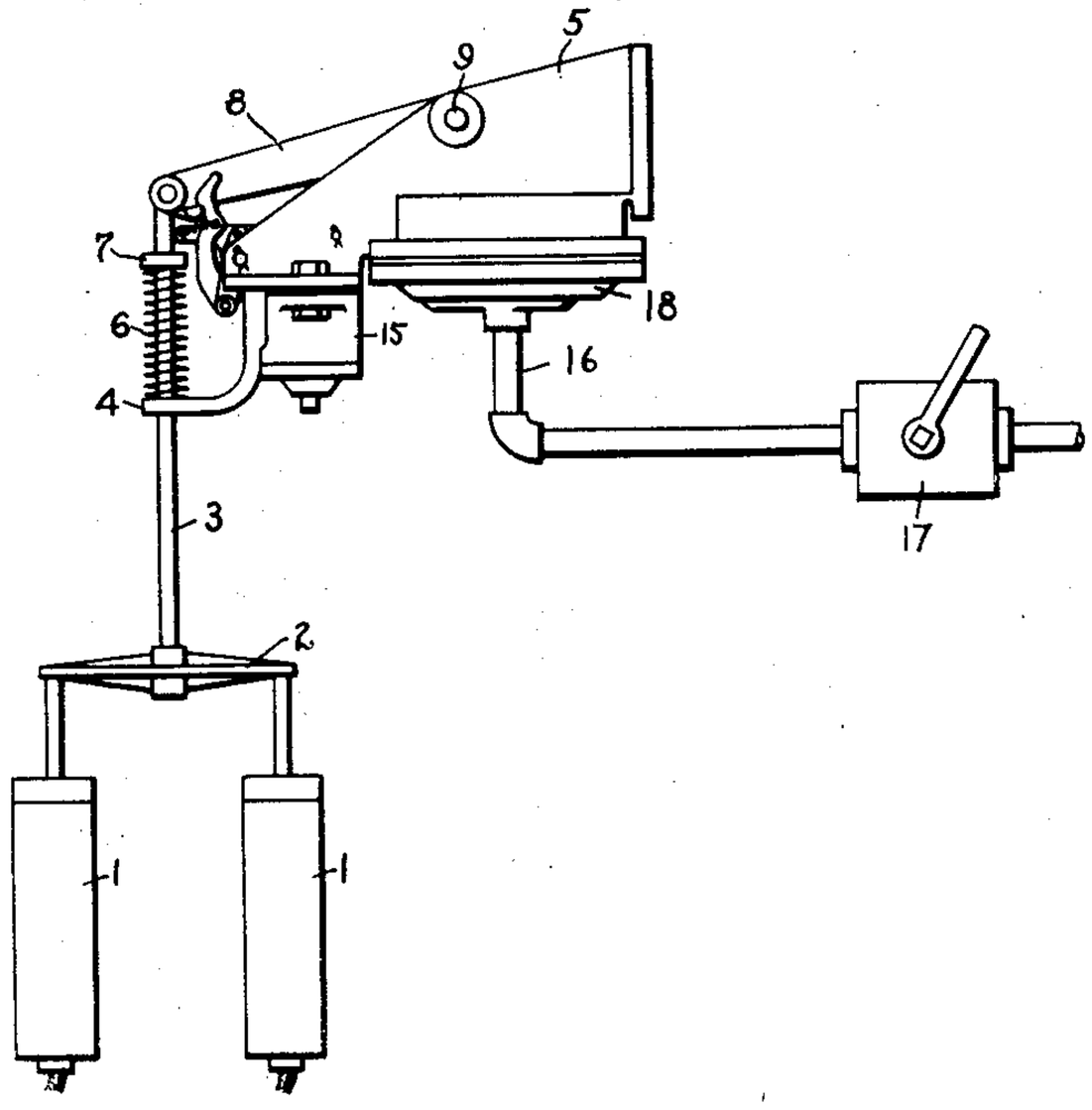


Fig. 4.



Witnesses:
Irving E. Steers.
J. Ellis Glen

Inventor
Harry M. Stevens,
by Albert G. Davis
Atty

UNITED STATES PATENT OFFICE.

HARRY M. STEVENS, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

DIAPHRAGM-MOTOR.

945,992. Specification of Letters Patent. Patented Jan. 11, 1910.

Application filed March 18, 1909. Serial No. 484,184.

To all whom it may concern:

Be it known that I, HARRY M. STEVENS, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Diaphragm-Motors, of which the following is a specification.

My invention relates to collapsible vessels having a flexible wall or diaphragm and more particularly to collapsible vessels suitable for use as fluid pressure motors, in which a difference in pressure on the opposite sides of the diaphragm causes it to move and in which the travel of the center of the diaphragm should be as great as possible.

In fluid pressure motors the motion of the diaphragm is usually transmitted to the parts to be actuated by means of a rigid member or rod which is secured to the diaphragm at the center and renders the central part of the diaphragm unyielding and inflexible. The greater the travel of the center member the greater must be the width of the yielding and flexible portion of the diaphragm between its edge and the center member, and the use of fluid under high pressure for actuating diaphragms having a great travel has heretofore been impracticable, because the flexible and unsupported portion of the diaphragm, if made wide enough to secure the desired travel, would bulge out and break under a comparatively moderate pressure of the fluid in the vessel.

The object of my invention is to provide a collapsible vessel suitable for fluid pressure motors, but useful for many other purposes, and having a flexible wall or diaphragm which is capable of extended movement and which cannot be bulged out and broken by the pressure of the fluid in the vessel.

In carrying out my invention, the diaphragm is made flexible and free to yield for a sufficient distance from its edge to secure the required travel of the central portion of the diaphragm and the flexible portion is protected from destruction by means of diaphragm supports arranged to support the flexible portion of the diaphragm at every point in its travel in such a way that high pressure cannot bulge out and break the flexible portion of the diaphragm which is nevertheless as free to bend with the travel of the diaphragm as though the supports were not present. The diaphragm supports are preferably in the form of rigidly mounted lugs which project inwardly from the edge of the diaphragm like the teeth of an internal gear wheel, while the rigid member on the center of the diaphragm has outwardly projecting lugs or teeth which fit loosely between the rigidly mounted lugs, all the lugs being shaped to permit the required travel of the diaphragm and at the same time to support it at every point in its travel.

My invention will best be understood in connection with the accompanying drawings, which illustrate one of the various forms in which the invention may be embodied and in which—

Figure 1 is a view of a fluid pressure actuating mechanism for operating an electric switch, with the fluid pressure motor shown in section; Fig. 2 a view of the device shown in Fig. 1 with the parts in the position assumed by them when fluid under pressure is admitted to the motor; Fig. 3 a longitudinal section along the line 3—3 of Fig. 1; and Fig. 4 a view in elevation showing the fluid pressure actuating mechanism applied to an electric switch.

The general arrangement of the specific form of device illustrated in the drawings is best shown in Fig. 4, which shows an oil switch having two oil pots 1, containing stationary contacts which coöperate with a movable bridging contact 2, mounted on a vertically movable operating rod 3, which moves freely in a guide 4, rigidly attached to and forming a part of a frame 5, which is rigidly mounted in any suitable way in fixed relation to the oil pots 1 and supports the various parts of the actuating mechanism. In Fig. 4 the switch is shown in the closed position and constantly tends to open on account of the pressure exerted by a resilient member, such as spiral spring 6, which surrounds the operating rod and is compressed between the guide 4 and a collar 7 on the operating rod when the switch is in the closed position. An operating lever 8, pivotally connected to the upper end of the operating rod 3 and mounted on the frame 5 by means of a pivot 9, is latched in the position shown in Fig. 4 and held against the strain exerted by the spring 6 by any suitable form of latching mechanism, which is preferably controlled automatically, so that the switch will open upon the occur-

rence of overload. In the specific form of latching mechanism shown in the drawings, a lug 10 near the end of the operating lever 8 is engaged by a hook 11, which holds the operating lever in the position shown in Figs. 2 and 4. The hook 11 is pivotally mounted on one end of a pivoted rocking member 12 which carries at the other end a shoulder 13 arranged to engage the hook 11 and force it out of locking relation to the lug 10 as the rocking member 12 rotates about its pivot into the position shown in Fig. 1. The latching mechanism holds the operating lever 8 in switch closing position as long as the rocking member 12 is held in the position shown in Fig. 2, and in the preferred construction the rocking member 12 is held in locking position by means of a locking toggle 14 which has one end connected to the rocking member 12 and the other end to a pin on the frame 5. The locking toggle is normally slightly overset to hold the latching mechanism in latching position as shown in Fig. 2 and is broken by means of a trip coil 15 connected in series in the circuit and so arranged that upon the occurrence of an overload the core of the trip coil 15 will break the locking toggle 14 and permit the parts to assume the position shown in Fig. 1.

In the specific embodiment of my invention shown in the drawings, the collapsible vessel is made in the form of a fluid pressure motor to which fluid under pressure is supplied through a pipe 16 controlled by any suitable controlling valve 17. The specific form of collapsible vessel consists of a cup-shaped rigid wall or member 18 with a flaring portion 19 and a flexible diaphragm 20, of rubber or any other suitable yielding material firmly secured to the edge of the cup-shaped member 18 to form a closed vessel into which fluid under pressure may be admitted by means of the pipe 16. A rigid center member 21 rests on the central portion of the flexible diaphragm 20 and the movement of the diaphragm is transmitted to the operating lever 8 by means of an actuating rod 22 secured to the center member 21 to engage a roller 23 which is mounted on the operating lever 8.

In order to make the travel of the center member 21 great enough to give the required movement to the bridging contact of the switch, the diaphragm must be left unsupported and free to yield for a considerable distance between the upper edge of the flaring portion 19 and the edge of the rigid center member 21. The greater the travel of the center, the greater must be the distance between the upper edge of the flaring portion 19 and the edge of the center member 21, and if the center member is given the required travel so much of the diaphragm is left unsupported that a pressure of forty or fifty pounds cannot be used without causing the diaphragm to bulge out between the edge of the rigid center member 21 and the edge of the flaring portion 19 of the wall 18 to such an extent that it will be broken. In accordance with my invention, the bulging and breaking of the diaphragm under the pressure of the fluid in the collapsible vessel is prevented by means of diaphragm supporting members or projections arranged in such a manner that in no position of the diaphragm is enough of the diaphragm left unsupported to permit bulging and breaking under pressure of the fluid in the collapsible vessel. The diaphragm supporting members are preferably made in the form of rigid extensions or lugs 24 mounted on the center member 21 to project outwardly like the teeth of a pinion and to extend between inwardly projecting lugs or extensions 25, which are formed on the inner surface of a flange or ring 26 and extend inward like the teeth of an internal gear wheel. The inwardly projecting lugs fit between the outwardly projecting lugs as best shown in Fig. 3, and both sets of lugs are so shaped where they engage the diaphragm that the diaphragm is supported in all of its positions.

It will be seen in Fig. 3 that on both the flange 26 and on the center member 21 the lugs or projections are so close together that the pressure in the vessel is unable to bulge and break the diaphragm by forcing it up between the lugs. In the specific arrangement shown in the drawing, the rigid center member 21 is shaped to fit into the cup-shaped rigid member 18 when the vessel is collapsed and the switch is open, with the parts in the position shown in Fig. 1, where the outwardly extending lugs or projections 24 rest against and form the sole support for the flexible and yielding portion of the diaphragm. When fluid is admitted beneath the diaphragm, the center member begins to rise and the flexible portion of the diaphragm begins to engage the lower edge of the projections 25 and is supported by them to an extent dependent upon the extent of movement of the diaphragm away from the wall 18. By the time the rigid center member 21 has completed about one-half of its travel, the diaphragm is practically flat and the flexible portion is supported partly by the projections 24 and partly by the projections 25, while as the center member 21 completes its travel and reaches the position shown in Fig. 2, the flexible portion of the diaphragm is supported entirely by the rigid or stationary projections 25. Since the inwardly extending lugs 25 are formed integral with the flange 26, and the rigid wall 18 is bolted firmly to the frame 5, the lugs or projections 25 are immovable relatively to

the rigid wall 18 and do not yield under the strain exerted by the flexible portion of the diaphragm.

My invention may be embodied in many other forms than that shown and described and I do not intend to limit the appended claims to the specific arrangement disclosed, but intend to cover all changes and modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. A collapsible vessel comprising rigid walls and a flexible diaphragm secured to said walls, said walls having diaphragm supporting projections rigidly mounted thereon in a position to engage and support said diaphragm to an extent dependent on the extent of movement of the diaphragm relative to said walls.

2. The combination with a collapsible vessel comprising a circular wall and a circular diaphragm secured to said wall to form a closed vessel, of diaphragm supporting means carried by said wall and arranged to engage said diaphragm to support an annular portion of which the outer edge coincides with the outer edge of said diaphragm and of which the width increases as the diaphragm moves away from normal position.

3. A collapsible vessel comprising a cup-shaped rigid member and a flexible diaphragm secured to the edge of said member to form a closed vessel, said member having diaphragm supporting means mounted thereon and arranged to successively engage and support said diaphragm at points which progressively increase in distance from the edge of the diaphragm as the diaphragm is moved away from said member.

4. A collapsible vessel comprising a wall having inwardly projecting lugs, a flexible diaphragm secured to said wall in a position to engage said lugs, and a member in engagement with said diaphragm and having outwardly projecting lugs which lie between the lugs on said wall.

5. A collapsible vessel comprising a flexible diaphragm, a wall secured to the edge of said diaphragm and having a set of inwardly extending lugs which project across a portion of said diaphragm toward the center thereof, and a member in engagement with said diaphragm and having a set of lugs which extend away from the center of said diaphragm and lie side by side with the lugs on said wall, said sets of lugs being shaped to coöperate and support said diaphragm in all positions thereof.

6. A collapsible vessel comprising a cup-shaped member having side walls, a flexible diaphragm secured to the edge of said walls to form a closed vessel, said walls having inwardly extending lugs which project over said diaphragm on one side thereof, and a movable member in engagement with the same side of said diaphragm and shaped to fit into said cup-shaped member, said movable member being provided with outwardly projecting lugs which extend between the lugs on said cup-shaped member.

7. A collapsible vessel comprising a wall having a set of inwardly projecting lugs, a flexible diaphragm secured to said wall in a position to engage said lugs, and a member in engagement with said diaphragm and provided with a set of outwardly projecting lugs which lie between the lugs on said wall, the diaphragm engaging surfaces of one of said sets of lugs being curved away from a plane perpendicular to the direction of movement of the diaphragm.

8. A collapsible vessel comprising a flexible diaphragm, a diaphragm supporting wall having stationary lugs which project toward the middle of said diaphragm, and a movable member resting on said diaphragm and having lugs which extend between said stationary lugs in a radial direction, whereby said diaphragm is supported at every point of its movement.

In witness whereof, I have hereunto set my hand this 17th day of March, 1909.

HARRY M. STEVENS.

Witnesses:
F. J. Dore,
Helen Orford.