

May 10, 1938.

W. C. SHAW

2,117,219

DIAPHRAGM

Filed Aug. 4, 1933

2 Sheets-Sheet 1

FIG.-I

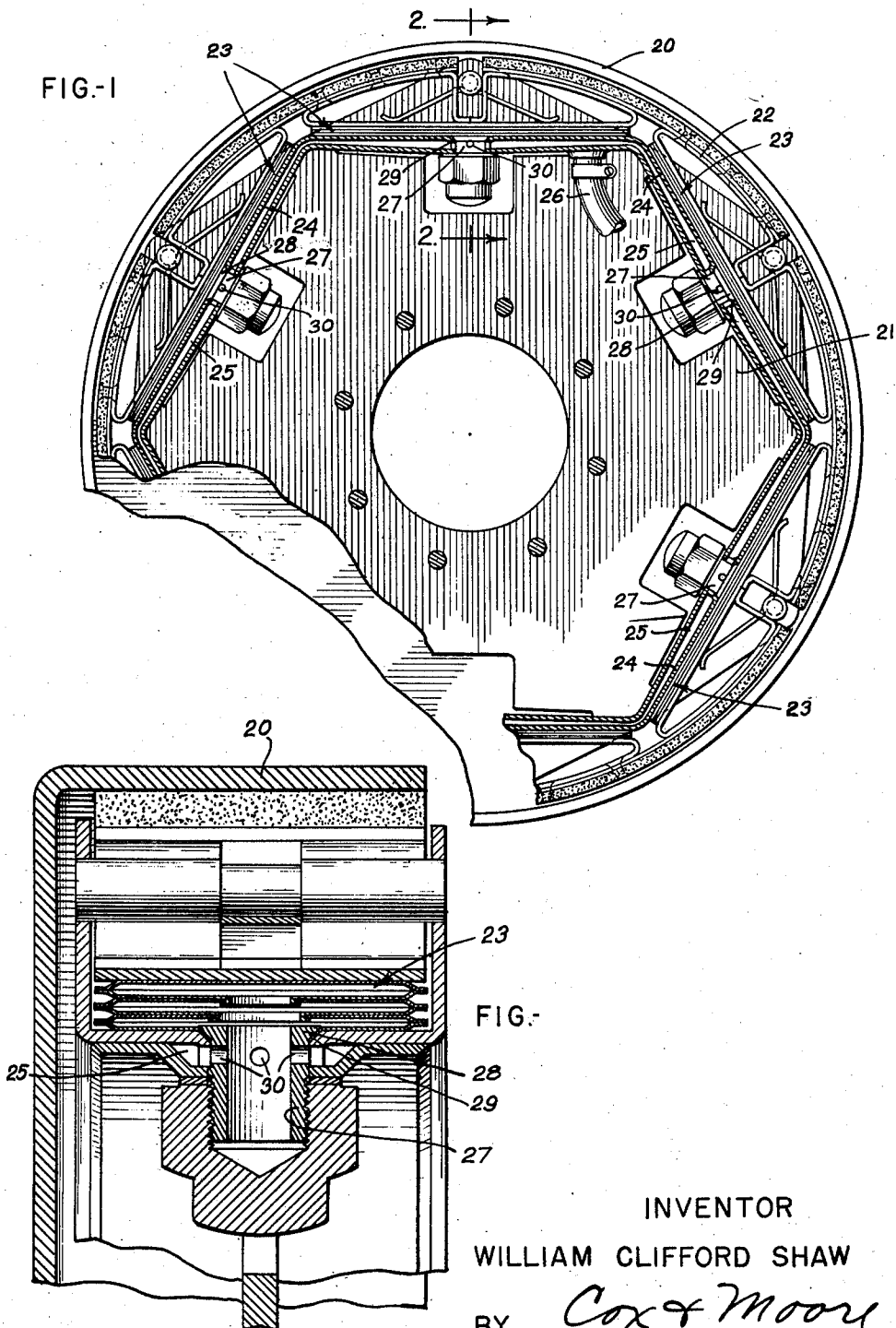


FIG.-

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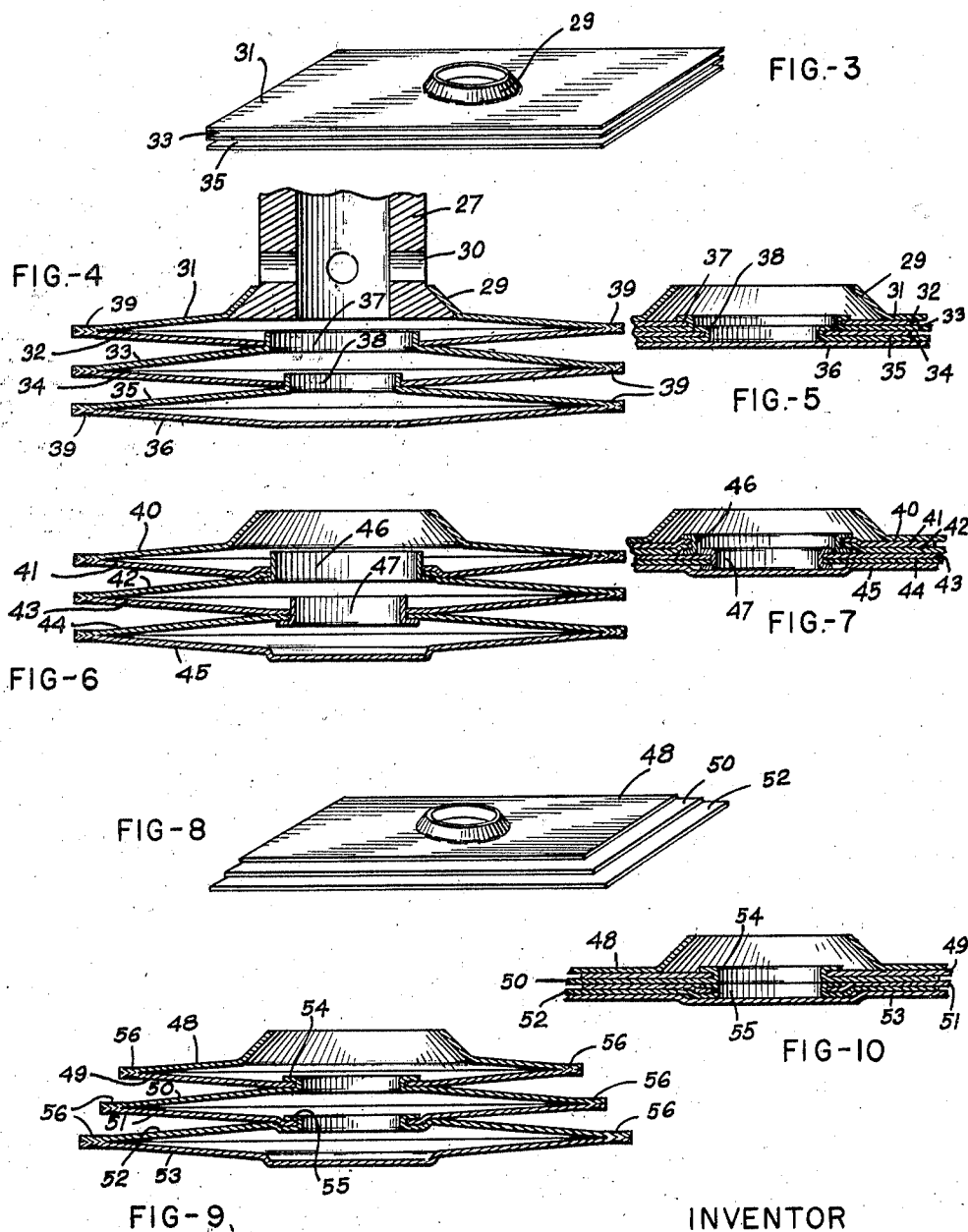
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2 Sheets-Sheet 2



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2,117,219

DIAPHRAGM

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Application August 4, 1933, Serial No. 683,585

7 Claims. (Cl. 137—156.5)

This invention relates to fluid pressure and vacuum operated metallic diaphragms and provides instrumentalities adaptable for general application and transmission of power which are durable, highly efficient in operation, inexpensive to manufacture and assemble, and which are capable of utilization in connection with various types of devices.

This application is a continuation in part of my co-pending application, Serial No. 654,279, filed January 30, 1933.

One of the objects of my present invention is to provide an all metallic diaphragmatic device for use in connection with various types of fluid pressure and vacuum operating systems.

Another object of this invention is to produce a new article of manufacture having a plurality of expansible chambers arranged in series to form a unitary accordion-like expansible chamber for any purpose to which such an expansible diaphragm may be used.

Another object of this invention is to provide a diaphragm of the type described which is made of a series of leaves preferably welded or otherwise permanently secured at their edges in which the connecting portions of the leaves are so arranged as to not be subjected to fatigue due to constant expansion and contraction of the diaphragm.

Other objects of this invention will appear hereinafter as the description thereof proceeds, the novel features, arrangements, and combinations being clearly set forth in the specification and claims hereunto appended.

In the drawings:

Fig. 1 is an inside elevational view of a braking mechanism with the diaphragm constructed according to my invention used for applying the braking pressure, parts of the braking mechanism being broken away;

Fig. 2 is a section taken along the line 2—2 of Fig. 1;

Fig. 3 is a perspective view of a diaphragm constructed according to my invention;

Fig. 4 is a longitudinal section through the diaphragm shown in Fig. 3 showing the diaphragm in a partially completed state;

Fig. 5 is a view similar to Fig. 4 showing the finished diaphragm;

Figs. 6 and 7 are views similar to Figs. 4 and 5 showing a modified form of my invention;

Fig. 8 is a view similar to Fig. 3 showing a still further modification of the diaphragm construction;

Fig. 9 is a longitudinal sectional view through

the diaphragm shown in Fig. 8 showing the diaphragm in a partially completed state;

Fig. 10 is a view similar to Fig. 9 showing the diaphragm completed;

In Figs. 1 and 2 of the drawings, 20 indicates the brake drum of an automobile or the like, and 21 a brake-shoe support which is generally secured to the axle of an automobile. The brake shoes are indicated by the reference numeral 22 and these are arranged peripherally about the support 21 with diaphragms 23 arranged between the brake shoes and the adjacent surface 24 of a peripheral metallic chamber 25 on the support 21 which chamber 25 is adapted to receive the pressure fluid through a tube 26 in a manner which is more fully described in my aforesaid co-pending application. The diaphragm itself as is clearly illustrated in Figs. 1 and 2, has connected thereto a hollow bolt 27 through which the pressure fluid is introduced into the diaphragm. The hollow bolt 27 has an enlarged flared head 28 welded or otherwise permanently secured to a conical flange 29 on the diaphragm indicated generally at 23. Peripherally arranged passages 30 in the bolt 27 form communicating passages between the hollow chamber 25 and the interior of the diaphragm 23 so that when the pressure fluid is forced into the chamber 25, it is distributed to the diaphragm 23 through the passages 30 and hollow bolts 27.

The present invention relates particularly to the diaphragm to be used for applying the brakes and the method of constructing said diaphragm.

The construction of one form of my invention is illustrated clearly in Figs. 3, 4, and 5 in which the reference characters 31, 32, 33, 34, 35, and 36 indicate flat plates or leaves which are of substantially the same outer peripheral dimension. The leaf 31 has the conical flange 29 formed thereon and before assembling the leaves of the diaphragm, the bolt 27 is welded or otherwise secured permanently to the flange 29 so as to provide a leak-proof joint there-between. The leaves 33 and 35 are formed respectively with the upstanding cylindrical flanges 37 and 38. Adjacent leaves 32 and 34 are formed with openings centrally thereof of substantially the same outer diameter as the outer diameters of the flanges 37 and 38 respectively.

Pairs of leaves 31—32, 33—34, 35—36, are then joined peripherally by welding the same along their meeting peripheral edges as at 39, or by turning over the edges of the leaves, whereby the outer peripheries of each pair of leaves are permanently secured together in fluid-tight en-

gagement. The pairs of leaves are then assembled in the manner illustrated in Fig. 4, and the flanges 37 and 38 are then swaged outwardly over the adjacent edges of the leaves 32 and 34 respectively in the manner illustrated in Fig. 5, whereby to make a fluid-tight diaphragm having one port comprising the hollow bolt 27. As will be noted from an inspection of Fig. 5, the passageway between the pairs of leaves 31-32 and 33-34 is larger than the passageway between pairs of leaves 33-34 and 35-36 so that when the leaves are collapsed they may lie flatly against each other and the flanges 37 and 38 will not interfere with the complete collapsing of the diaphragm. This enables the diaphragm to be collapsed within a smaller space and enables the diaphragm to be used to the full extent of its expansibility. In Figs. 6 and 7, I have illustrated a modified construction of my invention in which there are leaves 40, 41, 42, 43, 44, and 45 similar to the corresponding leaves 31 to 36 inclusive in Fig. 4, but instead of providing flanges such as 37 and 38 on leaves 33 and 35 respectively, on the leaves 42 and 44 respectively, I make the leaves 42 and 44 with central openings of the same diameter as the central openings in the leaves 41 and 43 and join leaves 41 and 42 and leaves 43 and 44 respectively by the eyelets 46 and 47 respectively which are formed as clearly illustrated in Fig. 6 and then upset as in Fig. 7 to overlie the edges of the adjacent leaves and hold the same securely in liquid-tight engagement with each other. The central portions of the leaves are off-set in the manner clearly illustrated in Fig. 7 in order to permit the remaining portions of the leaves to be brought into engagement with each other when the diaphragm is completely collapsed.

In Fig. 8, I have illustrated a still further modification of my invention in which there are pairs of leaves 48-49, 50-51, and 52-53, each pair being of successively greater peripheral dimensions, whereby the leaves 49 and 50 can be first joined together centrally as by upsetting the flange 54 on the leaves 40 in a manner similar to that described in connection with the form of the invention shown in Fig. 4 and the flange 55 on the leaf 52 similarly upset over the adjacent edge of the leaf 51 before the peripheral edges of the pairs of leaves are joined by welding at 56 and this enables a very tight joint to be made first between the leaves 49 and 50 and the leaves 51 and 52, and one might even weld these edges together before the outer peripheral edges of the leaves are welded together. The leaves are then assembled as in Fig. 9 and the edges welded at 56. Since the pairs of leaves are successively of greater diameters, one can better weld the edges together with welding equipment.

I prefer to have the leaves of the diaphragm made from resilient metal having long life and capable of assisting the diaphragm in its collapsing movement. In other words by using a spring metal which normally is shaped to a single plane and joining successive leaves together, I can form a diaphragm which when the fluid pressure is released will of its own action tend to collapse the diaphragm away from the brake shoe with the result that the brake shoe is free to release itself from its engagement with the brake drum.

By using a plurality of diaphragms instead of a single diaphragm, it is possible to get a total movement which is greater than can be obtained with the same amount of flexing of the leaves of a single diaphragm. However, I wish to have it understood that my invention is not limited

to having a plurality of diaphragms as shown in the drawings, as it may be found desirable to use a single diaphragm for the purposes set forth.

In my copending application, Serial No. 721,844, filed April 23, 1934, there is illustrated and claimed a further form of diaphragm having curved edges and provided with inserts between the portions connecting the curved edges.

The fluid may be introduced into the diaphragm in the manner indicated in my aforementioned application, Serial No. 654,279, or in any other desired manner. Also it is to be understood that the diaphragm construction is of general application and is suitable for a great number of other purposes than that described in this application.

Claims to the brake or clutch structure shown in Figs. 1 and 2, and to the diaphragm in combination therewith, are presented in my aforesaid application Serial No. 654,279. Only claims to the diaphragm structure as a device of general utility are presented herein.

Obviously those skilled in the art to which this invention pertains may make various changes in the particular construction and arrangement of parts without departing from the spirit of this invention, and therefore I do not wish to be limited except as hereinafter set forth in the appended claims.

Having thus fully described my invention, what I claim as new and desire to obtain by Letters Patent is:

1. A metallic diaphragm comprising a plurality of metal leaves each formed normally to lie in a common plane, means interconnecting said leaves to provide a plurality of superposed hollow expansible chambers, the walls of which are adapted to lie flat, one against the other when collapsed, certain of said leaves having openings adapted to receive the connections between certain other leaves to permit the nesting of said leaves when the diaphragm is collapsed.

2. A metallic diaphragm comprising a plurality of metal leaves each formed normally to lie in a common plane, connecting means forming a fluid-tight interconnection between said leaves to provide a plurality of hollow expansible fluid chambers, the walls of which, when collapsed, are adapted to lie flat one against the other, one of said leaves having means to receive said connecting means to permit said leaves to lie flat one against the other.

3. A diaphragm for fluid pressure operated devices comprising a series of substantially flat metallic plates joined peripherally in pairs to form a plurality of superposed expansible fluid chambers, pairs of openings formed substantially centrally of said plates forming communicating passageways between said chambers, successive pairs of openings being increasingly larger toward one end of the diaphragm, and said latter end of the diaphragm having an opening of still larger diameter whereby to render all of said openings accessible to a working tool.

4. As a new article of manufacture, a metallic expansible diaphragm comprising a plurality of rectangular metallic plates residing in congruent parallel relation, connecting means forming a fluid-tight connection between said plates to provide a plurality of hollow expansible fluid chambers, the walls of which when collapsed are adapted to lie flat one against the other, each of said plates residing in a substantially flat plane and with their rectangular peripheries residing substantially in said plane.

5. As a new article of manufacture, a dia-

phragm for fluid pressure operated devices comprising a series of superposed flat metallic plates, means arranged substantially centrally of pairs of the plates and connecting said pairs of plates by fluid-tight communicating passageways passing therethrough, adjacent pairs of the superposed plates being arranged with contacting plates in congruent relationship, each of said contacting pairs of plates being successively smaller whereby to permit peripheral securing thereof after the said pairs of plates have been centrally secured together, and means securing said contacting plates peripherally together to provide a plurality of superposed expandible fluid chambers.

6. In a diaphragm for fluid pressure operated devices, the combination of a series of separate expandible chambers comprising pairs of metallic plates each normally lying in a single plane joined peripherally with fluid-tight joints, said plates being of polygonal shape and adjacent plates of adjacent chambers having substantially centrally arranged circular openings therein communicating with each other, a fluid inlet to one of said chambers and means for joining said chambers in fluid-tight engagement comprising a circular flange surrounding the opening in one of the adjacent plates and extending from the plane of the said adjacent plate, said flange extending through the opening in the other of said plates and overlapping the edge of the opening in that

latter plate, the said flange being held in fluid-tight engagement with the latter plate, adjacent plates being arranged in the vicinity of the flange to permit the plates to reside flat one against the other when the diaphragm is collapsed, the said plates being formed with their peripheries lying substantially in their said plane.

7. In a diaphragm for fluid pressure operated devices, the combination of a series of separate expandible chambers comprising pairs of metallic plates each normally lying in a single plane and joined peripherally with fluid-tight joints, said plates being polygonally shaped and adjacent plates of adjacent chambers having substantially centrally arranged circular openings therein communicating with each other, a fluid inlet to one of said chambers and means for joining said chambers in fluid-tight engagement comprising circular eyelets extending through said openings and bent outwardly and against the adjacent edges of the openings to hold the plates at the edges of said openings in permanent fluid-tight engagement with each other, and means associated with the plates adjacent said eyelets to cause the eyelets to nest with adjacent eyelets when the diaphragm is collapsed whereby to permit the plates to reside flat one against the other, the said plates being formed with their peripheries lying substantially in their said planes.

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