No. 764,572. PATENTED JULY 12, 1904.

W. M. FULTON.

MOTOR.

APPLICATION FILED MAR. 20, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. 1.

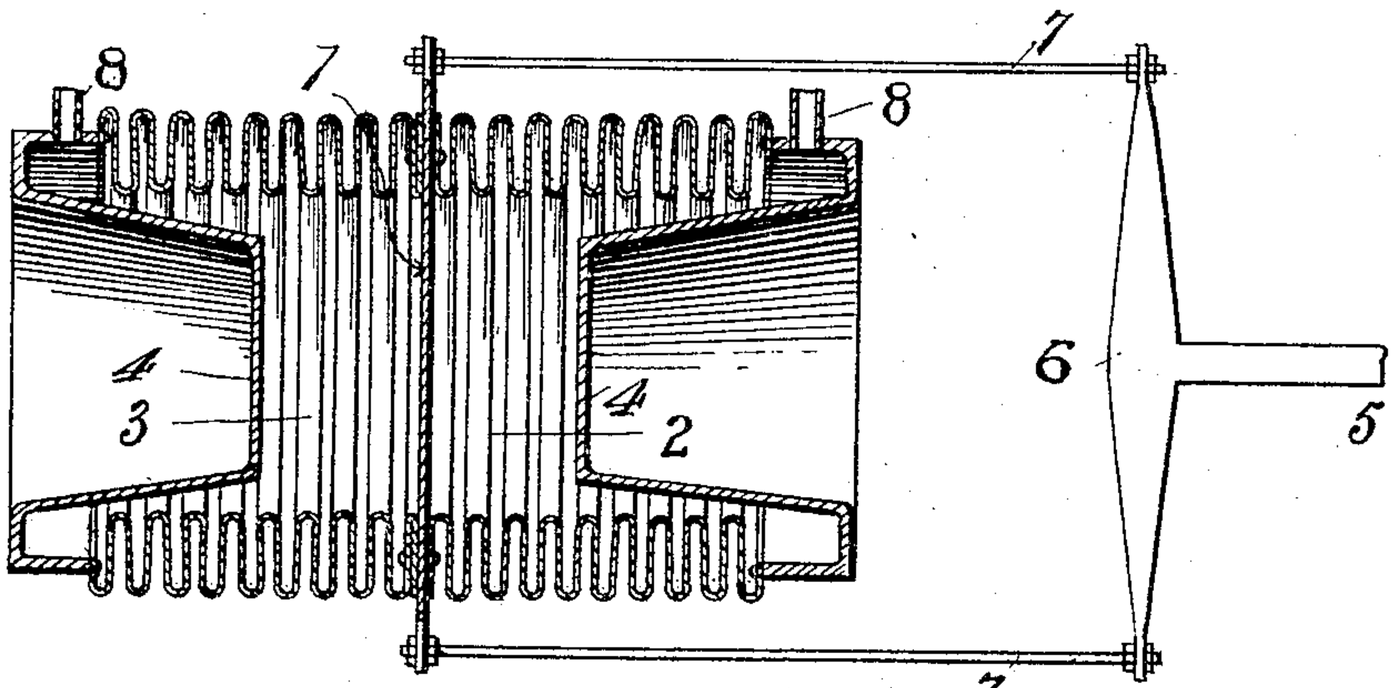


FIG. 2.

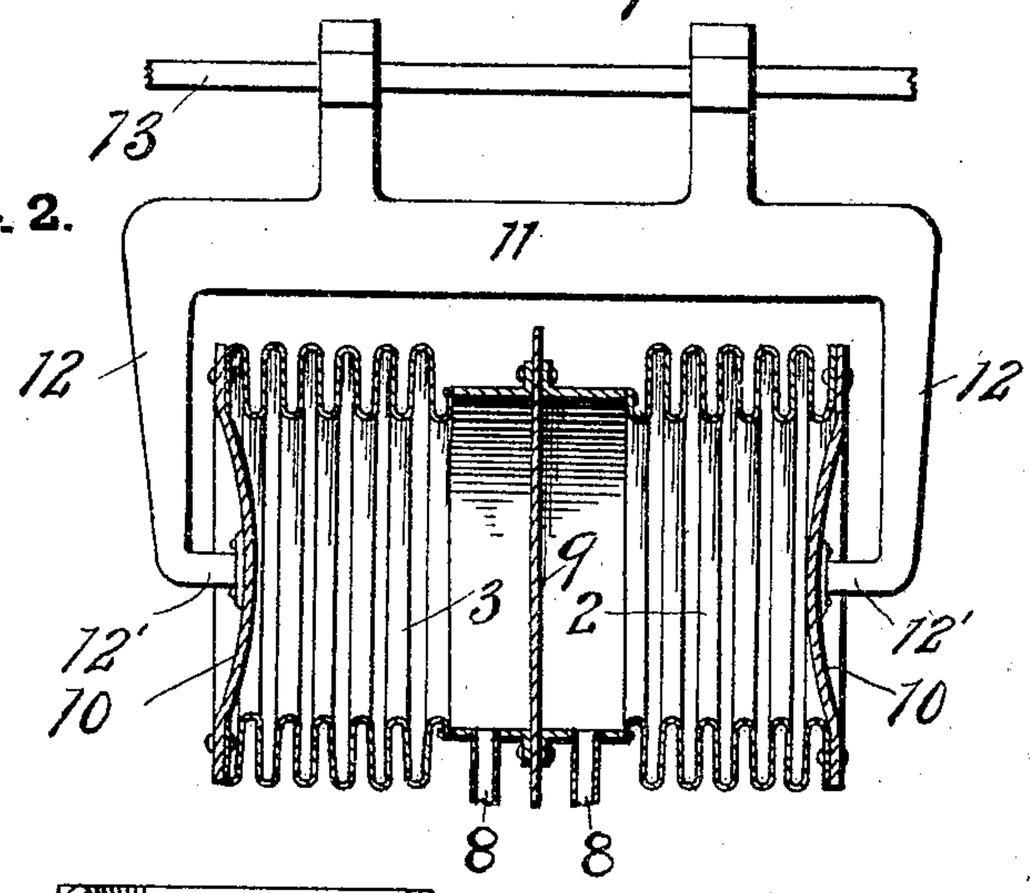
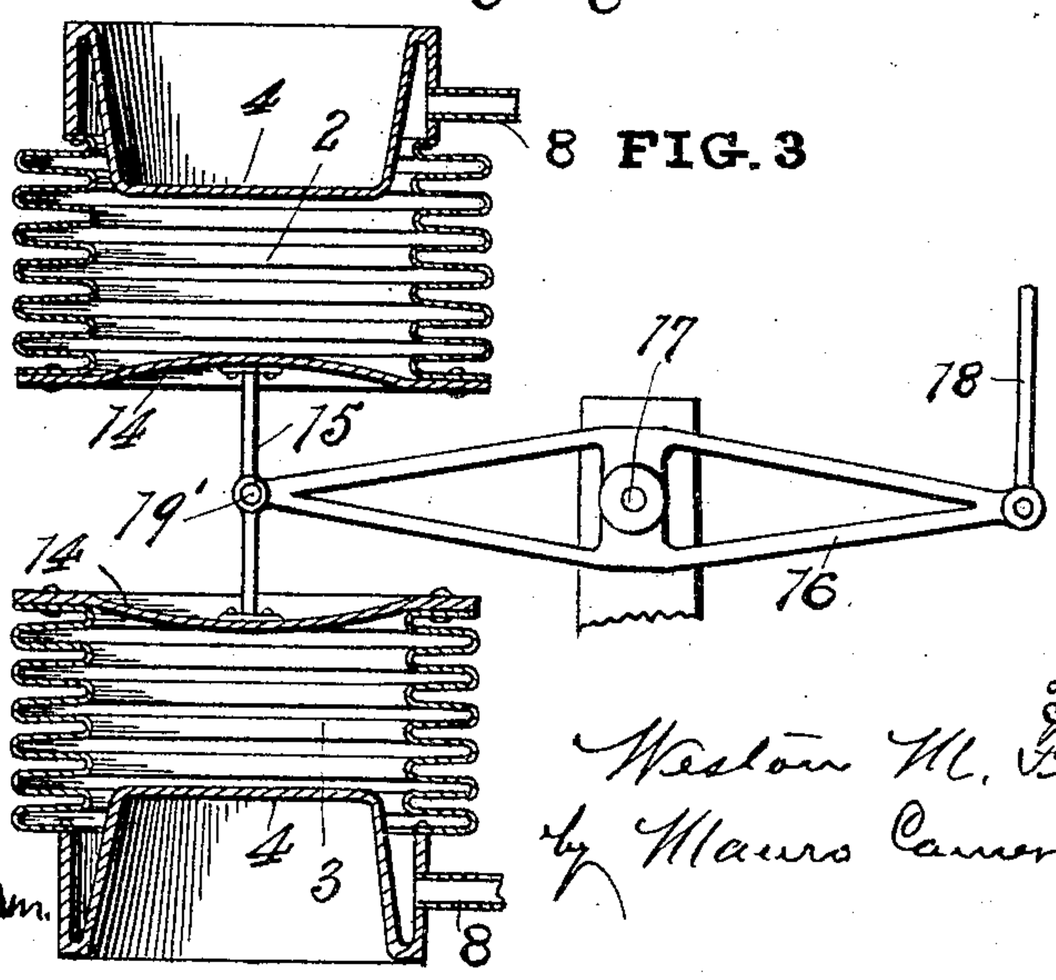


FIG. 3



Witnesses

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) MODEL. 2 SHEETS—SHEET 2.

FIG. 4.

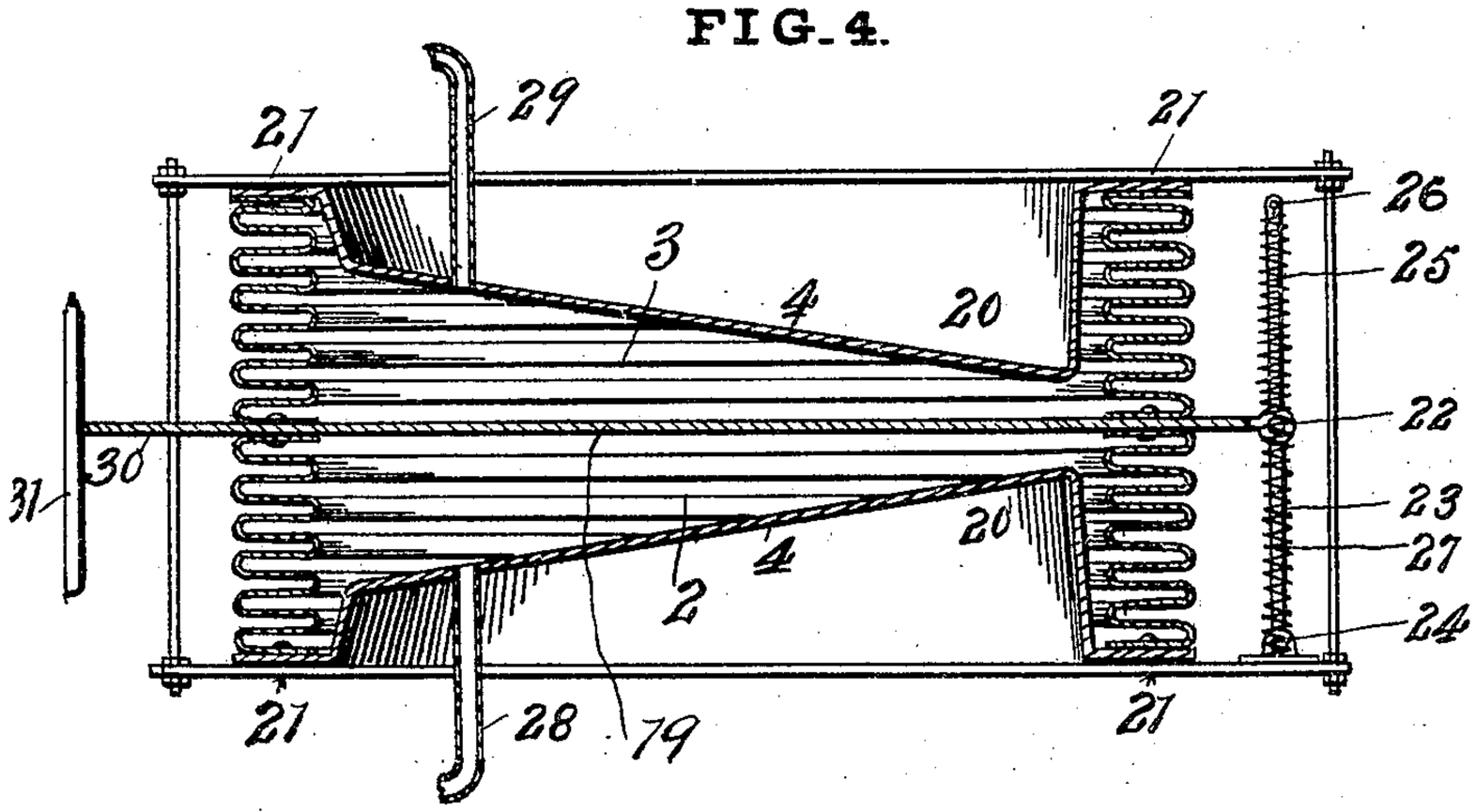
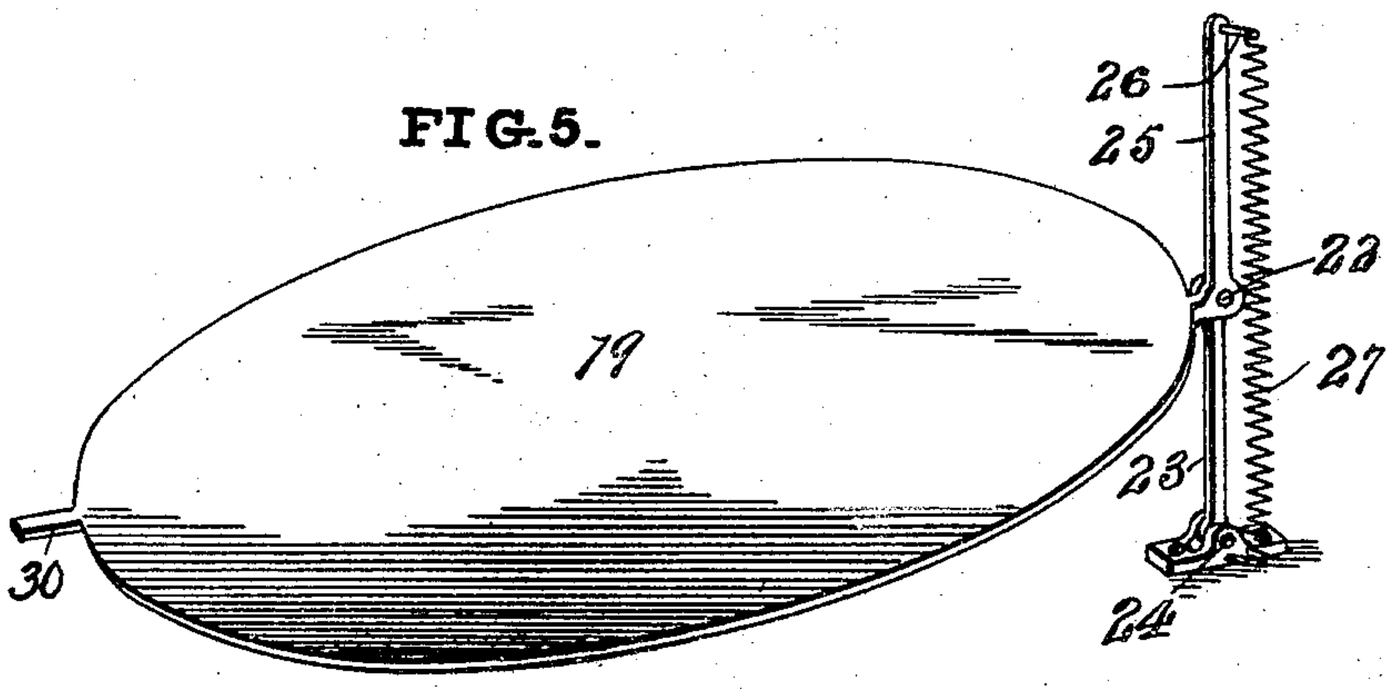


FIG. 5.



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No. 764,572. Patented July 12, 1904.

UNITED STATES PATENT OFFICE.

WESTON M. FULTON, OF KNOXVILLE, TENNESSEE.

MOTOR.

SPECIFICATION forming part of Letters Patent No. 764,572, dated July 12, 1904.

Application filed March 20, 1903. Serial No. 148,788. (No model.)

To all whom it may concern:

Be it known that I, WESTON M. FULTON, a resident of Knoxville, Tennessee, have invented a new and useful Improvement in Motors, which invention is fully set forth in the following specification.

The present improvements relate to fluid-operated motors or engines, and more particularly to the reciprocating type of the same.

The object of the invention is to provide a motor of this class in which friction is minimized to the least practical degree, a cheap and durable motor produced, and the action simplified.

The invention consists of a plurality of collapsible vessels having inlet and exhaust ports, fixed and movable abutments, and a translating mechanism or vibratory element connected with the movable abutments to perform work.

Various mechanical expressions may be given to this invention, a few of which are exemplified in the accompanying drawings.

Figure 1 represents a central sectional and partial elevation of a motor to which the invention has been applied. Fig. 2 is a similar view of another expression of the improvements. Fig. 3 shows also a similar view of a further modified form of the invention. Fig. 4, also a similar view, represents a specific application of the motor. Fig. 5 shows in perspective a detail of the motor of Fig. 4.

In Fig. 1 is represented a reciprocating member 1. Attached thereto on each side is a collapsible vessel 2 and 3, having, preferably, rigid fixed heads or abutments 4 supported by a frame in any suitable way. The reciprocating member 1 is attached to a rod 5 through any suitable connection, as cross-head 6 and rods 7. Vessels 2 and 3 are preferably cylindrical, with sides of sheet-metal formed in corrugations having substantially parallel folds, with non-angular portions connecting the parallel portions. The absence of any angular folds in the construction prevents any tendency of the corrugations to crack and also increases their resiliency and sensitiveness. The fixed heads 4 are preferably indented to provide for a practical exhaustion of the vessels before the limit of contractibility of the corrugated sides is reached and also incidentally strengthening them. Ports 8 are provided in vessels 2 and 3, which are connected to a source of fluid-supply through the usual or any suitable motor or engine valve for controlling the supply and exhaust of fluid to the vessels. Fluid entering vessel 2 and exhausting from vessel 3 will move the reciprocating member 1 to the left in the construction shown in Fig. 1 and the reverse action to the right. Reciprocating motion is thus imparted to the rod 5. The valve controlling the admission of fluid to parts 8 may be of the usual variable or expansion cut-off type.

In Fig. 2 is shown another mechanical expression of the same inventive idea. It differs from the form shown in Fig. 1 in that the abutment 9 between the vessels 2 and 3 is fixed instead of movable, while the outer heads 4 are movable instead of fixed, as in Fig. 1. Ports 8 have the same function as in Fig. 1. The heads 10 may be dished for strength. These heads constitute the reciprocating members and are connected up for translating motion by any approved mechanism. Fig. 2 illustrates one practical type comprising a forked arm 11, with its forks 12 secured at 12′ to the reciprocating heads 10 and partaking of the reciprocating motion thereof and imparts it to a reciprocating rod 13, to which it is secured. The valve connections controlling the ingress and egress of fluid to ports 8 8 may be the same as in Fig. 1 or of any suitable construction.

In Fig. 3 the same idea is shown embodied in a slightly-different form. In this exemplification instead of the head common to a pair of collapsible vessels two separate vessels are employed, with their adjacent heads 14 14 connected by a rigid rod or bar 15. The heads 14 may be movable and the heads 4 fixed or the heads 4 movable and the heads 14 fixed. In the present instance the heads 14 are the reciprocating members, and a translating device, as walking-beam 16, pivoted at 17 and 19′, is employed for translating the reciprocating motion to perform work, say, through a pivoted connecting-rod 18.

In Figs. 4 and 5 is shown a form of the in-

vention which is particularly applicable in measuring instruments like gas-meters. In many meters as now constructed the diaphragms or bellows are made of rubber, leather, or other flexible material, which harden and crack under the conditions to which they are exposed when in use, thereby rendering the meter ineffective and frequent inspection and repair necessary. By the construction shown in Fig. 5 I largely obviate these difficulties, since the structure is composed of sheet metal, which does not deteriorate under the condition of use, as does rubber, leather, and other like materials. Referring to Fig. 5, the two collapsible vessels 2 and 3, having the indented rigid heads 4 4, are provided with the common partition 19, and the whole is mounted in any suitable way to restrain the end walls from movement. In the present instance a frame surrounds the vessels and bears upon the flanges of the indented end walls at 21 21. The fixed end walls are preferably indented, and outwardly-presenting flanges 21 are formed, within which the cylindrical corrugated walls are seated. The partition 19 is hinged at 22 to a link 23, which in turn is hinged to the frame at 24. An arm 25 projects at right angles from the hinge 22, and a helical spring has one end attached to a lug 26 on the end of arm 25 and the other end attached to the frame at 24. The collapsible vessels 2 and 3 are preferably cylindrical in shape, so that the partition 19 is preferably a circular disk, with the parts 30 and 22 projecting from opposite points on its periphery. The pipes 28 and 29 are connected to the valve mechanism of the meter, which valve mechanism is operated by the oscillations of the projection 30 on the partition 19 through rod 31. As the gas passes through the meter partition 19 turns on hinge 22 and the end 30 moves up and down, the extreme limits of its motion being defined by the rigid end walls 4 4. The office of the helical spring attached to the standard 25 is to neutralize the elasticity of the corrugated walls of the collapsible vessels to prevent them from resisting the pressure of the gas in its effort to force the partition 19 back and forth. When this partition is in the position shown in the drawings, arm 25 is vertical, and the pull of the spring is in a direction parallel with the arm and its action is neutral. When, however, the partition moves downward, the upper end of arm 25 inclines to the left and the pull of the spring no longer acts in a direction parallel with the arm, but tends to incline it still farther to the left and force partition 19 downward still farther. Likewise, as the partition moves upward, as soon as arm 25 inclines slightly to the right of the vertical position the spring begins to force the partition still farther upward. The leverage of the spring is proportional to the trigonometric sine of the angle of deflection, and the resistance offered by the corrugated walls of the vessels 2 and 3 is inversely proportional to the sine of the same angle. Hence by properly adjusting the tension of the spring its action may be made just sufficient to neutralize the elasticity of the corrugated walls of the collapsible vessels, and the gas will flow through the meter under a more uniform pressure than is attainable in any of the present well-known gas-meters. In operation the flow of gas to the vessels 2 and 3 is controlled by the valve mechanism of the meter, so that as the gas flows into one vessel through one pipe it exhausts from the other vessel through the other pipe. This causes the partition 19 to oscillate and through the projection 30 to shift the valve mechanism of the meter back and forth. The inflowing gas under pressure through pipe 28 and the outflowing gas through pipe 29 thus cause vessel 3 to contract and vessel 2 to expand. As partition 19 oscillates toward pipe 29 link 23 and arm 25 move inwardly upon pivots 22 and 24. In the normal or medial position of the partition the tension of the spring 27 is neutral; but when the link 23 and arm 25 have started to move inwardly the spring 27 exerts a pressure which tends to aid the movement of the partition 19 toward pipe 29 and neutralizes what resistance there may be to the contraction of the walls of the vessel 3 and the expansion of the walls of the vessel 2. A like action ensues when the valve is reversed and the vessel 3 is expanding and the vessel 2 contracting, as will be apparent without further description.

All the described expressions of the invention may be interchangeably used for performing any of the particular work herein described or any other which will readily suggest itself to those skilled in the art. For example, the construction shown in Figs. 1, 2, and 3 may be employed for actuating the valve of a gas-meter instead of the form specifically shown in Fig. 4.

Other specific forms of the invention of general application are obvious to the skilled mechanic.

The term "collapsible vessel" comprises, of course, a vessel capable also of expansion.

What is claimed is—

1. The combination of a plurality of collapsible vessels, fluid-supply ports therefor and a head or partition common to said vessels, and means for imparting angular displacement of said head or partition.

2. The combination of a plurality of collapsible vessels, fluid-supply ports therefor, a head or partition common to said vessels, and means at one side thereof for imparting angular displacement to said head or partition.

3. The combination of a plurality of collapsible vessels, fluid-supply ports therefor, a

part connected thereto, means for imparting angular displacement of said part, and a vibratory element secured to the movable part.

4. The combination of a plurality of collapsible vessels, fluid-supply ports therefor, a part movable about a pivot connected to the walls of the vessels, and a link pivoted to the movable part and to the support.

5. The combination of a plurality of collapsible vessels, fluid-supply ports therefor, a part movable about a pivot connected to the walls of the vessels, a link pivoted to the movable part and to a support, and a vibratory member connected to the movable part.

6. The combination of a plurality of collapsible vessels, fluid-supply ports therefor, a movable part connected to the vessels, an angularly-disposed arm rigidly connected to the movable part, and means connected to said arm for neutralizing the resistance of the collapsible walls to the vibrations of the movable part.

7. The combination of a plurality of collapsible vessels, fluid-supply ports therefor, a pivoted movable part connected to the vessels, and means neutralizing the resistance of the collapsible walls to the vibrations of the movable part.

8. The combination of a plurality of collapsible vessels, fluid-supply ports therefor, a movable part connected to the vessels and a spring neutralizing the resistance of the collapsible walls to the vibrations of the movable part.

9. The combination of a plurality of collapsible vessels, fluid-supply ports therefor, a pivoted partition connected to the vessels, a link pivoted to a support and to the partition, an arm rigidly secured to the partition and a spring connected at one end to said arm and at the other to a support.

10. The combination of a collapsible vessel provided with a head inclined to the substantially parallel corrugated folds of the vessel, and means introducing and exhausting a motive fluid therefrom.

11. The combination of a pair of corrugated collapsible vessels each having a fixed end wall, a vibratory wall or partition common to both vessels, a pivotal support for said vibratory wall, and a vibratory element fixed to said vibratory wall.

12. The combination of a pair of corrugated collapsible vessels each having a fixed end wall, a vibratory wall or partition common to both vessels, a link pivoted to a suitable support and to said vibratory wall, and a vibratory element connected to said vibratory wall.

13. The combination of a pair of corrugated collapsible vessels each having a fixed end wall, a vibratory wall or partition common to both vessels, a link pivoted to a suitable support and to said vibratory wall, a spring interposed between the vibratory wall and a suitable abutment, and a vibratory element connected to said vibratory wall.

14. The combination of a pair of collapsible corrugated vessels each having a fixed end wall, a vibratory wall or partition common to both vessels and a port, a link pivoted to a suitable support and to the vibratory wall, an arm rigid with said vibratory wall, and a spring secured to said arm and to a suitable abutment.

15. The combination of a pair of collapsible corrugated vessels each having a fixed end wall, a vibratory wall or partition common to both vessels and a port, a link pivoted to a suitable support and to the vibratory wall, an arm rigid with said vibratory wall, and a spring secured to said arm and to a suitable abutment, said spring being neutral when the vibratory wall is in its medial position, and a vibratory member connected to said vibratory wall.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WESTON M. FULTON.

Witnesses:
J. W. CURRIER,
J. T. GRITMAN.