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W. M. FULTON.

COLLAPSIBLE VESSEL.

APPLICATION FILED APR. 21, 1903.

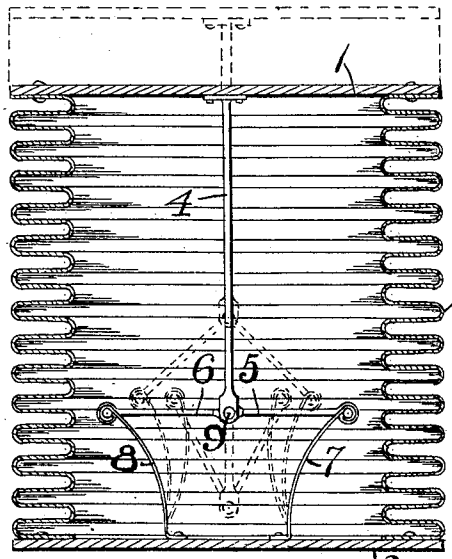


FIG. 1.

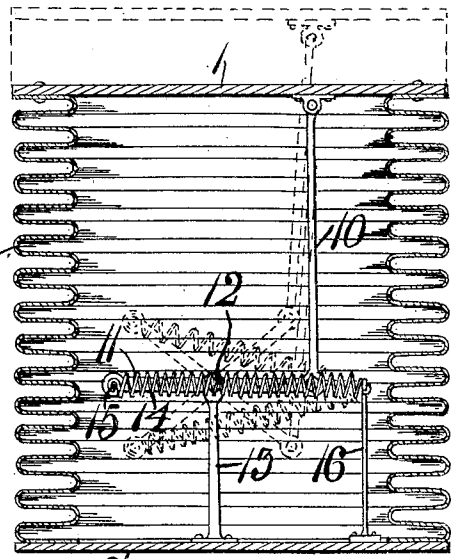


FIG. 3.

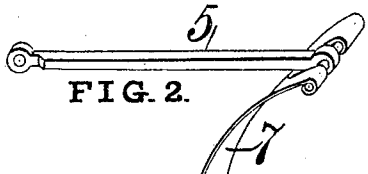


FIG. 2.

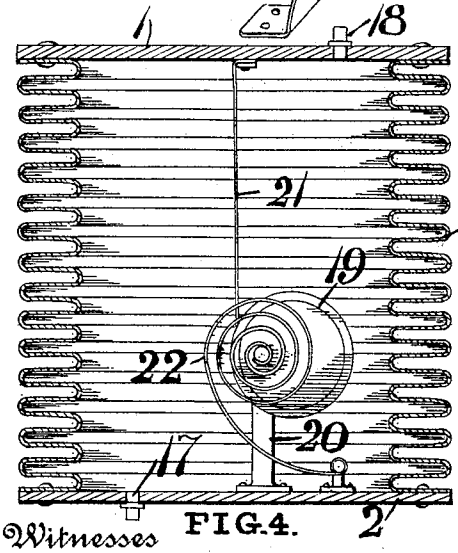


FIG. 4.

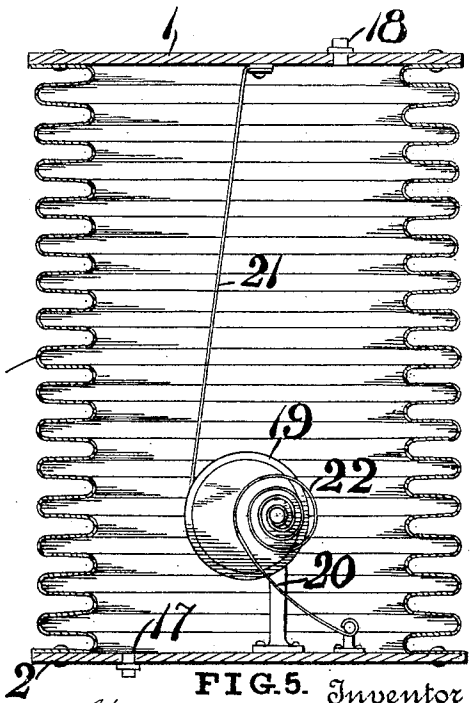


FIG. 5.

Witnesses

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COLLAPSIBLE VESSEL.

No. 805,720. Specification of Letters Patent. Patented Nov. 28, 1905.

Application filed April 21, 1903. Serial No. 153,707.

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 Collapsible Vessels, which invention is fully set forth in the following specification.

This invention relates to collapsible vessels, and more particularly to that class of collapsible vessels which expand above or collapse below a given point against the elasticity of the walls of the vessel. In this class of vessels it is sometimes found desirable to have the vessel expand and contract without resistance or to have it change its volume against a resistance different from that offered by the walls of the vessel. For example, in my application, Serial No. 148,788, filed March 20, 1903, I have shown how a helical spring may be attached to a collapsible vessel so as to adapt it for use as a bellows for gas-meters.

The present invention consists in combining a collapsible vessel with means for neutralizing or modifying or compensating for the resistance offered by its flexible wall to any force tending to change the volume of the vessel by expansion or contraction.

The inventive idea may be embodied in a variety of mechanical structures, and in the ones chosen for illustration herein said means consists in a spring or springs so arranged that it or they assist expansion and contraction, except at the point where the vessel is neither expanded nor contracted, at which point the action of the spring or springs is neutral.

In the drawings forming a part of this application, Figure 1 is a vertical central section, with parts in elevation, of a collapsible vessel, showing one form of the invention. Fig. 2 is a detail in perspective of lever 5 and spring 7 of Fig. 1. Fig. 3 is a view similar to Fig. 1, showing another form of the invention; and Figs. 4 and 5 show still another form with the vessel in its normal and its expanded positions, respectively.

Referring to Figs. 1 and 2, the collapsible vessel here shown is one having rigid end walls 1 and 2 and flexible corrugated lateral walls 3, preferably composed of sheet metal. Connected to the upper wall 1 is a depending bar 4, having two links 5 and 6, pivotally connected thereto at one end, the other ends of the links being pivoted to suitable springs 7 and 8, whose tension or line of pressure is inward toward the bar 4. As here shown, these springs are in the form of blades of steel or other suitable metal secured to the end wall 2 and having the links articulated thereto, as shown at 9 in Fig. 2.

In the position of the parts as shown in Fig. 1 the collapsible vessel is neither expanded nor contracted—*i. e.*, it is in its normal position—and the two springs 7 and 8 neutralize each other along a line passing through the pivotal connection of links 5 and 6 with the rod 4 and at right angles to said rod, and hence the springs have no tendency either to expand or contract the vessel. If now the vessel be slightly expanded, as by the pressure of a gas within the vessel, the expansion will be resisted by the elasticity of the walls 3 and aided by the springs 7 and 8, since these springs will push upward on the bar 4 the instant links 5 and 6 are moved out of alinement and the farther the pivot-point 9 departs from the line of force between the springs 7 and 8 the greater will be the component of force tending to carry the pivot still farther away from this line. If the vessel were now collapsed from its expanded position, this action would be aided by the elasticity of the walls 3 and opposed by the tension of springs 7 and 8 until the parts reached the position shown in Fig. 1. If the collapsing action continued beyond this point, it would be aided by the springs 7 and 8 and opposed by the elasticity of walls 3. The position of the parts in the expanded and in the collapsed positions is shown by dotted lines in Fig. 1. It is apparent that the elastic tension of the walls 3 of the vessel can therefore be neutralized or modified at will by adjusting the tension of the springs 7 and 8.

The same principle may be applied by a somewhat different structure, (shown in Fig. 3,) wherein a bar 10 is shown pivoted at its upper end to the top wall 1 and at its lower end to a lever 11, fulcrumed at 12 to a standard 13 on the bottom wall 2. A spring 14 is connected at 15 to one end of the lever 11, the other end of the spring being secured to a standard 16, the proportion and arrangement of the parts being such that when the vessel is in its normal position—*i. e.*, neither collapsed nor expanded—the tension of spring 14 is exerted along a line passing through the fulcrum 12 of lever 11, and hence has no tendency to either expand or collapse the

vessel. If, however, the vessel be partially expanded or collapsed, the line of action of the spring will be thrown off of the dead-center 12, and the spring will then act to aid expansion above and assist contraction below the position shown in Fig. 3, and by adjusting the tension of the spring 14 the elasticity of wall 3 can be neutralized or modified, as explained in connection with Fig. 1.

In Figs. 4 and 5 is shown another means for controlling the resistance of the walls of a collapsible vessel. Suppose it is desired to employ such a vessel as a gas-reservoir where it is desirable to have a constant pressure exerted upon the gas within the vessel—as, for example, on an air-reservoir for a bellows. The object of such a reservoir is to produce a steady flow of air to a furnace or blowpipe. Suppose the air to enter the vessel through port 17 by intermittent charges and to flow out uniformly through port 18 to a blowpipe. In order to maintain this uniform flow of air, it is necessary that the vessel should expand and contract under uniform pressure. For the purpose of securing this result an eccentric pulley 19 is mounted on a standard 20, fixed to the lower wall 2 of the vessel, and a tape 21, with one end secured to the pulley, is passed once around the pulley and then has its other end secured to the top wall of the vessel. A coiled spring 22 has one end secured to the lower wall 2 of the vessel at 23 and the other end secured to the pulley near its axis. When the vessel is in its normal or unexpanded position, the tape 21 is arranged so as to be tangent to the pulley at the end of its shortest radius. With the parts thus constructed and in the position shown in Fig. 4 any force expanding the vessel would have to overcome the resiliency of the walls 3 and and the tension of the spring 22, and as the vessel expanded the resistance of the walls 3 would progressively increase. Suppose the power to be pressing upward on wall 1. The leverage which such power would have to overcome the spring 22 would constantly increase as the tape revolves the pulley, and if the spring be such that its tension would not be appreciably increased by a half-turn of the pulley we shall have the force acting against an approximately constant power (spring 22) with a constantly-increasing leverage. It will therefore be evident that if the combination be so adjusted that the vessel shall reach its desired maximum limit of expansion when the tape is tangent to the pulley at the end of its longest radius the resistance of the spring 22, combined with that of the walls 3, may be caused to exert a uniform pressure upon the gas within the vessel at every stage of the vessel's expansion by merely proportioning the tension of the spring 22 and the eccentricity of the pulley 19 to the resistance of the walls 3. Moreover, by varying the eccentricity of the pulley and by giving various curves to its periphery the action of the collapsible vessel may be modified in almost any manner desired.

The construction of Figs. 1 and 3, as well as the pulley construction of Figs. 4 and 5, show a shiftable leverage connection between the spring and the walls of the vessel which affords an efficient means whereby the resistance offered by the vessel to any force tending to expand or contract the same may be modified or controlled or compensated for in an infinite variety of ways.

It is to be understood that the exact location and construction of parts herein shown and described may be changed in a great variety of ways and still retain the principles of construction of this invention. Thus, for example, while the controlling devices are all herein shown as within the vessel such location is not at all essential. Furthermore, while the particular form of collapsible vessel chosen for illustration is one with corrugated walls the invention is not limited to this form, as it also includes any form whose walls resist a force tending to expand or collapse the vessel.

What is claimed is—

1. A collapsible vessel having a flexible corrugated wall which resists a force tending to change the volume of said vessel, and means operatively connected to said vessel whereby the resistance offered by its wall may be neutralized.

2. A collapsible vessel having a sheet-metal corrugated wall which resists a force tending to change the volume of said vessel, and means operatively connected to said vessel whereby the resistance offered by its wall may be neutralized.

3. The combination of a collapsible vessel having a flexible corrugated wall which resists any force tending to expand or collapse it, and automatic compensating means for controlling such resistance, and enabling the vessel to exert a uniform force during expanding or collapsing.

4. The combination of a collapsible vessel which resists any force tending to expand or collapse it, and automatic compensating means for controlling such resistance, and enabling the vessel to exert a uniform force during expanding or collapsing.

5. The combination of a collapsible vessel which resists any force tending to expand or collapse it, and spring-actuated means for controlling such resistance, and enabling the vessel to exert a uniform force during expanding or collapsing.

6. The combination of a collapsible vessel which resists any force tending to expand or collapse it, and automatic compensating means comprising a spring, and means connecting the spring and vessel whereby the spring may exert a varying force on the walls of the ves-

sel to enable the latter to exert a uniform force during expanding and collapsing.

7. The combination of a collapsible vessel which resists any force tending to expand or collapse it, a spring and a pivoted connection between said spring and vessel whereby the spring may exert a varying force on the vessel as the latter expands or collapses.

8. The combination of a collapsible vessel which resists any force tending to expand or collapse it, a spring, and an eccentric pulley connected to the spring and to said vessel whereby the spring may exert a varying force on the vessel as the latter expands or collapses.

9. The combination of a collapsible vessel which resists any force tending to expand or collapse it, a spring having one end fast to the inner wall of the vessel, a pivoted connection between said spring and vessel whereby the spring may exert a varying force on the vessel as the latter expands or collapses.

10. In combination, a collapsible vessel having a flexible corrugated wall and rigid end walls, a spring having one end fast to one end wall, an eccentric pulley supported in the vessel and connected to said spring, and a flexible connection between said pulley and vessel whereby the spring may exert a varying force on the vessel as the latter expands or collapses.

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

WESTON M. FULTON.

Witnesses:
R. M. WILLIAMSON,
J. F. VOORHEES.