July 29, 1952 A. E. SWINDLER 2,604,758

FLOWABLE WEIGHTED DIAPHRAGM AIR COMPRESSOR

Filed June 25, 1948

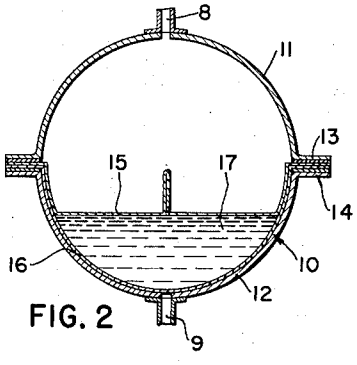


FIG. 2

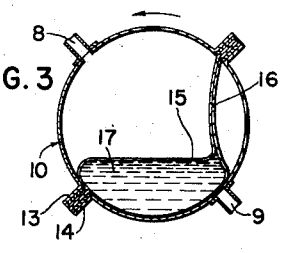


FIG. 3

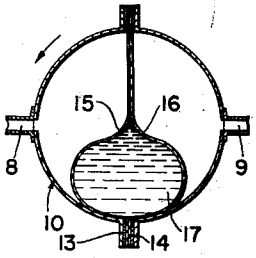


FIG. 4

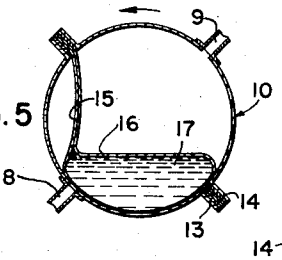


FIG. 5

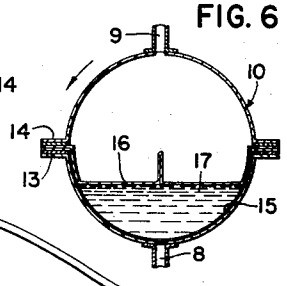


FIG. 6

FIG. 1

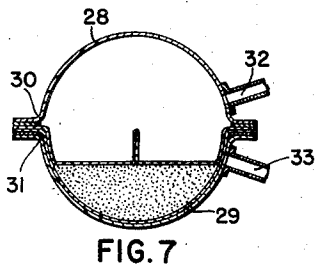


FIG. 7

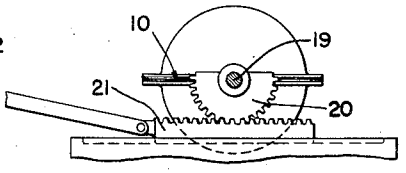
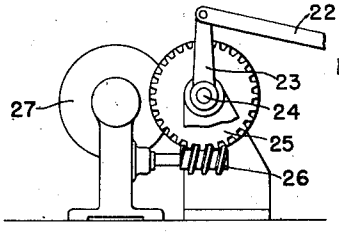


FIG. 8



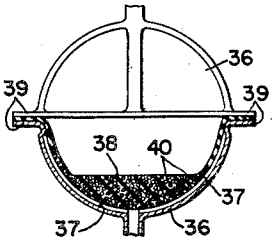


FIG. 9

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FLOWABLE WEIGHTED DIAPHRAGM AIR COMPRESSOR

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17 Claims. (Cl. 60—62.6)

1

The present invention relates to a pulsating type diaphragm air compressor of the type in which the diaphragm is weighted to the desired amount to give the required air pressure. More particularly, the weighting means is a fluid such as mercury, loose shot, sand or attached or imbedded weight.

Another object of this invention is to provide predetermined air pressure for use in a pneumatic mattress having plural sections which are alternately inflated. The particular means employed for inducing alternate pressure in the sections of the mattress comprises a rockable container having weighting means for alternately forcing air out of the container into the different sections of the mattress. The weighting material determines the force with which the air is expelled from the container.

This device is primarily designed to eliminate expensive air compressing mechanisms and to provide a simple means for compressing the air which will facilitate the use of the device in the home. With manual control, the device can be made very simple and inexpensive to operate.

More particularly, my invention has to do with the application of alternating pressures having a predetermined magnitude controlled by a flowable mass of liquid or other weighting means which periodically forces the air first into one part of the mattress and then the other, the rockable member being moved by hand or by any mechanical, electrical or similar device which will rock it through approximately 180°.

In the drawings:

Fig. 1 is a top plan view showing a mattress with a pulsating device made according to my invention;

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

Figs. 3, 4, 5 and 6 are views similar to Fig. 2, with the rockable device in successive positions in one-half of the cycle of movement thereof;

Fig. 7 is a view similar to Fig. 2 showing a modified construction;

Fig. 8 is a front elevation of the pulsating device and means for rocking same shown in Fig. 1; and

Fig. 9 is a view similar to Fig. 7, showing a further modification of my device with only the lower part in section.

In Fig. 1, I have shown more or less diagrammatically a mattress 1 having interfitting toothed-like hollow sections 2 and 3, these sections being inflatable and independent of each other. The section 2 is inflated through a conduit 4 and section 3 is inflated through a conduit 5 through tubes 6 and 7, respectively, which in turn are connected to the outlets 8 and 9 on the rockable container 10. The container, as shown in Fig. 2, comprises two semi-spherical sections 11 and 12 having flanges 13 and 14 which are adapted to be bolted together to make a substantially spherical container. Interposed between the flanges are two layers of flexible material forming diaphragms 15 and 16. These are preferably of a rubber impregnated fabric. The diaphragms 15 and 16 are preferably of a size to just line one-half of the inner circumference of the container, and between the diaphragms 15 and 16 I interpose a flowable mass 17 of weighting material such as mercury, small shot (preferably not over $\frac{1}{16}$" in diameter), sand or similar loose material. Preferably, the air is all exhausted from between the diaphragms when a liquid such as mercury is used. The diaphragms 15 and 16 therefore form an enclosure for the weighting material and hold it confined as the member 10 is rocked. These diaphragms 15 and 16 assume somewhat the positions shown in Figs. 3, 4, 5 and 6 as the container is rocked through approximately 180° until the diaphragm 16 is on top as in Fig. 6, instead of on the bottom as in Fig. 2.

2

As the container 10 is rocked, the loose weighting material, which always tends to gravitate to the bottom of the hollow container, forces the air out of the container on one side of the diaphragm and then the other and air escapes through outlets 8 and 9. This causes air to be alternately forced through the tubes 6 and 7 into the sections 2 and 3, respectively, of the mattress. The pressure of the air is determined by the position of the weighting material in the container. As will be obvious from an inspection of the drawings, the pressure in the mattress sections will vary as the container 10 is rocked. As the air is forced into the section 2, air is withdrawn from the section 3, and vice versa, with the result that the fingers of the comb-like mattress sections are alternately raised and depressed so that anyone lying on the mattress is supported principally first by one section and then the other. Such action prevents bed soreness and acts to massage the body to increase the comfort of the patient. It also helps to induce sleep.

However, my invention relates primarily to the idea of using a closed container spanned by diaphragms which enclose mercury as the pressure medium for forcing the air out of the chamber into the different mattress sections or a single

weighted diaphragm such as is shown in Fig. 9. The pressure to be obtained in the mattress sections is determined by the weight of the mercury or other weighting means.

Of course, the container 10 can be made in any desired shape and does not have to be spherical, but my particular construction is very economical to make as the two spherical sections can be easily drawn and then fitted together with the diaphragms held firmly therebetween.

In order to rock the container 10, I mount it on a set of bearings 18 which receive the aligned pintles 19 on the container 10. On one of the pintles 19, such as that shown at the bottom in Fig. 1, I rigidly secure a segmental gear 20. This gear meshes with a rack 21 connected by a pitman 22 to the outer end of a crank 23 carried by the shaft 24 which in turn carries a worm wheel 25, driven from the worm 26 actuated through any suitable gearing (not shown) by a motor 27. The crank causes the rack 21 to be moved back and forth which in turn rocks the member 10 due to the meshing of the gear 20 with the rack. Any other suitable means could be used to rock the container 10 back and forth through approximately 180° of movement to cause the air to be forced out of the container 10, first into one chamber and then the other.

In Fig. 7, I have shown a slight modification of the device shown in the other figures, such as in Fig. 2, and in which the spherical sections 28 and 29 correspond to the spherical sections 11 and 12. However, at the points 30 and 31, the spherical sections are rounded so that the diaphragms will not have to lie against a sharp corner, and in fabrication the sections are more readily drawn. With the construction shown in Fig. 7, the diaphragms will last longer than with a construction such as shown in Fig. 2. Also, in this modification of the invention, the outlets 32 and 33, corresponding to the outlets 8 and 9 of Fig. 2, are arranged close to the flanges of the spherical members so that there is less chance of the air being trapped inside of the container. With the outlets 32 and 33 arranged as shown in Fig. 7, it will be noted that they are located in such a position as to be adjacent the last amounts of air to be pushed out of the container (see the relative positions of the diaphragms in Figs. 2–6).

In order to supply the desired initial quantities of air to the mattress, I provide valves 34 which may be opened to admit air through conduits 35 to which a bicycle pump or other source of air supplying means may be attached. When the required amount of air has been supplied to the sections 2 and 3 of the mattress, the valves 34 are closed and the device is ready for operation. Air lost through leakage may be replaced the same way.

In Fig. 9, I have shown a further modification of my device in which the semi-spherical members 36 are provided with grooves such as 37 for eliminating trapped air. These grooves may be quite minute in actual practice and the number needed may readily be determined by those skilled in the art.

In this form of the invention, a single diaphragm 38 is clamped between the flanges 39 of the semi-spherical members and is made quite thick at the central portion in which I preferably embed lead weight 40 or the like to give the desired weight to the diaphragm to force the air out of the chamber.

Any of the forms of the invention may be constructed to provide the venting means described in connection with Fig. 9.

Other modifications of my invention may appear to those skilled in the art to which it pertains and therefore I do not wish to be limited except as hereinafter set forth in the claims appended. The container could also be actuated by manually actuated means whereby the patient himself could determine the pressure of the pulsations as well as the period.

Having thus fully described my invention, what I claim and desire to secure by Letters Patent of the United States is:

1. A pulsating device comprising a hollow rockable container having a port, a flexible weighted imperforate, fluid weighted diaphragm spanning the interior of the hollow rockable member, for forcing the diaphragm in the direction toward said port to expel the air through the port when the container is rocked, means for rocking said container and means for admitting air to said container between said port and diaphragm as said container is rocked in the opposite direction.

2. A pulsating device comprising a hollow rockable container having a port, a flexible diaphragm spanning the interior of the hollow rockable member, flowable weighting material on the side of the diaphragm opposite the port for forcing the diaphragm in the direction toward said port to expel the air through the port when the container is rocked, means for rocking said container and means for admitting air to said container between said port and diaphragm as said container is rocked in the opposite direction.

3. A pulsating device comprising a hollow rockable container having a port, a flexible diaphragm spanning the interior of the hollow rockable member, and a liquid pressure medium on the side of the diaphragm opposite the port for forcing the diaphragm in the direction toward said port to expel the air through the port when the container is rocked, means for rocking said container and means for admitting air to said container between said port and diaphragm as said container is rocked in the opposite direction.

4. A pulsating device comprising a hollow rockable container having a port, a flexible diaphragm spanning the interior of the hollow rockable member, and mercury on the side of the diaphragm opposite the port for forcing the diaphragm in the direction toward said port to expel the air through the port when the container is rocked, means for rocking said container and means for admitting air to said container between said port and diaphragm as said container is rocked in the opposite direction.

5. A pulsating device comprising a hollow container having at least two ports, each on opposite sides of the container, a pair of diaphragms spanning the interior of the hollow container, a quantity of weighting material in the space between the diaphragms, and means for rocking the container to cause the material to actuate the diaphragms, first toward one port and then the other, whereby the air is alternately forced out through the one port and drawn through the other, depending on the direction the diaphragms are moved by the material therebetween.

6. A pulsating device comprising a hollow container having at least two ports, each on opposite sides of the container, a pair of diaphragms spanning the interior of the hollow container, a quantity of liquid in the space between the diaphragms, and means for rocking the container to cause the liquid to move the diaphragms, first

toward one port and then the other, whereby the air is alternately forced out through the one port and drawn through the other, depending on the direction the diaphragms are moved by the liquid therebetween.

7. A pulsating device comprising a hollow container having at least two ports, each on opposite sides of the container, a pair of diaphragms spanning the interior of the hollow container, a quantity of mercury in the space between the diaphragms, and means for rocking the container to cause the mercury to move the diaphragms, first toward one port and then the other, whereby the air is alternately forced out through the one port and drawn back through the other, depending on the direction the diaphragms are moved by the mercury therebetween.

8. A pulsator comprising a hollow container having at least two ports, adjacent diaphragms sealed with respect to the sides of the container to divide the container into at least two chambers, at least one of said ports communicating with one chamber and another port with the other chamber, a quantity of weighting material between the diaphragms, and means for rocking the container in opposite directions to cause the diaphragms to force the air first out of one chamber through the port communicating therewith and then the other chamber through the port communicating therewith as the container is rocked, the opposed faces of the diaphrgam and container being formed to provide vents therebetween when in contact, the air being drawn into the chamber through one port as it is forced out of the container through the other port.

9. A pulsator comprising a hollow container having at least two ports, adjacent diaphragms sealed with respect to the sides of the container to divide the container into at least two chambers, at least one of said ports communicating with one chamber and another port with the other chamber, a quantity of fluid between the diaphragms, and means for rocking the container in opposite directions to cause the diaphragms to force the air first out of one chamber through the port communicating therewith and then the other through the port communicating therewith as the container is rocked.

10. A pulsator comprising a hollow container having at least two ports, a pair of diaphragms in the container forming a closed chamber for a quantity of liquid, at least one of said ports communicating with one chamber and another port with the other chamber, a quantity of liquid in said chamber, the diaphragms additionally dividing the container into two separate pressure chambers for pressure fluid, means for angularly moving the container, the diaphragms loosely spanning the space between opposite walls of the container, whereby the liquid will force the diaphragms first in one direction and then in the other, to reduce the volume of one pressure chamber and then the other, and ports forming outlets and inlets communicating with each pressure chamber.

11. A device as set forth in claim 10 in which the liquid substantially fills the space between the diaphragms.

12. A pulsator comprising at least two sections shaped when joined together to form a hollow container, a pair of diaphragms having their outer edges clamped between the sections of the container at their meeting edges to divide the container into two fluid receiving chambers, a port in the wall of each chamber, a weighting material heavier than the fluid to be supplied to the chambers positioned between the diaphragms for forcing fluid from one of said chambers through one port and for drawing fluid into the other of said chambers through the other port as the container is rotated.

13. A pulsator comprising at least two sections shaped when joined together to form a hollow container, a pair of diaphragms having their outer edges clamped between the sections of the container to divide the container into two chambers, a port in the wall of each chamber, and mercury positioned between the diaphragms for forcing fluid from one of said chambers through one port and for drawing fluid into the other of said chambers through the other port as the container is rotated.

14. A pulsator comprising at least two sections shaped when joined together to form a hollow container, a diaphragm having its outer edge clamped between the sections of the container to divide the container into two chambers, ports forming outlets and inlets, at least one for each chamber, and fluid weighting material embedded in the diaphragm for forcing fluid from one of said chambers through its port and for drawing fluid into the other of said chambers through its port as the container is rotated.

15. A pulsator comprising a rotatable hollow member divided transversely by at least one fluid weighted diaphragm dividing the container to form at least two fluid receiving chambers, ports forming outlets and inlets, at least one for each chamber, and means for moving the container to cause the diaphragm to be moved first in one direction and then in the other, transversely to the direction in which the diaphragm spans the container, whereby the dimensions of one chamber and then the other is reduced and the fluid when supplied to each chamber is alternately forced out of its respective port, and drawn into the other chamber through its port.

16. A device as set forth in claim 15 in which the container is provided with a segmental gear rigidly connected thereto, a rack for actuating said gear and a crank and pitman connection with actuating means therefor for moving said rack back and forth to cause said container to be oscillated.

17. A pulsator comprising a container and actuating means for rocking said container, said container being formed of at least two similarly shaped joined sections, the walls of the sections at their edges curving outwardly and having contiguous flanges, a pair of diaphragms clamped between the flanges and spanning the container, a flowable mass between the diaphragms, and ports, one communicating with each chamber, and through which fluid flows into and out of the container as it is rocked.

ALBERT E. SWINDLER.

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