No. 795,761. PATENTED JULY 25, 1905.

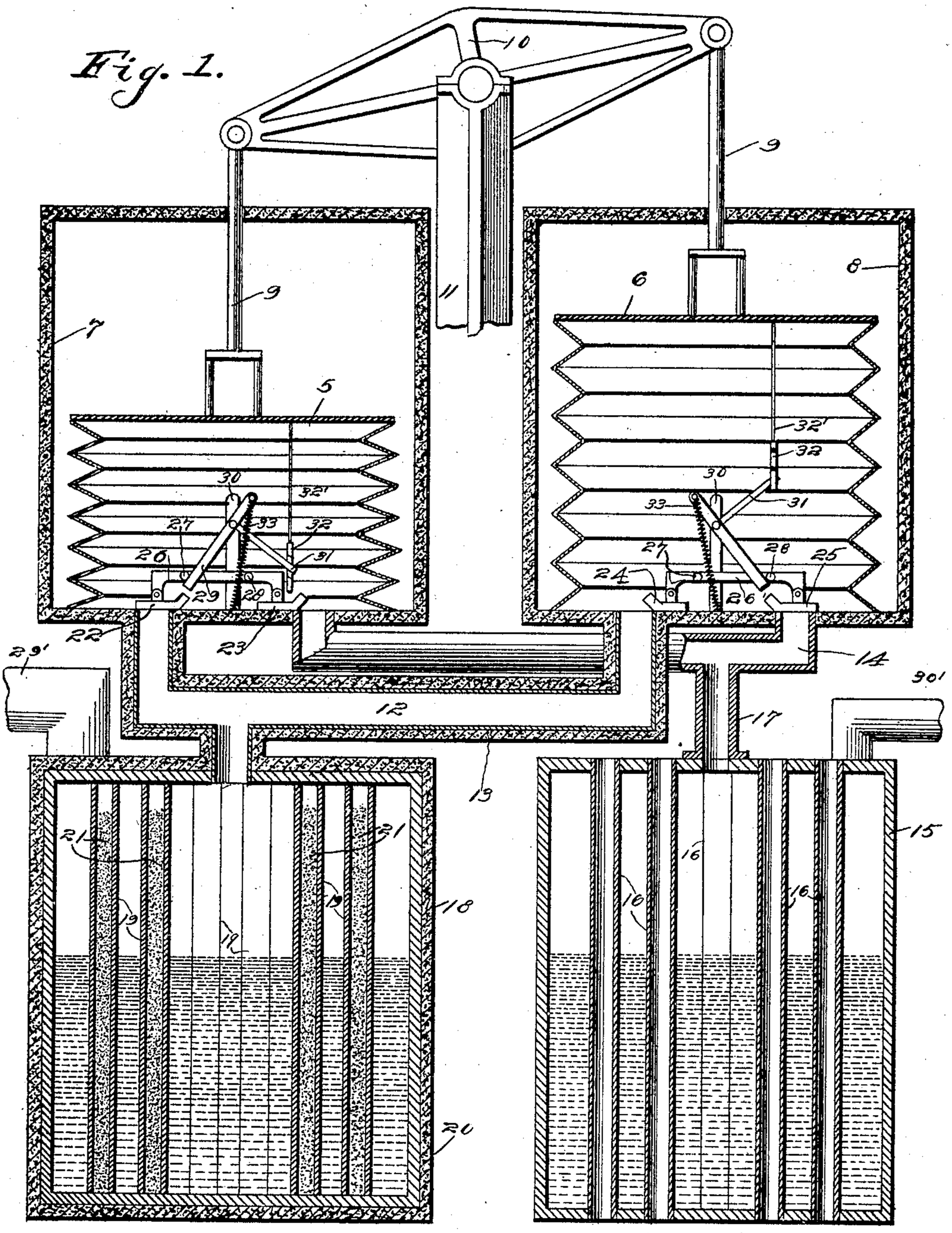
W. M. FULTON.

ATMOSPHERIC PRESSURE AND TEMPERATURE MOTOR.

APPLICATION FILED FEB. 25, 1901.

2 SHEETS—SHEET 1.

Fig. 1.



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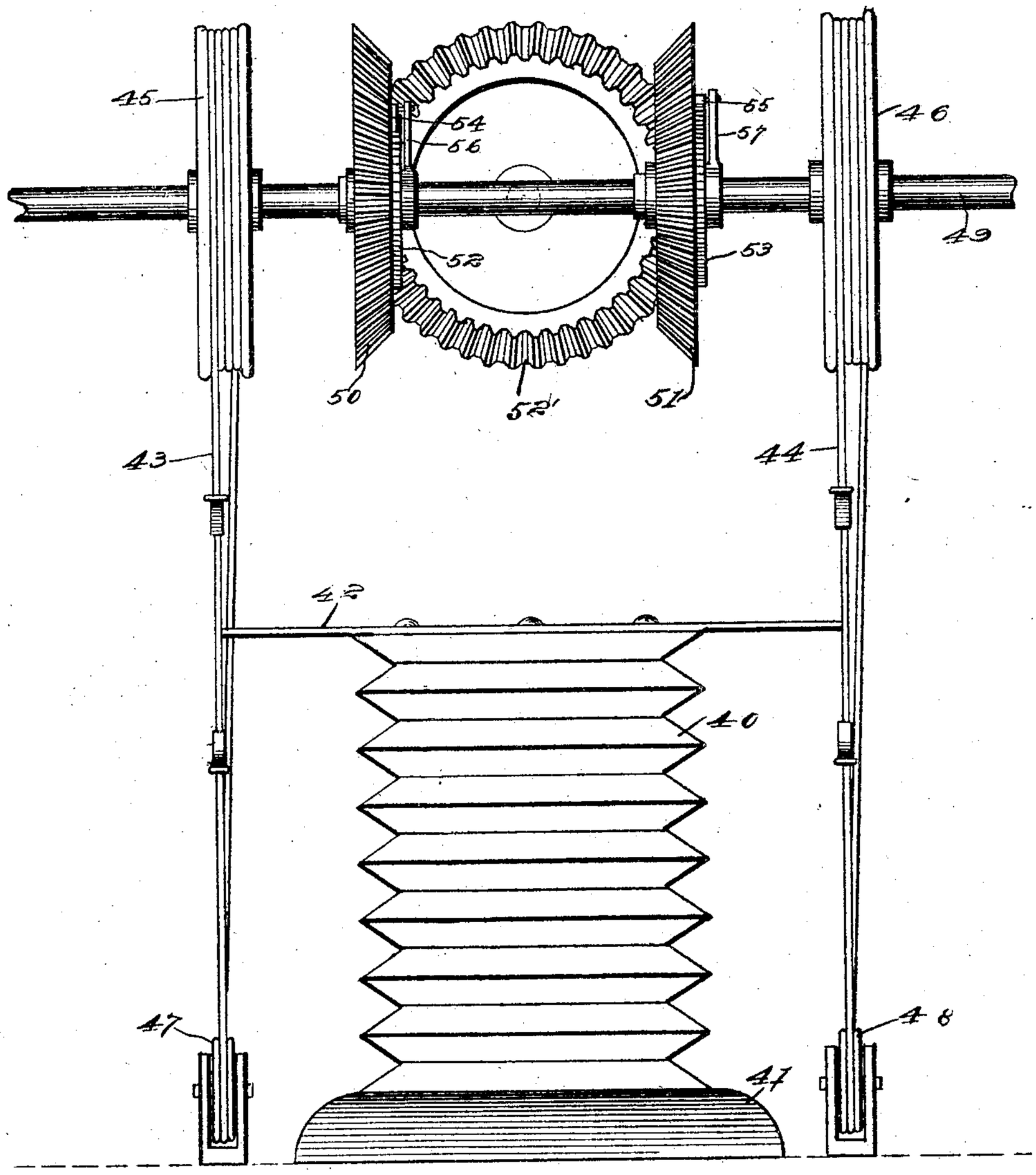
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

WESTON MILLER FULTON, OF KNOXVILLE, TENNESSEE, ASSIGNOR TO THE FULTON COMPANY, OF KNOXVILLE, TENNESSEE, A CORPORATION OF MAINE.

ATMOSPHERIC PRESSURE AND TEMPERATURE MOTOR.

No. 795,761. Specification of Letters Patent. Patented July 25, 1905.

Application filed February 25, 1901. Serial No. 48,852.

To all whom it may concern:

Be it known that I, WESTON MILLER FULTON, a citizen of the United States, residing at Knoxville, in the county of Knox and State of Tennessee, have invented a new and useful Atmospheric Pressure and Temperature Motor, of which the following is a specification.

This invention relates to motors, and more particularly to that class operable from variations in atmospheric temperature and pressure; and it has for its object to provide for utilizing a greater percentage of the energy that is obtainable from these atmospheric changes than has heretofore been accomplished. As motors of this nature have been heretofore made they have utilized metals and gases or gases combined with vapors as the expansible medium for converting the energy into mechanical motion; but I have found that by the use of a volatile liquid with its vapor a greater portion of the energy in question may be converted, and I have shown two different mechanisms by which this may be done.

In the drawings forming a portion of this specification, and in which like numerals of reference indicate similar parts in the several views, Figure 1 is a sectional view of one mechanism for utilizing the atmospheric changes in accordance with the present invention. Fig. 2 is an elevation showing a second form of mechanism for a like purpose.

Referring now to the drawings, and more particularly to Fig. 1 thereof, there is shown an apparatus including two substantially cylindrical expansible chambers 5 and 6, each of which is corrugated circumferentially and is made of sheet metal or other suitable material which will permit of movement of the ends or heads of the chambers toward and away from each other to vary its cubical contents.

The chambers 5 and 6 are disposed within casings 7 and 8, respectively, and are arranged with their axes vertical, and connected with their upper heads are rods 9, attached to the opposite ends of a walking-beam 10, mounted upon a post 11 and which walking-beam may have any suitable connection with a shaft to be driven.

The casings 7 and 8 are formed from or provided with a coating of asbestos or other suitable material to prevent passage of heat to or from them, and connecting the lower ends of the casings and opening therethrough into the chambers 5 and 6 is a pipe 12, which is also provided with a protecting-coating 13, this pipe 12 being connected at a point adjacent to the inner side of the bottom of casing 8 and at a point adjacent to the outer side of the casing 7. A second pipe 14 is connected at one end through the bottom of casing 8 at a point diametrically opposite to the point of connection of pipe 12 and is connected at its opposite end through the bottom of casing 7 at a point diametrically opposite to the point of connection of pipe 12 therethrough.

Two vaporizing-chambers are employed, one of which consists of a shell 15 of some metal of high conductivity and which shell is cylindrical in form and is provided with tubes 16, passed longitudinally therethrough and secured to the heads of the shell, so that there may be a free circulation of air both through and around the shell, and the interior of the shell communicates at times with either of the expansion-chambers through a pipe 17, which is connected with the pipe 14.

The second vaporizing-chamber consists of a shell 18, which is also cylindrical in form and of metal and in which are disposed a number of tubes 19, having their ends closed to prevent circulation of air therethrough, and which casing has a non-conducting coating or jacket 20, of asbestos or similar material, which while not absolutely preventing access of atmospheric heat to the chamber will retard it, so that the contents of the shell 18 will respond to atmospheric temperature changes much more slowly than the contents of shell 15, thereby differentiating the effects of heat on the two chambers. The shell 18 is connected with the pipe 12, as shown.

In each of the shells 15 and 18 is disposed a quantity of a highly-volatile liquid after the air from said shells and the connected expansion-chambers has been exhausted, and these liquids surround the tubes or flues of the shells.

To permit the apparatus to operate in the manner hereinafter set forth, it is necessary that the pipe 14 be in communication with one of the expansion-chambers while the pipe 12 is in communication with the other.

The tubes 19 each has a filling 21 of some material, such as alcohol or ethel-ether, having a high specific heat, while the volatile

liquid used exterior to the tubes of both vaporizing chambers or shells 15 and 18 may be carbon disulfid, chloroform, or other similar liquid.

In order that the tubes 12 and 14 may be connected with the chambers 5 and 6 alternately and automatically, valves 22 and 23 for the tubes 12 and 14 are disposed within chamber 5 and valves 24 and 25 are disposed within the chamber 6.

Valves 22 and 23 are pivoted at the ends of a slide 26, having studs 27 and 28 on one face and between which studs lies one end of a rocker 29, pivoted upon a post 30, and from the pivotal point of this rocker there extends an arm 31, the outer end of which is passed through a frame 32 at the lower end of a rod 32′, attached to the upper end of the chamber 5. A helical spring 33 is attached at one end to the rocker, above the pivot thereof, and at the opposite end to the foot of the post 30, vertically under the pivot of the rocker, so that if the rocker be swung upon its pivot as soon as it has passed its center of gravity the spring will move it quickly to its limit of movement. Thus with the parts in the positions shown if the chamber 5 be expanded the frame 32 will rise and engaging the arm 31 will move the rocker past its center of gravity, when the spring will throw the rocker violently and will cause it to strike the stud 28 and move the slide 26 to carry the valve 22 from over pipe 12 and carry the valve 25 to cover the pipe 14. A like mechanism is shown in connection with chamber 6, and the same reference-numerals and description apply thereto. When the chamber 5 is expanding, the chamber 6 is contracting, and the frame 32 of the latter chamber moves the rocker past its center of gravity, so that its spring will throw it and cause it to operate the slide to move valve 23 from over pipe 14 and move the valve 22 to cover the pipe 12.

The operation of this apparatus is as follows: Supposing that the parts are in the positions shown, if there be a rise in temperature vapor will be given off from the liquid in shell 15 and will also be given off, but at a slower rate, from the liquid in the shell 18, owing to the presence of the lagging-jacket and to the fact that the filling 21 absorbs a portion of the heat contributed to the liquid in shell 18. The pressure of vapor in chamber 5 will therefore rise above the pressure in chamber 6, and in consequence chamber 5 will expand and will compress the vapor in chamber 6 and the walking-beam will be rocked in one direction. This movement will continue until the valve mechanism is shifted in the manner above described, when chamber 6 will be brought into communication with shell 15 and chamber 5 will be brought into communication with shell 18. The vapor in shell 18 being then at a lower temperature than that in shell 15, the vapor in chamber 5 will be condensed and said chamber will contract, while vapor from shell 15 will pass to chamber 6 to expand it. When the chamber 6 has expanded to its maximum and the chamber 5 has contracted to its minimum, the valves will be again reversed and the chambers will be reversely actuated. If there be a drop in temperature of the atmosphere when the expansion-chamber connected with shell 15 is expanded, the vapor in shell 15 will be condensed, so that the pressure in said connected expansion-chamber will be less than in the other expansion-chamber, and the shell 18 will then be the one to supply pressure, while the shell 15 will act as a condenser.

In order that there may be operation on both rise and fall of temperature of the atmosphere, additional pipes 29 and 30 are provided, leading from the shells 15 and 18 of the vaporizing-chambers, and with them may be connected a pair of expansion-chambers the same in every respect as those above described, but having their valves reversely disposed. It will be understood that the filling 21 acts as a storage medium for heat and also to assist in the action of the chamber as a condenser by absorbing heat.

In Fig. 2 of the drawings there is shown an apparatus comprising an expansible chamber 40 similar to those above described and in which is placed a quantity of a highly-volatile liquid after the air has been exhausted from said chamber. The expansible chamber is mounted upon a base 41, and connected with the upper end thereof is a cross-head 42, with which are connected the ends of cords or cables 43 and 44, the cables being taken upwardly from the cross-head and around drums 45 and 46 with several convolutions, then down and around pulleys 47 and 48, and then upwardly to the cross-heads, so that as the cross-head rises and falls the drums will be oscillated. The drums 45 and 46 are fixed upon a shaft 49, and mounted loosely thereon are two bevel-gears 50 and 51, meshing with a bevel-gear 52′, carried by a shaft intersecting shaft 49. The bevel-gears 50 and 51 have annular ratchets 52 and 53 on their faces disposed reversely, and these ratchets have pawls 54 and 55, disposed also reversely and in coöperative relation to the ratchets, so that as the shaft 49 moves in one direction one gear thereon will be positively rotated and when the shaft moves in the opposite direction the other gear will be rotated, the pawls being pivoted at the ends of arms 56 and 57, fixed to shaft 49. With this construction a rise in temperature will cause the liquid within the expansion-chamber to volatilize and expand the chamber, while a drop in atmospheric temperature will cause the vapor of volatilization to condense, when the chamber will collapse. Furthermore, if the atmospheric density varies without change of atmospheric temperature the relation between interior and exterior pressure will vary, and

the expansion-chamber will be correspondingly moved.

It will be observed that in the form of apparatus shown in Fig. 1 all of the valves, together with the parts that operate them, are within the liquid-tight chambers 5 and 6, so that nothing can be lost by leakage, a charge of liquid once furnished to the two vaporizing-chambers being capable of use for an indefinite period. This is also true of the structure shown in Fig. 2. Thus it will be seen that this mechanism is responsive either to changes in atmospheric temperature or to changes in atmospheric density, or to both simultaneously, and it has been found that with the use of a volatile liquid as described the apparatus is more delicately responsive and the results are greater in the aggregate than when metals or gases are used in the place of the volatile liquid.

It will of course be understood that in practice modifications in structure of apparatus may be made without departing from the spirit of the invention, which is the use of a volatile liquid and its vapor as distinguished from the use of metals, gases, or vapors.

What is claimed is—

1. In a motor, the combination of a plurality of vessels having collapsible walls, a heat-insulating casing inclosing each of said vessels, a plurality of chambers adapted to contain a vaporizable liquid, conduits connecting each of said chambers with each of said vessels, one of said chambers being provided with a heat-insulating covering, heat-exchange tubes in each chamber whereby vaporization may be retarded in one chamber and facilitated in another, valves in each vessel for opening and closing said conduits, and automatic means for operating said valves, whereby said vessels and chambers alternately communicate with each other on the expansion and collapsing of said vessels.

2. In a motor, the combination of a plurality of vessels having collapsible walls, a heat-insulating casing inclosing each of said vessels, a plurality of chambers adapted to contain a vaporizable liquid, conduits connecting each of said chambers with each of said vessels, one of said chambers being provided with a heat-insulating covering, closed heat-exchange tubes located in said insulated chamber and containing a substance having a high specific heat, open-ended tubes extending through the uninsulated chamber, valves in each vessel for opening and closing said conduits, and automatic means for operating said valves whereby said vessels and chambers alternately communicate with each other on expansion and collapsing of said vessels.

3. In a motor, the combination of a vessel having collapsible walls, two vaporizing-chambers the walls of said chambers differing in heat conductivity, conduits connecting the vessel and chambers, slide-valves in the vessel for opening and closing said conduits, means attached to a movable wall of the vessel for actuating the slide-valves, and a resilient member for accelerating the movement of said valves.

4. In a motor, the combination of a vessel having collapsible side walls, and rigid end walls, conduits located in one of the end walls, a slide-valve carried by said wall for opening and closing said conduits, a rocking arm engaging said slide-valve, and means connected with a movable wall of the vessel and with said arm for tilting the arm, whereby the valve is moved each time the vessel is extended or collapsed.

5. In a motor, the combination of a vessel having collapsible side walls, and rigid end walls, conduits located in one of the end walls, a slide-valve carried by one of said walls for opening and closing said conduits, a rocking arm engaging said slide-valve, means connecting said arm and movable wall of the vessel for tilting the arm, and a spring for throwing said arm after it has passed its dead-center, whereby the slide-valve is given a rapid movement each time the vessel is extended or collapsed.

6. A motor operable by fluctuations in atmospheric temperature, including expansible chambers having separate non-conducting jackets, an air-exhausted expansion-chamber having a heat-retarding jacket, a second non-jacketed expansion-chamber responsive to delicate fluctuations in temperature, connections between the expansion-chambers and the expansible chambers, and valve mechanisms within and operable by movement of the expansible chambers, for alternately establishing and cutting off communication between the expansible chambers and the expansion-chambers.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

WESTON MILLER FULTON.

Witnesses:

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J. J. GALBRAITH.