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VAPOR MOTOR

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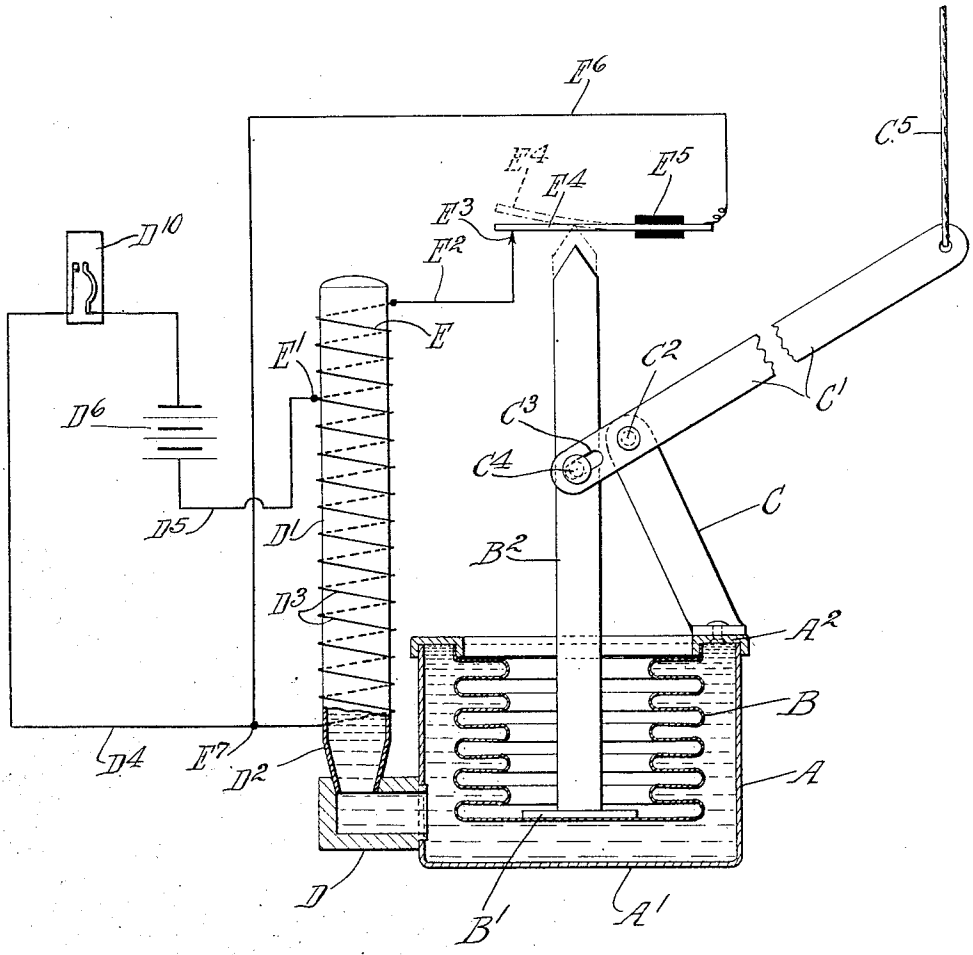

Inventor
Laurence M. Persons.
by Parker & Carter
Attorneys.

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LAURENCE M. PERSONS, OF ST. LOUIS, MISSOURI

VAPOR MOTOR

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My invention relates to improvements in electrically or otherwise heated vapor motors such as are used for operation of switches, controls and the like in response to temperature, pressure, or other conditions. It has for one object to provide, in connection with the conventional type of electrically heated vapor motor, means whereby increase in pressure in the working chamber may serve to limit or control the heat to which the fluid is subjected. Another object is the provision of means for so limiting and controlling the heat that, while keeping the liquid constantly subjected to heat, it is possible to reduce the total quantity of heat used during a portion of the period, permitting the use of relatively large heating effects intermittently, in cooperation with a smaller constant heating effect. Other objects will appear from time to time in the course of the specification and claims.

My invention is illustrated in the accompanying drawing which is a diagrammatic section through a vapor motor embodying my invention.

Like parts are indicated by like symbols throughout.

A indicates a rigid housing, herein shown as cylindrical, having a relatively rigid bottom portion A^1 and a flange or channel A^2 surrounding the upper edge of the housing.

Associated with the flange A^2 is a flexible metallic bellows generally indicated as B, which closes the end of the housing A opposite to the rigid end wall A^1. The bellows B is provided with a relatively rigid plate B^1 to which is secured the rod or stem B^2. This rod may be employed to perform work, as for example to operate a draft control in a heating plant.

I illustrate, as an example of means for transmitting the energy developed, a bracket C and a lever C^1 pivoted thereto as at C^2, the lever being slotted as at C^3 to receive any suitable pin or connection C^4 whereby the movement of the stem B^2 is imparted to the lever. C^5 indicates any suitable power transmitting means, for example a rod or cord.

D indicates a passage block or extension from one side of the housing A which receives the lower end D^2 of the heating chamber D^1 herein shown as a cylinder. About the chamber D^1 is any suitable resistance D^3 which is connected, as by the conductors D^4 and D^5, with any suitable source of electric energy, diagrammatically indicated at D^6. D^{10} diagrammatically indicates any suitable thermostat which may, for example, be responsive to room temperature if my device is employed to control a domestic heating plant. It will be observed from the diagram that, when the thermostat is in circuit closing position, the resistance D^3 is in constant circuit with the source D^6 and is therefore constantly heated, until the thermostat breaks the circuit.

I further indicate an additional resistance E which is in conductive communication with the resistance D^3 and the conductor D^5 as at the point E^1. E^2 indicates a conductor extending from the opposite end of the resistance E to a terminal E^3 which is adapted to be engaged by the flexible switch member E^4 which is mounted in any suitable and preferably fixed insulated base E^5. E^6 indicates a conductive connection from the switch member or connection E^4 to the conductive line D^4 which it meets as at E^7.

It will be noted that the resistance E is at the upper portion of the cylinder, adjacent the upper portion of the liquid contained therein.

In the operation of my device it will be understood that the resistance D^3 is constantly heated, but to a heat insufficient to collapse the bellows B and raise the stem B^2 to its maximum. Assuming that an input of ten watts is insufficient to hold the bellows collapsed, and that an input of fifteen watts would be sufficient I may employ a resistance D^3 with an input of less than fifteen watts, say, of ten watts. But when the bellows are not collapsed, but are in the expanded position in which they are shown in the figure, the switch E^4 is in contact with the terminal E^3 and a circuit is closed which includes the electric power source D^6 and a supplemental or intermittently operative resistance E. This resistance has an input sufficient to give a heating effect which, when taken in connection with the heating effect of the constant resistance D^3, is sufficient to heat or boil

the liquid and create the pressure necessary to collapse the bellows B, to move the stem B^2 upwardly, to draw down on the connection C^5, and, finally, to break the switch E^4.

Note that the resistance E is positioned adjacent the upper level of the liquid, where the boiling starts and when the circuit therethrough is closed a quick action is obtainable. For example I may employ a resistance having an input of forty watts, which creates a rapid heating of the upper portion of the liquid and starts it quickly to boiling. As soon as the resultant pressure is sufficient to raise the stem B^2 to the dotted line position, the switch E^4 is opened and the resistance E, is thereby cut out, leaving only the constant resistance D^3. The liquid and vapor in the tube or chamber D^1 remain heated for some time, the heating effect of the resistance D^3 being only slightly below that necessary to maintain the bellows B collapsed. When finally sufficient heat has been lost to permit the switch E^4 to be closed, the process of intermittent heating at the upper level of the liquid is repeated.

There is a great advantage in having an uneven distribution of the heating effect. For example with a 20 watt input and even distribution of heat the expansion takes place, in one size of tube, in six minutes. With the same tube, with the concentration of heat at the top, as herein shown, a 20 watt input will result in expansion in two minutes. In the present method, not only is the heat concentrated at the top, but an intense heat is employed. And I find, with a given size of tube that by employing an input of fifty watts at the top and ten watts at the bottom, a total input of sixty, I get expansion in fifteen seconds.

It will be realized that whereas I have described and shown a practical and operative device, nevertheless many changes might be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my description and drawing to be taken as in a broad sense illustrative and diagrammatic rather than as limiting me to my specific showing.

It will be understood that when in the claims I speak of one portion of the resistance being in constant circuit with the source of energy I wish to be understood as meaning constant circuit during the time that the thermostat D^{10} is in circuit closing position. When such a thermostat is employed, and is in circuit breaking position, the circuit through the conductive lines D^4 and D^5 is interrupted.

I claim:

1. In a vapor motor, a closed, liquid system including intercommunicating heating and working chambers, a working liquid in said system, a sectional electrical resistance heater associated with the heating chamber and adapted to heat the liquid therein, a source of electric energy in circuit with said heater, one portion of the heating resistance being in constant circuit with said source of energy, and means for intermittently cutting the other portion off and on, in response to the heating and cooling of said liquid.

2. In a vapor motor, a closed, liquid system including intercommunicating heating and working chambers, a working liquid in said system, a sectional electrical resistance heater associated with the heating chamber and adapted to heat the liquid therein, a source of electric energy in circuit with said heater, one portion of the heating resistance being in constant circuit with said source of energy, and means for intermittently cutting the other portion off and on, in response to variations in the pressure in said working chamber.

3. In a vapor motor, a closed, liquid system including a heating chamber and a working chamber, said chambers being interconnected for fluid flow, a liquid in said system, a movable pressure responsive work performing member associated with said working chamber and movable in response to changes in pressure in said working chamber, and means for creating pressure in said heating chamber, and thus in said working chamber, including a resistance associated with said heating chamber, and a source of electric energy in circuit with said resistance, said resistance including a portion with a relatively small input, in constant circuit with the source of electric energy, and a portion with a relatively large input, and means for intermittently connecting the last mentioned portion of the resistance in circuit with said source of energy, said portion with the relatively large input being positioned above the portion with the relatively small input and adjacent the upper portion of the liquid contained in said heating chamber.

4. In a vapor motor, a closed, liquid system including a generally upright tubular heating chamber and a working chamber in communication therewith, a working liquid in said system, a movable member operatively associated with the working chamber and movable in response to pressure variations within the liquid therein, a resistance associated with said tubular heating chamber, said resistance including a portion about the lower portion of said chamber, with a relatively low input, and a portion about the upper portion of said heating chamber, adjacent the upper portion of the liquid contained therein, having a relatively high input, a source of potential for energizing the resistance, a temperature responsive switch for connecting said resistance to the source of potential, and an auxiliary switch operatively associated with the movable member of the working

chamber for selectively de-energizing the upper portion of the resistance in response to pressure variations within the working chamber.

5. In a vapor motor, a closed, liquid filled system including communicating heating and working chambers, a work performing member associated with said working chamber and adapted to do work in response to changes in pressure in said working chamber, and means for creating pressure in said heating chamber, and thus in said working chamber, including a resistance associated with said heating chamber, and a source of electric energy in circuit with said resistance, said resistance including a portion having a low heating value and a portion having a higher heating value, the force required to operate the work-performing member being greater than that resulting from the heat effect of the first mentioned portion, said first mentioned resistance portion being in constant circuit with the source of electric energy, and said second mentioned resistance portion having an input sufficient, in connection with the first mentioned resistance portion, to cause the work performing member to do work, and means for putting said second mentioned resistance portion intermittently in circuit with said source of energy.

6. In a vapor motor, a closed, liquid filled system including communicating heating and working chambers, a work performing member associated with said working chamber and adapted to do work in response to changes in pressure in said working chamber, and means for creating pressure in said heating chamber, and thus in said working chamber, including a resistance associated with said heating chamber, and a source of electric energy in circuit with said resistance, said resistance including a portion having a low heating value and a portion having a higher heating value, the force required to operate the work-performing member being greater than that resulting from the heat effect of the first mentioned portion, said first mentioned resistance portion being in constant circuit with the source of electric energy, and said second mentioned resistance portion having an input sufficient, in connection with the first mentioned resistance portion, to cause the work performing member to do work, and means for putting said second mentioned resistance portion intermittently in circuit with said source of energy, in response to movement of said work performing member.

7. In a vapor motor and control means adapted to be actuated thereby, a closed system, including a heating chamber, an expansible liquid therein, an expansion member associated with said chamber, resistance heating means for said chamber, an actuating circuit therefor and means for cutting out a portion of said resistance heating means in response to a predetermined movement of said expansion member.

8. The structure of claim 7 characterized by the employment of a supplemental circuit including a portion of said resistance heating means, a movable switch member in said circuit and means for moving said movable switch member in response to a predetermined movement of the expansion member.

9. In a vapor motor and control means adapted to be actuated thereby, a closed system including an elongated tubular heating chamber, an expansible liquid therein, an expansion member associated with said chamber, an electrical resistance heating coil surrounding the heating chamber and extending along the outer surface thereof, an energizing circuit for the heating resistance and means for cutting out a portion of said resistance in response to a predetermined movement of said expansion member, said portion of the heating resistance cut out in response to movement of the expansion member being positioned at the upper end of the heating chamber, and said chamber being positioned substantially upright.

Signed at St. Louis, Missouri, this 9th day of April 1929.

LAURENCE M. PERSONS.