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S. H. PAGE ET AL

TEMPERATURE CONTROLLING MEANS FOR MOTORS

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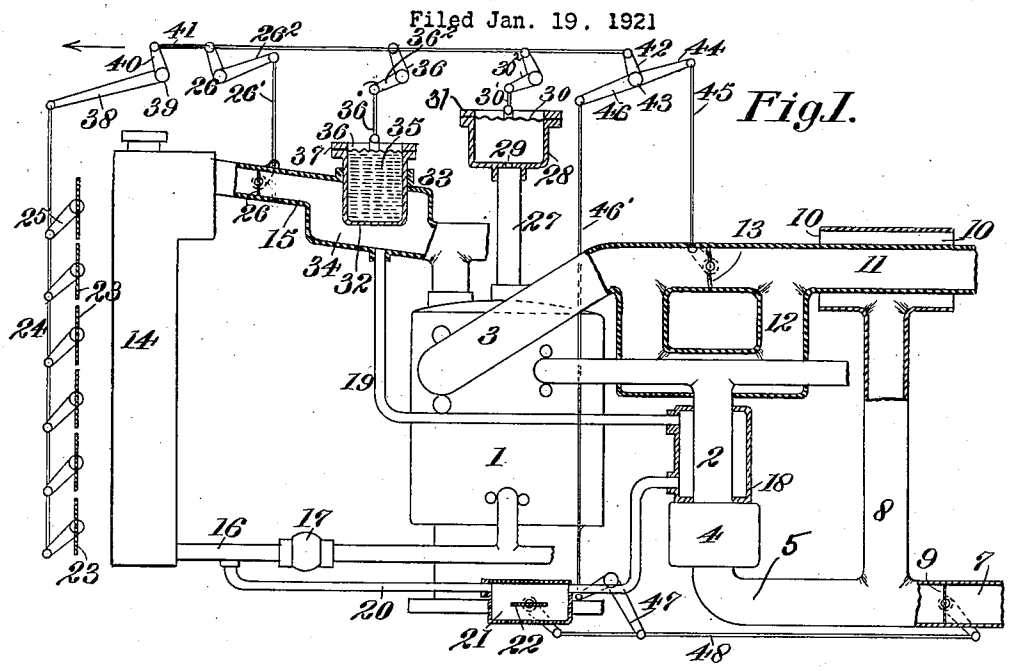
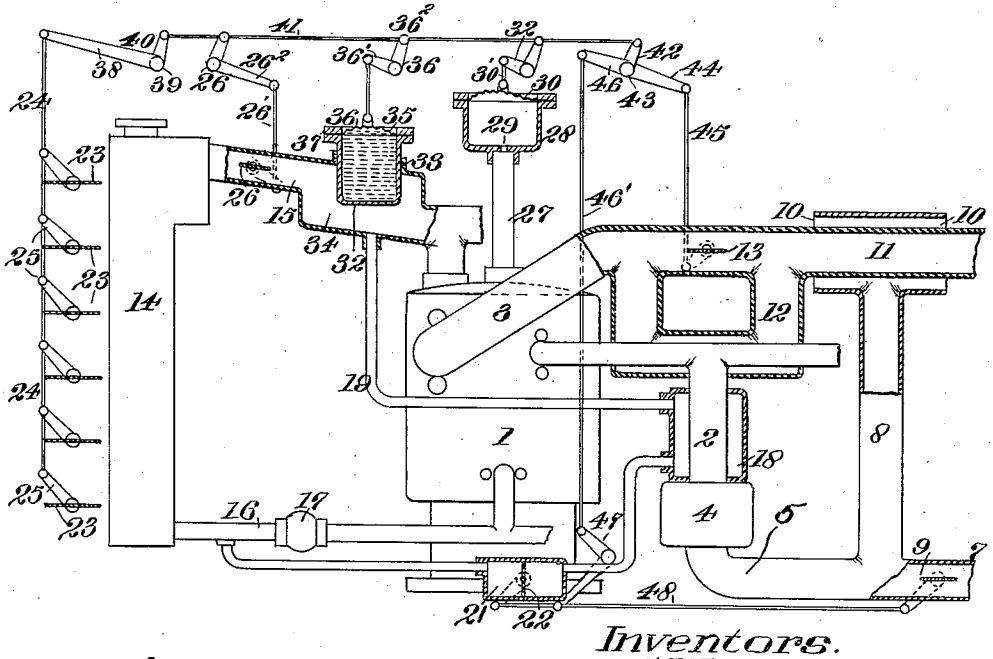


Fig. 1.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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TEMPERATURE-CONTROLLING MEANS FOR MOTORS.

Application filed January 19, 1921. Serial No. 438,518.

To all whom it may concern:

Be it known that we, STANLEY H. PAGE and JACOB B. STRUBLE, citizens of the United States, residing at the city and county of San Francisco, and Oakland, in the county of Alameda, and State of California, respectively, have invented certain new and useful Improvements in Temperature-Controlling Means for Motors, of which the following is a specification.

The present invention relates to the automatic control of the temperature in the cylinder of an internal combustion engine in accordance with the power output thereof, the control acting in such a manner that the temperature of the compressed charge within the cylinder is maintained at a point conducive to maximum vaporization, and slightly below its self-ignition temperature. Liquid fuels as they become heavier require higher temperatures to effect their vaporization, and if adjustments are made within the apparatus to afford the requisite charge temperature for maximum fuel vaporization during a period of small power output, the same adjustment will provide a higher temperature than is desired when the power output is at or near its maximum, resulting in self-ignition, knocking and reduction of the power which the engine would otherwise be capable of delivering.

On the other hand if adjustments are made within the apparatus to give the desired temperature during periods of heavy power output, then under a light output the charge temperature will be too low to effect complete vaporization of the fuel, resulting in another series of faulty performances.

It is one of the principal objects of this invention to enable the maximum vaporization of the fuel in the cylinder charge to be obtained when operating under light or heavy loads without permitting the charge to reach its self-ignition point, and to accomplish this result through automatically varying the temperature of the cylinder in accordance with the density of the charge supplied thereto, limiting the cylinder temperature to a relatively low point during full or high output periods, and holding the cylinder temperature within relatively high limits during periods of small power output, thus maintaining the temperature of the cylinder charge at a point most desirable for maximum vaporization but always at a point below its temperature of self-ignition.

With the above mentioned and other objects in view, the invention consists in the novel construction and combination of parts hereinafter described, illustrated in the accompanying drawings, and set forth in the claims appended hereto, it being understood that various changes in the form, proportion, size and minor details of construction within the scope of the claims may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

While various forms of mechanism may be employed for carrying out our invention, that illustrated has been selected as the preferred embodiment, and in the drawing:—

Figure 1 is a diagrammatic view of an internal combustion motor with our invention applied thereto, and with the various parts illustrated in position for the motor to operate under an extremely light load or when idling.

Figure 2 is a view similar to Figure 1 illustrating the relative position of the parts when the motor is operating under a heavy load.

Referring to the drawings wherein like characters of reference designate corresponding parts throughout the several views, 1 indicates the cylinder of an internal combustion motor having the usual intake manifold 2 and exhaust manifold 3. Associated with the intake manifold 2 is the usual carburetor 4 equipped with an air supply pipe 5 branching as at 7 and 8, the branch 7 through which cold air is supplied being equipped with the controlling valve 9 and the branch 8 through which warm or heated air is supplied being provided with lateral openings 10 and surrounding the main line 11 of the exhaust manifold 3. The main line of the exhaust manifold is provided with a by-pass channel 12 extending therefrom and surrounding a portion of the inlet manifold

2, and said main line is equipped with a valve 13 for directing the exhaust gases through the said by-pass channel 12.

The radiator 14 of any well known type, and of the requisite capacity affords a means for cooling the water for controlling the temperature of the cylinder 1, and said radiator is connected at its upper end with the upper portion of the cylinder water jacket by a conduit 15, and is connected at its lower end with the lower portion of the cylinder water jacket by a tube or pipe 16 illustrated as having a pump 17 therein to maintain the circulation of the fluid when required. A water jacket 18 surrounds the manifold 2 above the carburetor 4 and is connected with the conduit 15 by a pipe 19 and with the pipe 16 by another pipe 20, the latter pipe mounting a valve chamber 21, which in turn mounts a valve 22 for controlling the circulation of water through said jacket 18.

To control the passage of cooling air through the radiator 14 a shutter consisting of the pivotally mounted slats 23 is positioned in advance thereof, said slats being pivotally connected to a common operating rod 24 through arms 25, to permit or obstruct the passage of air through the radiator as desired. To further regulate or control the temperature of the cylinder cooling fluid, a valve 26 is mounted in the conduit 15 to control the flow or circulation of the water therethrough.

The means for operating the various valves to maintain the temperature of the cylinder at a point conducive to maximum vaporization of the explosive charge and below its self-ignition temperature, is constructed as follows:—

Connecting with the interior of the cylinder 1 is a pipe 27 open at its lower end to the pressure in the interior of the cylinder. The pipe is illustrated as relatively long and carries on its end one form of a pressure operated means consisting of a shell 28 threaded over the upper end of the pipe 27, and having a relatively small orifice 29 communicating with the interior of the pipe and through which the fluid pressures within the cylinder are transmitted into the shell 28. The upper end of the shell is illustrated as being closed by a flexible diaphragm 30 held in position to seal the shell 28 by a ring 31. The positioning of the shell at a short distance from the cylinder and connecting the interior thereof with the cylinder interior through a restricted port or orifice 29 serves to relieve the diaphragm and associated connections of the varying pressures of the cycle in the cylinder. This smoothing out of the pulsations is due to the restricted flow of gas through the small orifice 29 during the time of any period of cycle, and does not admit of an appreciable change in the pressure within the shell 28 during the cycle because the volume of gas within the shell is large in proportion to that which flows through the orifice during any period of the cycle, thus the diaphragm 30 is subjected to a steady pressure in proportion to the power output of the cylinder, and assumes a position in response to that pressure. By providing the pipe 27 of some length, the shell is located at a distance from the cylinder and in addition, the restricted orifice 29 is removed a sufficient distance from the cylinder to preclude the clogging of the orifice with products of combustion, such as carbon. Since the characteristic of the diaphragm 30 of the shell 28 is to lower the temperature of the water or combustible charge, or both, as the cylinder power output is increased, and since the characteristic of the thermostat is to restrict the rising jacket temperature under the same conditions, the diaphragm 30 has been combined with a thermostat in the manner hereinafter described, the resultant motion of the diaphragm and thermostat thus providing a means for controlling the charge temperature in accordance with its density, the requirements of maximum vaporization and the avoidance of self-ignition.

The thermostat in its preferred embodiment consists of a shell 32 inserted through an opening 33 into an enlargement or chamber 34 formed in the conduit 15, said shell preferably containing a highly volatile liquid 35. The shell is closed by a flexible diaphragm 36 held in position thereon by any suitable mechanism such as a ring 37.

The member 24 connects at one end with the arm 38 of a bell crank fulcrumed as at 39 and with the other arm 40 of said bell crank pivotally connects a rod 41 which is pivotally connected at its opposite end to the arm 42 of a T lever, fulcrumed as at 43. Connected respectively with the valve 26, diaphragm 30 and diaphragm 36 are the respective links 26′, 30′ and 36′ connected respectively with the arms 26^2, 30^2 and 36^2, of suitable fulcrumed bell cranks, the other arms of which are pivotally connected to the rod 41. The arm 44 of the T-lever connects through a link 45 with the valve 13 and the arm 46 of said T-lever connects through a link 46′ with one arm of a bell crank 47, which is connected to a link 48 connecting valves 9 and 22.

Referring particularly to the drawings, and knowing the relative position of the respective parts in Figures 1 and 2, which views illustrate the motor operating respectively under a light load and a heavy load, it will be observed in Fig. 1 that the shutter and valves, with the exception of valve 22, are closed. This is due to the action of the light power output of the cylinder which creates very little pressure

against the diaphragm 30, and the thermostat, due to the small power developed in the cylinder, is subjected to comparatively little heat. Therefore under conditions of light load, the diaphragms 30 and 36 both assume the position, as in Fig. 1. Should, however, the temperature of the cooling fluid in the cylinder jacket become too highly heated, the same will tend to raise the diaphragm 36, but its operation will be resisted in a measure by the diaphragm 30, which, under the operating conditions of low pressure serves as a retardant for the operation of the rod 41 due to the expansion of the fluid 35. When under a light load, it will be observed that the carburetor air is taken in through the stove, and that the products of combustion are directed around the inlet manifold, and that the inlet manifold water jacket is maintained hot, all of which conditions assist in admitting the relatively light charge of fuel into the combustion chamber in a highly heated condition. As the volume of fuel charge is increased, pressures within the cylinder will promptly increase, as will the temperature of the explosion, and thus increased pressure will operate the diaphragm 30, and the increased temperature will operate the diaphragm 36, opening the shutters 23, and actuating the respective valves to vary the temperature of the cylinder walls and the combustible charge inversely as the power output of the cylinder.

It will be observed that the temperature of the cylinder and of the ingoing charge for small power output is, without reaching its self-ignition point, preferably and permissibly higher than is necessary for maximum vaporization. This temperature is higher than is permissible with full power output because of self-ignition which would result from higher temperatures due to the added heat of compression of the charge within the cylinder.

Having thus described our invention what we claim as new and desire to secure by Letters Patent of the United States is:

1. In combination with the cylinder of an internal combustion motor provided with a water jacket, a circulating water system connected with said jacket, a thermostat therein, means whereby said thermostat controls the temperature in said water system, and means actuated by the varying fluid pressure within the combustion chamber and operating jointly with said thermostat for regulating the operation of said water temperature controlling means.

2. In combination with the cylinder of an internal combustion motor provided with a cooling jacket, a cooling medium circulating system connected with said jacket and a means for disposing of the heat absorbed by said cooling medium, a thermostat incorporated in the system and operated by the changing temperature of the cooling fluid therein, a means for controlling the flow of cooling fluid, a member actuated by the varying pressure within the combustion chamber, and interconnecting mechanism between said thermostat, means for controlling the flow of cooling medium and the pressure actuated member whereby the cooling fluid control operates to vary the temperature of the cooling medium inversely with the power output of the motor.

3. In combination with the cylinder of an internal combustion engine, means for supplying a cooling medium thereto for controlling the temperature thereof, a pressure chamber, a wall provided with a restricted opening affording a connection between the chamber and the interior of the cylinder, a movable member associated with the pressure chamber and opposing the chamber pressure and actuated by the pressure therein for controlling the supply of cooling medium to the engine to vary the temperature of the cylinder inversely with the power output thereof.

4. In combination with an internal combustion motor cylinder, a pressure chamber connecting therewith, a movable member associated with the pressure chamber opposing the chamber pressure and actuated by the pressure within the chamber, means for controlling the passage of a cooling medium to control the temperature of the cylinder, an operating connection between said controlling means and the movable member of the pressure chamber, whereby the controlling means is operated to vary the temperature of the cylinder inversely with the power output of the motor.

5. In combination with the cylinder of an internal combustion motor, a pressure chamber provided with a restricted opening, a passage within the wall of the chamber providing means for transmission of pressure between the interior of the cylinder and said chamber through said orifice, a movable member for closing said chamber and opposing the pressure therein, and means connected with said movable member and operated thereby in accordance with the change of fluid pressure within the cylinder for varying the temperature of the cylinder inversely with the power output thereof.

6. The means for varying the temperature of the cylinder of an internal combustion motor inversely with the power output thereof, comprising means for controlling the temperature of the motor, a pressure accumulating chamber, a wall provided with a restricted orifice affording a connection between the combustion chamber of the motor cylinder and the pressure accumulating chamber, a movable member associ-

ated with the pressure chamber, said member opposing the pressure in the chamber and actuated thereby, and an operating connection between the movable member and the temperature controlling means whereby on a reduction of pressure within the chamber the temperature of the combustion chamber is raised, and on an increase of pressure in the chamber the temperature of the combustion chamber is lowered.

In testimony whereof we have signed our names to this specification.

STANLEY H. PAGE.
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