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PROCESS OF AND APPARATUS FOR OPERATING INTERNAL COMBUSTION ENGINES

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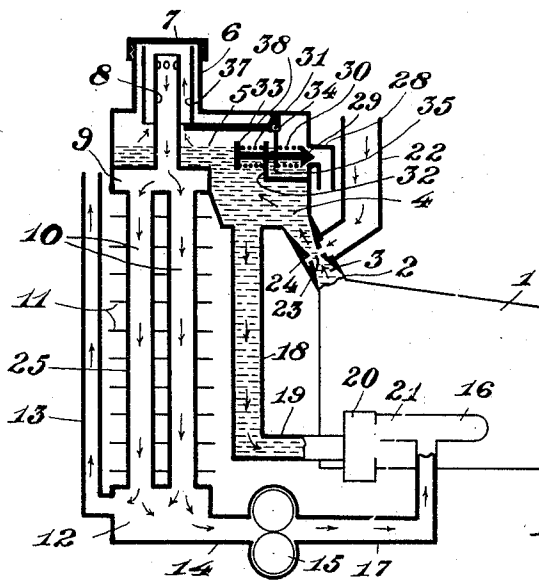


Fig. 1

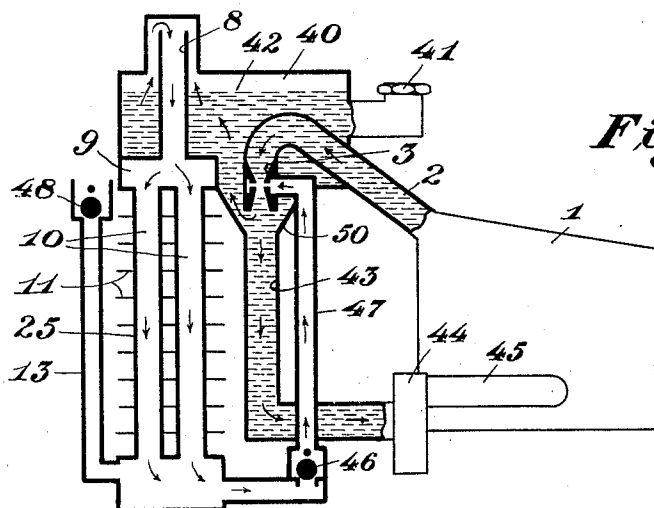


Fig. 2

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PROCESS OF AND APPARATUS FOR OPERATING INTERNAL-COMBUSTION ENGINES.

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This invention relates to a process of and an apparatus for operating internal combustion engines, and has for its object to provide a means which will be more efficient than those which have been heretofore proposed.

With these and other objects in view, the invention consists in the novel steps and combinations of steps constituting the process, and in the novel parts and combinations of parts constituting the apparatus, all as will be more fully hereinafter disclosed and particularly pointed out in the claims.

Referring to the accompanying drawings forming a part of this specification, in which like numerals designate like parts in all the views:

Figure 1 is a diagrammatic partially sectional view of a cooling system for internal combustion engines, made in accordance with this invention; and

Figure 2 is a view similar to Figure 1, showing a somewhat modified arrangement of the cooling system.

1 indicates an internal combustion engine jacket, 2 a pipe or passage leading from said jacket, 3 a Venturi tube or what is commonly known as a Giffard injector, connected to said tube 2, 4 a tank into which said injector delivers, 5 the normal level of liquid in the tank 4, 6 the filling opening for said tank 4, 7 a filling cap adapted to be adjustably screwed up and down over the opening 6, 8 a tube or passage extending up into the opening 6, and connecting with the chamber 9, and the water tubes 10 of any suitable form of radiator core, open at their upper ends as shown. 11 indicates heat radiating fins or other means for conducting away the heat of the water in said tubes 10; 12 indicates a liquid tank or chamber into which the lower ends of said tubes 10 open, and 13 indicates a vent tube or passage leading from the tank 12, adapted to carry away any air that may be brought over by the condensed fluid in said tank 12. Leading from the tank 12 to the suction side of the pump 15 is a pipe 14 and joining the force side of said pump 15 with the pipe or passage 16 is the pipe 17. Said pipe 16 leads back into the jacket 1, as will be clear from the drawings. Leading from the lower portion of the tank 4 is the pipe or passage 18 and leading from said passage 18 is the pipe 19 which enters the suction side of the pump 20. Leading from the force or delivery side

of said pump 20 is the pipe 21 which joins or is made integral with the pipe 16, above mentioned.

The operation of this invention, as above disclosed, is as follows:

The liquid in the jacket 1 becomes heated through the explosions in the combustion chambers, not shown, and passes out through the restriction 23 of the Venturi tube 3, which causes air to be sucked through the tube 22, and passages 24, into said fluid or liquid, whereupon the mixed air and fluid finds its way in the tank 4 and collects up to about the level 5, as illustrated. At the level 5 water vapor in the form of steam, and air are freely given off and enters the upper open end of the tube 8 whence it passes down into the chamber 9 into the water tubes 10 of the radiator 25, whence it passes in a condensed form into the lower chamber 12. When the mixed vapor and air reaches the lower chamber 12, air present will be vented out of the vent tube 13 to the atmosphere, as indicated by the arrows. In the meantime, the pump 15 sucks the condensed fluid into its suction side and forces said fluid out its delivery side through the pipe 17 and pipe 16 back into the jacket 1.

In addition to this, the pump 20 sucks water through the pipe 19, through the pipe 18, and tank 4, into its suction side and forces the same through the pipes 21 and 16 back into the jacket 1. That is to say, there is a continuous circulation of cooling fluid by the pump 20 from the tank 4 back into the jacket and through the Venturi tube 3 back into the tank 4, which maintains the pressure in the jacket 1 considerably higher than the pressure in the tank 4. The level in the tank 4 is maintained substantially constant by the mechanism now to be disclosed.

28 represents an overflow controlled by the valve 29, whose stem is surrounded by the springs 30 and 31 separated by the bracket 32. 33 represents a bell crank lever pivoted at 34, one arm 35 of which is adapted to compress the spring 30 and thus force the valve 29 toward the right, as seen in Figure 1, to close the passage 28. The other arm of said bell crank lever is secured to the sleeve 37 located between the pipe 8 and the filling opening 6 which is adapted to contact with the under side of the filling cap 7, as shown. The spring 31 normally presses against the bracket 32, and the head

38 of the valve stem and thus tends to maintain the valve 29 open and the sleeve 37 in its elevated position. Therefore, by unscrewing the filling cap 7, the overflow pipe 28 is opened, and the liquid is maintained at the level 5 as illustrated. On the other hand, by screwing down on the filling cap 7, the sleeve 37 will be lowered, whereupon the spring 30 will be compressed, and the overflow 28 will be more or less closed, whereupon the liquid level 5 will rise. When the overflow 28 is completely closed, the liquid will rise to a point at which it will overflow into the pipe 8, and in such case, the radiator 25 will operate as a liquid cooling system, instead of a steam cooling system. On the other hand, when the parts are in the position shown in the drawings, only steam and air will pass through the radiator, while if the overflow 28 is only partially restricted so that the level 5 comes to about the top or a little bit below the top of the pipe 8, the radiator 25 will operate as what is known as a semi-wet system, which is a system employing both steam and liquid.

Another advantage of the valve 29 resides in the fact that when the cap 7 is unscrewed the overflow is necessarily opened by the spring 31, and therefore one cannot put too much water into the system, for the level of the liquid therein cannot rise above that indicated at 5.

In this cooling system, the surplus heat in the motor is absorbed both by the radiator 25 in the regular way, and by the additional air which is sucked in through the pipe 22. The higher pressure in the jacket 1 which is maintained by the Venturi tube 3, enables a higher uniform temperature to be maintained in the combustion chambers, and thus can poor fuel be burned in said combustion chambers with greater facility than has been the case heretofore.

Coming now to the somewhat modified form of the invention shown in Figure 2, the jacket 1, passage 2, Venturi tube 3, pipe 8, water passages 10, fins 11, radiator 25, tank 12, and vent tube 13 is or may be the same as in the preceding disclosure. In this modified form, however, the tank 40 is of a different shape from that shown in Figure 1, and the filling cap 41 is so placed that the level 42 of the liquid is fixed by said filling cap. Further, the passage 43 from the tank 40 leads down to the pump 44 which delivers through the passage 45 back into the jacket 1.

In operation, this form of the invention is substantially the same as that previously described, in that the pump 44 circulates liquid around and around the circuit through the jacket 1, the passage 2, the Venturi tube 3, passages 44 and 45. Thus is the pressure in the jacket maintained at a point

higher than that of the atmosphere, or than that in the tank 40. Steam is given off from the level 42 of the liquid and passes down along with any air that may be entrapped in the fluid through the pipe 8 into the chamber 9 through the water tubes 10 of the radiator 25 and finds itself condensed in the tank 12, whence it is sucked by the Venturi tube or injector 3 past the valve 46 up through the tube 47 and is delivered into the passage 43 and tank 42, as shown. In the meantime, the air that has been entrapped in the fluid escapes from the tank 12 and passes up through the vent tube 13 and past the valve 48 into the atmosphere. The said valve 48 prevents air from entering the system when the pressure therein is less than that of the atmosphere which is often the case when the steam is freely condensed. The funnel shaped mouth 50 of the passage 43 causes the surplus fluid which is forced under pressure through the venturi 3 to pass upwardly into the tank 40, as will be readily understood.

This escape for the surplus water regulates the even flow of the fluid through the jacket and the maintaining of the pressure in the jacket at a substantially constant point notwithstanding the variations in temperature of the combustion chambers. In this case, it will be observed that there is a considerable superatmospheric pressure always existing in the motor jacket and generally a pressure less than that of the atmosphere existing in the tank 12 at the bottom of the radiator.

It will now be clear that in both forms of the invention, one is enabled to maintain a constant pressure in the jacket above that of the atmosphere, and therefore a substantially constant temperature in the combustion chambers, which is higher than that due to an atmospheric pressure in the jacket, and from this fact follows two very important advantages in the operation of the motor. That is, as is well known, it is very desirable indeed to maintain around the combustion chambers a substantially uniform temperature because the fuel mixture can be so adjusted as to ignite with greater efficiency at a given temperature, and when this said temperature is once established the motor will continually run with its greatest satisfaction, so long as said temperature is maintained. But it is further well known that it is very difficult indeed to maintain such uniform temperature because the temperature of the combustion chambers are constantly changing, due to the varying loads put on the engine and to the varying operating conditions such as changes in the atmospheric temperature, changes in the altitude at which the motor is operated and therefore changes in the oxygen supply, etc. In this invention, on the other hand, the tempera-

ture of the combustion chambers is raised considerably above that which could be maintained with an atmospheric pressure in the jackets, and therefore considerable variations in the temperature of the combustion chambers can be had without varying appreciably over long periods the temperature of the jacket fluid, for the surplus heat given off by the combustion chambers under heavy loads will be absorbed in the form of latent heat and carried off in the form of steam. On the other hand, when the temperature of the combustion chambers begins to lower due to lighter loads, the surplus heat that has already been absorbed by the jacket walls, the steam present etc., will be given back to a greater or less extent and thus it is found to be rather difficult to suddenly change the jacket temperature or the satisfactory performance of the motor, notwithstanding the sudden changes of load and working conditions.

It is obvious that those skilled in the art may vary the details of construction as well as the arrangement of parts without departing from the spirit of the invention, and it is further recognized that like changes could be made in the operation of the system, without departing from the spirit of the invention as disclosed. Therefore I do not wish to be limited to the above disclosure except as may be required by the claims.

What I claim is:

1. In a cooling system for an internal combustion engine the combination of a jacket; a tank for holding an excess supply of cooling fluid for said jacket; a pump and circuit for continuously circulating said fluid through said jacket and tank; means in said circuit to restrict the flow of fluid and maintain the pressure in said jacket above that in said tank; means associated with said last named means to admit air to said circuit; a radiator; a tank for condensed fluid associated with said radiator; means to pass vapors from said first named tank into said radiator for condensation and collection in said second named tank; means associated with said second named tank to vent air therefrom; and means to pass the condensate from said second named tank back into said circuit, substantially as described.

2. The process of operating a cooling system for an internal combustion engine provided with a cooling circuit including a jacket, which consists in restricting the cooling fluid in its passage out of said jacket to provide a superatmospheric pressure in said jacket; mixing air with said fluid after it leaves said jacket; condensing any vapors given off from said fluid; and returning the condensate to said jacket.

3. The process of maintaining a relatively high temperature in the jacket fluid of an internal combustion engine which consists in passing said fluid out of said jacket at a superatmospheric pressure through a Venturi tube; admitting air to said fluid as it leaves said jacket; cooling said fluid; and forcing said fluid void of said air back into said jacket at a superatmospheric pressure, substantially as described.

4. The process of maintaining a temperature in the jacket fluid of an internal combustion engine higher than that corresponding to atmospheric pressure which consists in so restricting the passage of said fluid out of said jacket as to cause it to rise to a superatmospheric pressure; mixing air with said fluid and continuously forcing said fluid back into said jacket at a rate sufficient to maintain said last named pressure, substantially as described.

5. The process of maintaining a temperature in the jacket fluid of an internal combustion engine higher than that corresponding to atmospheric pressure which consists in so restricting the passage of said fluid out of said jacket as to cause it to rise to a superatmospheric pressure; mixing air with said fluid; condensing any vapors given off; and continuously forcing said fluid and condensate back into said jacket at a rate sufficient to maintain said last named pressure, substantially as described.

6. In a cooling system for internal combustion engine, the combination of a jacket; a tank for holding an excess supply of cooling fluid for said jacket, and adapted to permit the separation from said fluid of substantially all the vapor formed; means to admit air to said fluid as it enters said tank; means to continuously circulate said fluid through said tank and jacket; a restriction in said means disposed between said jacket and tank adapted to maintain the pressure in said jacket higher than that in said tank; and means for cooling the fluid in said tank and returning it voided of said air to said jacket.

7. In a cooling system for an internal combustion engine, the combination of a jacket; a tank for holding an excess supply of cooling fluid for said jacket; means comprising a pump to continuously circulate said fluid through said tank and jacket; a restriction in said means disposed between said jacket and tank to maintain the pressure in said jacket higher than that in said tank and adapted to admit air to said circuit; and means for cooling the fluid in said tank and returning it voided of said air to said jacket.

In testimony whereof I affix my signature.
WELLINGTON W. MUIR.