May 24, 1927.

1,630,069

W. W. MUIR

COOLING SYSTEM

Filed Aug. 16. 1922

2 Sheets-Sheet 1

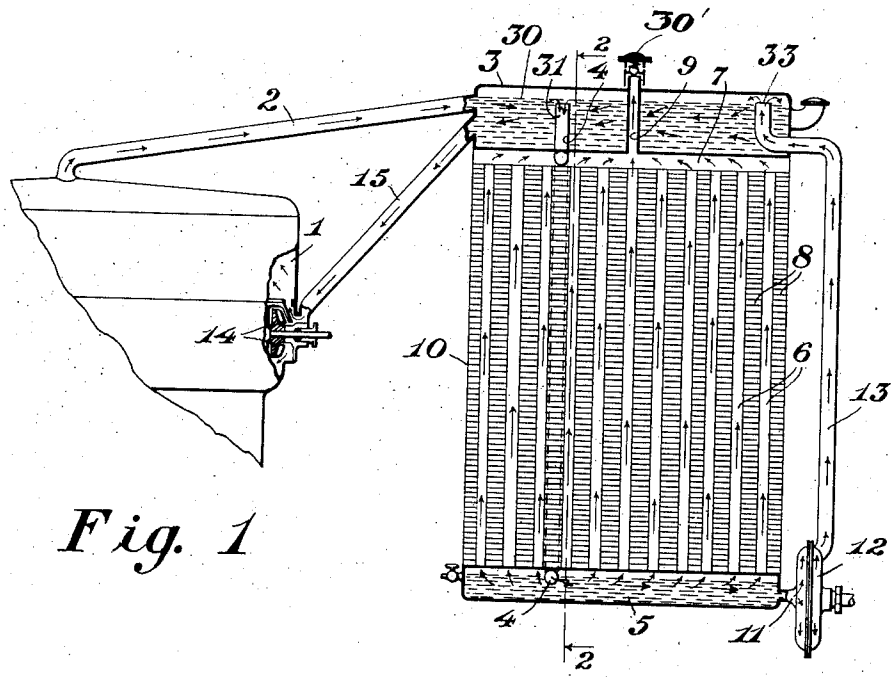


Fig. 1

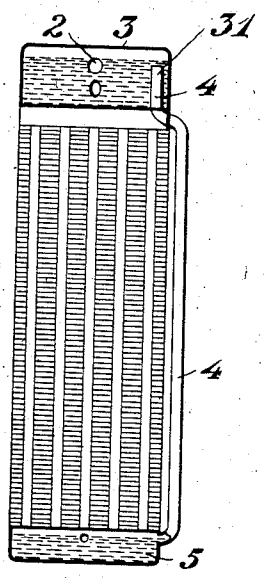


Fig. 2

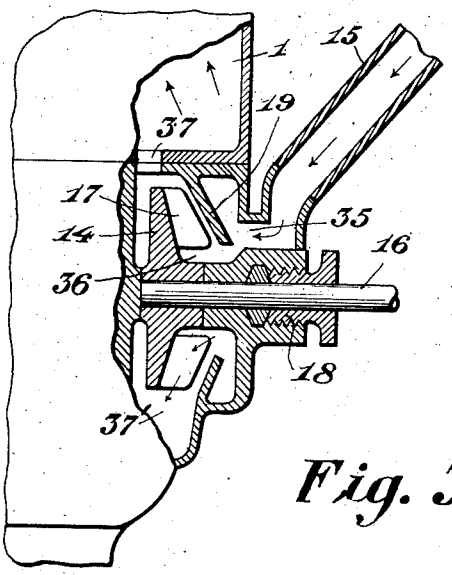


Fig. 3

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COOLING SYSTEM

Filed Aug. 16. 1922 2 Sheets-Sheet 2

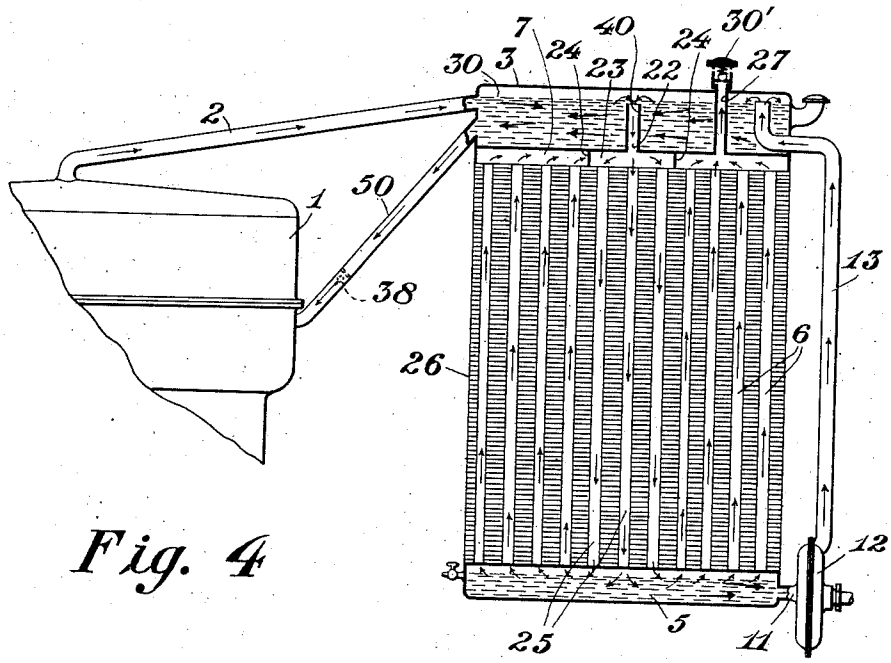


Fig. 4

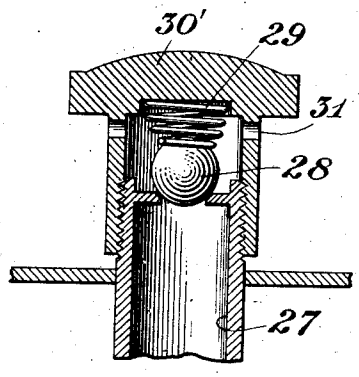


Fig. 5

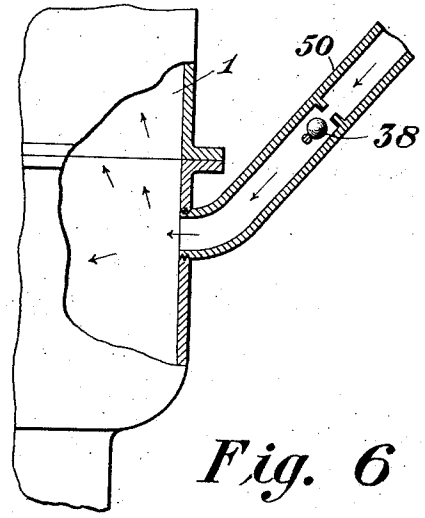


Fig. 6

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Patented May 24, 1927. 1,630,069

UNITED STATES PATENT OFFICE.

WELLINGTON W. MUIR, OF LOCKPORT, NEW YORK.

COOLING SYSTEM.

Application filed August 16, 1922. Serial No. 582,218.

This invention relates to cooling systems for internal combustion engines and has for its object to improve the operation as well as the efficiency of the systems which have been heretofore proposed.

With these and other objects in view the invention consists in the novel details of construction and combination of parts 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 made in accordance with this invention;

Figure 2 is a sectional view of a portion of the parts shown in Figure 1;

Figure 3 is an enlarged detail partially sectional view of the pump and its associated parts shown in Figure 1;

Figure 4 is a view similar to Figure 1 but showing a somewhat modified form of construction;

Figure 5 is a detail sectional view of the valved air vent shown in Figure 4; and

Figure 6 is a detail sectional view of a portion of the jacket and the pipe leading thereto illustrated in Figure 1.

Referring to Figures 1 to 3, 1 indicates a jacket, 2 a pipe leading from said jacket to a tank 3, 4 a pipe leading from said tank 3 to the tank 5, 6 a plurality of water tubes whose lower ends open into said tank 5 and whose upper ends open into the air tank 7, 8 heat radiating fins surrounding said tubes 6, and 9 a vent pipe leading from said air tank or chamber 7 to the atmosphere. Connected to the radiator 10 by the passage 11 is the pump 12, delivering into the pipe 13 connected to the tank 3 as shown. Leading from said tank 3 to the pump 14 is the pipe 15. Said pump 14 is provided with a shaft 16, a set of impeller blades 17, a single stuffing box 18, and a baffle or partition 19 as illustrated.

In the modified form of the invention illustrated in Figures 4 to 6, the pipe 4 is dispensed with, and the short pipe 22 is led into the space 23 formed by the partitions 24 in the air chamber 7, and from this space 23 lead one or more tubes 25 of the honey comb of the radiator 26. The lower ends of tubes 25 open into tank 5, and from chamber 7 leads the vent tube 27 provided with the cap 30′ associated with the openings 31′ and valve 28, controlled by the spring 29. This cap 30′ with its associated openings 31′ and valve 28 are also provided on the pipe 9 illustrated in Figure 1 in order to control the temperature of the fluid in the circuit containing the pump 12.

In this modified form of the invention the pump 14 is dispensed with and the colder bottom fluid flows by gravity from tank 3 to jacket 1. Referring more particularly to Figure 1, the operation of this invention is as follows:—

Steam or hot water, or a mixture of steam and hot water pass from the jacket 1, under pressure, through the pipe 2 to the tank 3 until the level 30 of said fluid in said tank overflows the extreme end 31 of the pipe 4, when said hot fluid will flow down said pipe 4 into the tank 5, whereupon vapor will be given off from said fluid which will rise in the water passages 6 and be condensed therein owing to the cooling effect of the fins or other heat radiating elements with which said tubes are provided in the radiator 10. As fast as the vapors are condensed they will flow down said tubes 6 under the action of gravity and collect in the tank 5. Any vapors which are not condensed in the tubes 6 will find their way into the air chamber 7 between the top ends of the tubes 6, and the bottom of the tank 3, where said vapors being brought into contact with the cooler portion of the fluid in tank 3 will be further condensed and will therefore find their way back into the tubes 6 and under the action of gravity descend said tubes to the tank 5.

The pump 12 is operated by means not shown to suck the fluid out of the tank 5, and force it through the pipe 13 back into said tank 3, as fast as the vapors are condensed. The fluid is thus circulated around and around through the tank 3, the pipe 4 and the tank 5 so long as the level 30 is maintained above the extreme end 31 of the pipe 4, and so long as the pump 12 is running. The extreme end 33 of the pipe 13 is located on the level above that of the extreme end 31 of the pipe 4 so that the fluid is taken out of tank 3 by pipe 4 before it rises to a height sufficient for it to flow back into said pipe 13. When the load on the engine increases the combustion chambers get hotter and therefore the temperature in the jacket rises with a result that more steam or other fluid passes through the pipe 2 into the tank 3 than is the case when the load is lighter.

Under such conditions the pump 14 which is preferably of the centrifugal type runs faster and therefore sucks through the passages 35 and 36 more than the normal quantity of fluid which enters said jacket through the passage 37. The fluid thus sucked into the passage 36 is forced radially outward by the impellers 17, and thus is a pressure created in the impeller chamber 37' which causes said fluid to be forced out past the baffles 19 into the passage 37 and into the jacket 1, all in a manner which will be understood from Figure 3 of the drawings. It thus results that as the speed of the engine increases the circulation of the fluid through the pipe 4 increases as well as the condensation of said fluid in the tubes 6. In the meantime, the pump 12 has its speed correspondingly increased so that the fluid is returned at an increased rate to the tank 3 and thus is the extra cooling demand on the system supplied. Said pipe 4 does not pass directly through the radiator honey comb, and therefore its cooling effect is relatively slight.

In the modified form of the invention shown in Figure 4, however, the water tubes 25 of the honey comb are utilized to return the fluid from the tank 3 and pipe 22 to the tank 5, and as these tubes are subjected to a much greater cooling action than the tube 4, any fluid passing therethrough is of necessity cooled to a greater degree than would be the case in Figure 1. In this construction shown in Figure 4, the vapor passes up the water tubes 6 on the outside of the conducting tubes 25 and said vapors are condensed in the manner above disclosed and fall back into the tank 5 as will be readily understood.

Any vapors that are not condensed in said tube 6 find their way into the air chamber 7 and they are likewise additionally cooled in the same manner as was disclosed in connection with Figure 1. The pump 12 likewise returns the cooled fluid tc the tank 3 through the pipe 13 and thus circulates the fluid around and around from tank 3 to tank 5 and back in the same manner as above mentioned. Owing to the fact that the bottom of the tank 3 will contain the coldest stratas of fluid the pipe 50 is relied upon to convey its proportion of fluid back to the jacket 1 through the action of gravity. A suitable valve 38 is preferably employed in said pipe 50 to prevent a sudden rise of temperature in the jacket 1 from forcing fluid out of said pipe back into the tank 3. Either of these forms of radiators may be operated at atmospheric pressure or below atmospheric pressure as desired.

In the forms shown a spring controlled valve 28 is provided which is adjustable and therefore the pressure in the system may be increased to any point desired.

In the form shown in Figure 4, there is no possibility of oversupplying the jacket by means of a pump because no pump directly forces fluid into the jacket. The circuit from the tank 3 to the jacket and back to said tank 3 is one of low radiating capacity and therefore, the jacket fluid can be rapidly brought to the boiling point. Further, when the level 30 of the fluid in the tank 3 gets below the extreme end 31 of pipe 4 or the extreme end 40 of pipe 22 it is evident that steam will pass directly down either pipe 4 or pipe 22, and their connections into the tank 5 whence it will pass upwardly through the water tubes 6 and be rapidly condensed.

It is further evident the vapors will only pass up said tubes 6 to such distance as is necessary to condense the same whereupon the condensed fluid will return to the tank 5 and under normal conditions will the upper ends of said tubes 6 be substantially empty and dry. Of course, the heat radiating capacity and therefore the cooling capacity of the passages 25 may be increased to any point desired for all that it is necessary to do is to select a sufficient number of said passages 25 to provide the necessary radiation.

It will be clear that this system may be run at temperatures above and below as well as at atmospheric pressures. For by controlling the escape of the gases including the air from the tube 9 by any suitable means, as indicated for example, in Figure 5, the pressures in the tanks 7 and 5, and therefore, in the jacket 1, are controlled; and by controlling these last named pressures the temperatures in the combustion chambers, and the ignition and burning of the fuel mixtures are controlled. As the temperatures of the combustion chambers govern the satisfactory propulsive efforts of the fuel it is clear that the efficiency of the engine and its smooth workings under varying loads and conditions will depend in a measure upon the satisfactory control of the jacket pressure, as disclosed above. Further, it will be clear that the above important control of the jacket pressures are effected in this invention by disposing the water tubes 6 in parallel with the tank 5 and with their open upper ends connected with tank 7 so that vapors arising from tank 5 ascend said tubes 6 until they are condensed and they fall back in the liquid form into the tank 5, whence they are pumped out through pipe 13 back into tank 3.

It will further be observed that this system comprises a closed circuit wherein it may be said that liquid or vapor from pipe 2 divides in tank 3; one part returning to jacket 1 through pipe 15, and another part passing from pipe 4 to tank 5 and through pipe 13, tank 3 and pipe 15 back to jacket 1. The radiator or cooler 10 is joined in

parallel with this last named circuit for the heated fluid rises up in the passages of the radiator to a point where condensation takes place, as above stated, and where air is liberated and then returns to tank 5 through the same passages it first ascended.

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 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 internal combustion engines the combination of a jacket; a tank; a connection between said jacket and tank; a second tank; a connection between said first and second named tanks; a pump; a connection between said pump and said second tank; a connection between said pump and said first named tank; a cooling means located above said second tank having vapor condensing tubes communicating with the latter; and a second connection including a pump between said first named tank and said jacket, substantially as described.

2. In a cooling system for internal combustion engines the combination of a jacket; a liquid circuit composed of a tank and connections leading from said jacket to said tank and from said tank back to said jacket; a second tank; a heat extracting means located below said first named tank provided with an air chamber, and open ended passages joining said chamber and second tank; and means for circulating liquid from said first named tank to said second tank and from said second tank to said first named tank, substantially as described.

3. In a cooling system for internal combustion engines, the combination of a jacket; a pair of liquid holding tanks located one above the other; means for continuously circulating liquid between and through said tanks; means for condensing vapors given off in the lower one of said pair of tanks; and connections including a pump between said jacket and the uppermost tank, substantially as described.

4. In a cooling system for internal combustion engines the combination of a jacket; a pair of liquid holding tanks located at different levels; means for passing liquid and vapors from the uppermost one of said tanks to the lowermost one of said tanks; means for passing liquid back from the lowest to the highest of said tanks; a cooling means located between said tanks adapted to condense any vapors given off from said lowest tank; and a pair of connections between said jacket and said upper tank, substantially as described.

5. In a cooling system for internal combustion engines, the combination of a jacket; an upper tank; a lower tank; a pump and connections for continuously circulating a liquid between said jacket and said upper tank; a cooling means located between said tanks and connected with said lower tank; and a second pump and connections for continuously circulating liquid between said tanks.

6. In a cooling system for internal combustion engines the combination of an upper and a lower tank; means for circulating fluid from one tank to the other and back again; open ended cooling passages connected to the lower tank; an air chamber between the upper tank and the open upper ends of said passages; a jacket; and a connection between said jacket and the upper tank, substantially as described.

7. In a cooling system for internal combustion engines, the combination of an upper and a lower tank; a jacket; a connection between said jacket and the upper tank; means for circulating fluid from one tank to the other and back again; open ended cooling passages connected to the lower tank; an air chamber between the upper tank and the open upper ends of said passages; and means associated with said air chamber for relieving the pressure therein.

8. In a cooling system for internal combustion engines, the combination of a circuit for the jacket fluid; a second circuit communicating with said first named circuit for said fluid; separate means for circulating the fluids in said circuits; a radiator joined in parallel with said circuits; and means for controlling the temperature in said last named circuit.

9. In a cooling system for internal combustion engines including a tank, the combination of a circuit for the jacket fluid including said tank; a second circuit including said tank for said fluid; separate means for circulating the fluids in said circuits; a condenser joined in series with said second circuit and parallel to said first circuit; and means for controlling the temperature in said second circuit.

10. In a cooling system for internal combustion engines including a tank, the combination of an all-liquid circuit for the jacket fluid including said tank; a second circuit of liquid and vapor and including said tank for said fluid; separate means for circulating the fluids in said circuits; a condenser joined in series with said second circuit and parallel to said first circuit for condensing the vapors in said circuits; means to restrict in said circuits; the liquid levels to create thereabove the space for said vapor; and means for controlling the temperature in said second circuit.

In testimony whereof I affix my signature.

WELLINGTON W. MUIR.