Oct. 17, 1939. H. B. DRAPEAU 2,176,331

CIRCULATORY COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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Fig. 1.

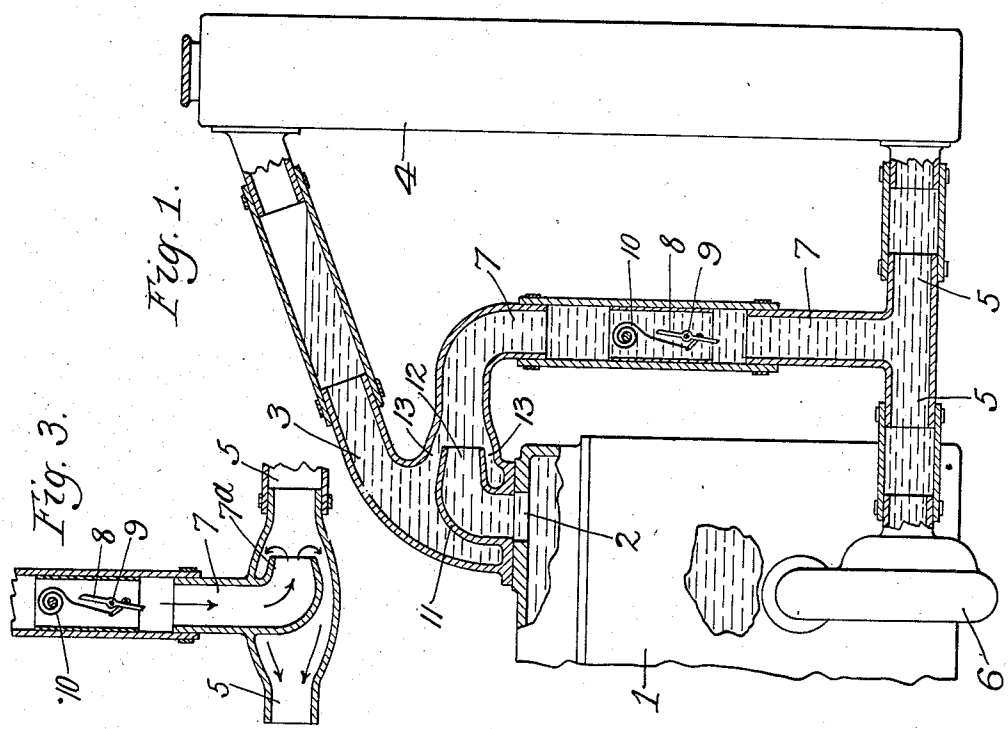
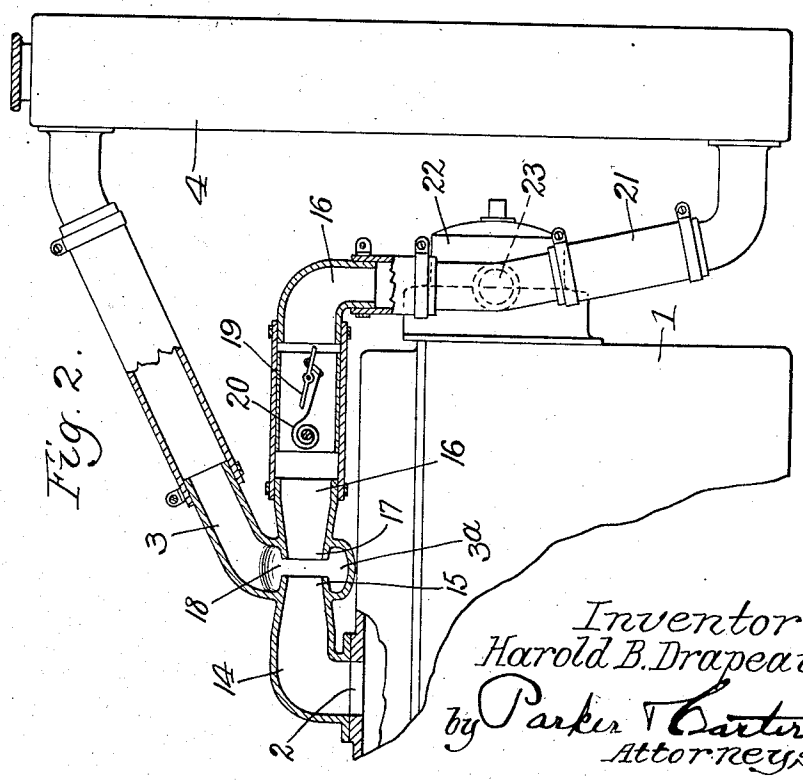


Fig. 3.

Fig. 2.



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CIRCULATORY COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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4 Claims. (Cl. 123—178)

This invention relates to circulatory cooling systems for internal combustion engines and has for its object to provide a new and improved system of this description.

The invention has as a further object to provide a circulatory cooling system for internal combustion engines with a thermostatic control arranged so that the engine cannot become overheated if the thermostat remains closed. The invention has as a further object to provide such a system wherein without endangering the engine because of overheating, the liquid in the system can be kept at a sufficiently high temperature to be utilized for heating the interior of the automobile, regardless of the external temperature and the high speed of the automobile.

The invention has as a further object to provide such a system having a controlled bypass and having the main circulatory system through the radiator open at all times. The invention has as a further object to provide a system of this description having a bypass, having a valve thermostatically controlled by a reversely acting thermostat which closes the valve when the thermostat is heated, the main circulatory system being free from any thermostatic controlling device. The invention has other objects which are more particularly pointed out in the accompanying description.

Referring now to the drawing,

Fig. 1 is a view showing an internal combustion engine provided with one form of circulatory cooling embodying the invention;

Fig. 2 is a view showing a modified construction;

Fig. 3 is a view showing a modified construction of the lower end of the bypass.

Like numerals refer to like parts throughout the several figures.

Referring now to the drawing, I have illustrated a conventional form of internal combustion engine having the cylinder block 1 with the usual water jacket having an outlet 2. A conduit 3 is connected with the outlet 2 of the water jacket and leads to the radiator 4. A conduit 5 connects the radiator 4 with the water jacket of the cylinder block of the engine, thus forming a circulatory system from the water jacket to the engine through the radiator. A pump is located somewhere in this system. As herein shown, there is provided a pump 6 which takes the liquid from the conduit 5 and pumps it through the water jacket and through the system. The main circulatory system is free from any thermostatic or other movable controlling device. Connected in this system is a bypass 7, which as herein shown connects the conduits 3 and 5. Located in the bypass 7 is a valve 8. This valve may be of any suitable construction and for the purposes of illustration is shown as a butterfly valve pivotally mounted at 9. A thermostat 10 is connected with this valve and with a fixed part, the thermostat being a reversely acting thermostat which opens the valve when cool or partially closes or closes the valve when hot. Some means is provided for directing the liquid from the water jacket of the engine into the bypass. This means will depend upon the location of the bypass and the construction of the parts. In the construction illustrated in Fig. 1, the bypass is connected with the end of the conduit 3 nearest the engine and there is arranged a nozzle 11 which directs the liquid from the water jacket into the bypass. This nozzle may be of any suitable form and is preferably of the Venturi type. The discharge end 12 of the nozzle 11 is smaller in cross sectional area than the portion of the pipe or conduit surrounding it, so as to leave a space 13 through which liquid may pass to the conduit 3 and the radiator 4. The discharge end of the nozzle is also preferably of substantially the same cross sectional area as the conduit 3. In the particular construction shown, the lower end of the conduit 3, the nozzle 11 and the upper end of the bypass are preferably formed of a single unitary construction, but it may be of any other construction.

Under certain conditions and for certain constructions, I may arrange the lower end of the bypass 7 with a discharge end 7a which discharges the liquid toward the radiator, so that when the by-pass is in operation this liquid opposes the flow of the liquid from the bottom of the radiator. This discharge end may be in the form of a nozzle and also of a Venturi nozzle.

In Fig. 2 I have shown a modified construction where there is a pipe 14 connected with the engine water jacket and which is provided with a nozzle 15 connected with the conduit 3 leading to the radiator. The by-pass 16 is provided with a portion 17 which projects into the lower end 3a of the conduit 3 and which is opposite the nozzle 15, there being a circular space 18 between the nozzle 15 and the end 17 of the by-pass. The lower end 3a of the conduit 3 surrounds the opposed ends of the nozzle and the by-pass. Located in the by-pass is the valve 19 which is normally open when the cooling liquid is cool and which is actuated by the thermostat 20, which is a reversely acting thermostat.

It is of course evident that the pump and other parts may be arranged in any desired manner. In this particular construction the conduit 21 leading from the bottom of the radiator 4 connects with the by-pass 16 and the conduit 21 and by-pass 16 are connected to the pump 22 by a pipe 23. The pump when in operation draws the liquid through the pipe 16 when the by-pass is open, a small portion being also drawn through the pipe 21. When the by-pass is partially closed more liquid is drawn through the conduit 21 and when the by-pass is completely closed all the liquid is drawn through the conduit 21, the liquid being discharged into the water jacket of the engine.

I have described in detail a particular construction embodying the invention, but it is of course evident that the parts may be varied in many particulars without departing from the spirit of the invention as embodied in the claims hereto appended, and I therefore do not limit myself to the particular construction shown.

The use and operation of my invention are as follows.

Referring now to Fig. 1, when the engine first starts up the liquid and thermostat 10 are cold and the valve 8 in the bypass is open. The pump 6 being now in operation, directs the fluid from the water jacket through the opening 2 into the nozzle 11 and out at the end 12 of the nozzle into bypass 7. The cooling liquid passes through the bypass into the conduit 5 and back through the pump into the engine water jacket. The liquid passing out of nozzle 11 is directed into the bypass instead of passing through the conduit 3 to the radiator, and thus the cooling liquid is short-circuited around the radiator. The discharge of the liquid from the nozzle 11 produces a reduced pressure around said nozzle in the space 13. The parts are preferably arranged so that a small amount of the cooling liquid will pass into the pipe 3 and through the radiator 4 when the valve 8 is fully open, so as to prevent stagnation of the liquid in the radiator.

As the liquid in the water jacket becomes heated the thermostat 10 will be heated and will move the valve 8 towards its closed position. When the valve 8 is partially closed the cross sectional area of the bypass at this point is reduced and part of the liquid passes through the conduit 3 into the radiator 4 and back to the water jacket of the engine. The amount that the valve 8 is closed depends upon the conditions. In hot weather for example, the cooling fluid may reach such a temperature that the valve 8 will be entirely closed and then the cooling liquid will circulate through the main circulatory system, consisting of the water jacket of the engine, the conduit 3, radiator 4 and the return conduit 5. In cold weather the valve 8 may be only partially closed so that a portion of the cooling fluid passes continuously through the bypass so that it will be heated a sufficient temperature to maintain the efficiency of the engine and to provide heat for the heaters for heating the interior of the automobile.

I have found that by properly arranging the parts, the cooling liquid in the water jacket of the engine may be maintained at the proper temperature for maintaining the efficiency of the engine and for use in the heaters, regardless of the low outside temperature and when the engine is running at an exceedingly high speed. In fact, the parts can be arranged so that this liquid may be maintained at the desired temperature regardless of the speed of the engine and the outside temperature.

This arrangement provides a safety device with flexibility. With the ordinary system with thermostatic control in the main circulatory system, it often happens that the valve controlled by the thermostat, because of injury to the thermostat, remains closed, in which event the cylinder of the engine will become too hot and thus become injured. If the thermostat works properly, then in cold weather and when the engine is running at very high speed, the cooling liquid is cooled to such a degree that the engine is not heated to sufficient temperature to secure its maximum efficiency and the temperature of the liquid is too low to be effectively used for heating purposes. With the present device these evils are eradicated and in the coldest weather the cooling liquid can be maintained at sufficiently high temperature for effective heating purposes. With this system, in the very coldest weather the radiator may be substantially cut out of circuit except for the flow necessary to prevent stagnation of the liquid therein, and when the weather is not so exceedingly cold the radiator may be alternately cut in and out, and in warmer weather more or less of the radiator utilized as the conditions require, and all this is done automatically and with entire safety to the engine.

With this system there is substantially normal circulation of water through the water jacket at all times, that is when the engine first starts up and at all other times when it is operating, thereby eliminating the possibility of excessive pressure in the water jacket. Another advantage of this system is that when the cooling liquid is inserted or added, the air is expelled and there are no air pockets so as to provide an air-bound condition, thus preventing injury to the engine.

The main difficulty in keeping the cooling liquid at the proper temperature occurs in the winter time. In this system even when there are foreign solid particles in the cooling liquid, such particles cannot interfere with the system so as to bring about a condition where the cooling liquid temperature will be lowered to such an extent as to interfere with the efficiency of the engine or the temperature which it is desired to maintain. It will be noted that in this construction the energy of the cooling liquid is utilized to deliver cooling liquid toward or into the bypass.

I claim:

1. A circulatory cooling system for internal combustion engines provided with a water jacket and a radiator, comprising a continuously open main circulating circuit from the water jacket through the radiator for the cooling liquid, and through which a portion of the cooling liquid at all times passes when the engine is running, a bypass around the radiator, through which a portion of the cooling liquid passes when the engine is running, said water jacket having an outlet in alignment with the inlet of said bypass.

2. A circulatory cooling system for internal combustion engines provided with a water jacket and a radiator, comprising a continuously open main circulating circuit from the water jacket through the radiator for the cooling liquid, and through which a portion of the cooling liquid at all times passes when the engine is running, a bypass around the radiator, through which a portion of the cooling liquid passes when the engine is running, means for directing water from the water jacket of the engine directly into the inlet end of

the bypass and a thermostat located in the bypass intermediate its ends.

3. A circulatory cooling system for internal combustion engines provided with a water jacket and a radiator, comprising a continuously open main circulating circuit from the water jacket through the radiator for the cooling liquid, a bypass around the radiator, means for utilizing the energy of the cooling liquid for directing cooling liquid into said bypass, a valve in said bypass, normally open when the cooling liquid is cool, a thermostat connected with said valve so as to open it, the thermostat acting to move the valve toward its closed position when the temperature of the cooling liquid rises above a predetermined point.

4. A circulatory cooling system for internal combustion engines provided with a water jacket and a radiator, comprising a continuously open main circulating circuit from the water jacket through the radiator for the cooling liquid, a bypass extending from the upper part of the main circulatory circuit to the lower part thereof and provided with a nozzle directed toward the radiator, a valve in said bypass, normally open when the cooling liquid is cool, a thermostat connected with said valve so as to operate it, the thermostat acting to move the valve towards its closed position when the temperature of the cooling liquid rises above a predetermined point.

HAROLD B. DRAPEAU.