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COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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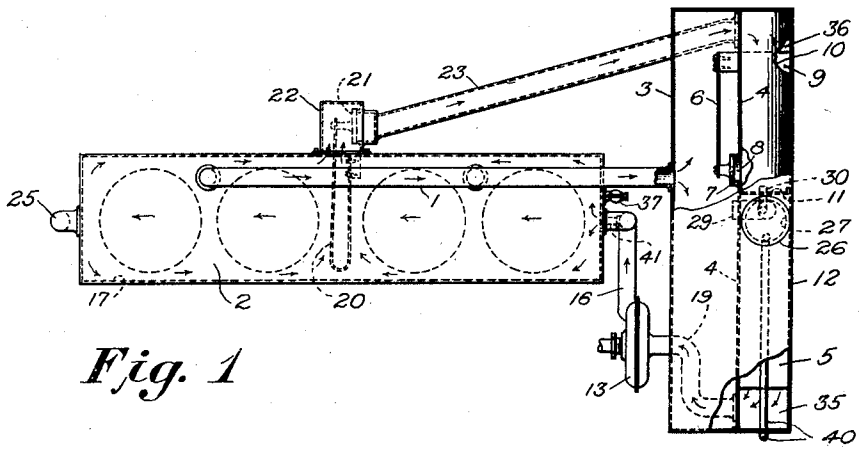


Fig. 1

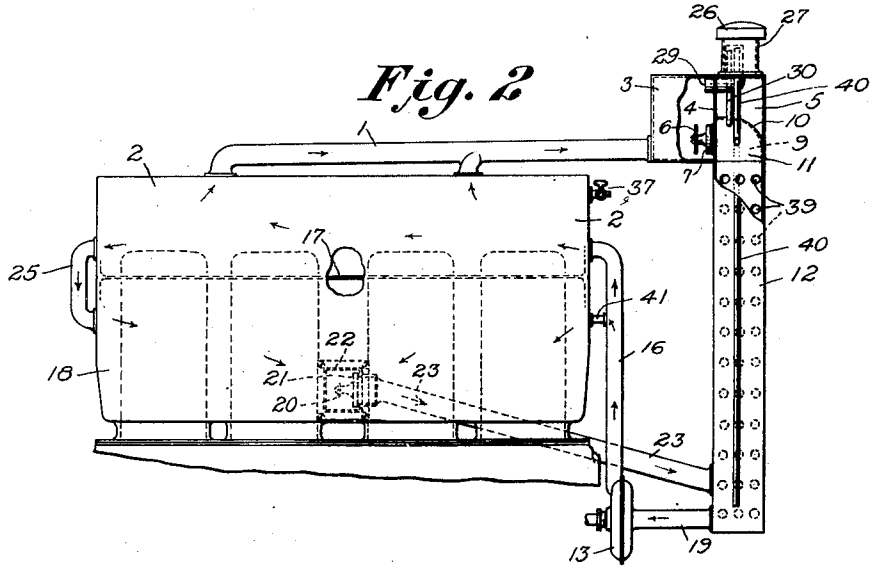


Fig. 2

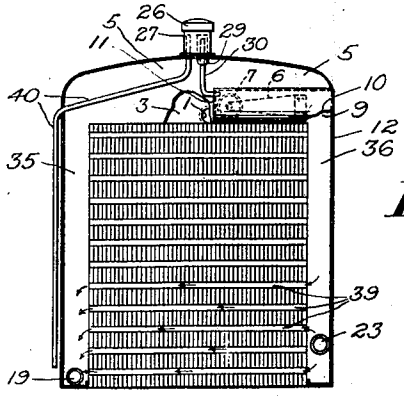


Fig. 3

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COOLING SYSTEM FOR INTERNAL-COMBUSTION ENGINES.

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This invention relates to a cooling system for internal combustion engines, and has for its object to improve the systems heretofore proposed.

With this and other objects in view the invention consists in the novel details of construction and combinations 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:—

Fig. 1 is a plan view partially broken away of an apparatus made in accordance with this invention;

Fig. 2 is a side elevational view partially broken away of the parts shown in Figure 1; and

Fig. 3 is a front elevational view of the radiator when looking toward the engine.

1 indicates a pipe leading from the upper portion 2 of the engine jacket, 3 a tank located across the top of the radiator to which said pipe 1 is joined for the purpose of receiving and storing liquid while the engine is being heated up, 4 a wall or partition extending from end to end of the tank 3, 5 a space or tank extending across the radiator top on the opposite side of the partition 4 from the tank 3, and 9 is a tank, space or enclosure communicating with the tank 36 to be described below, said tank or enclosure 9 has an end portion 11 constituting a partition between the tanks 5 and 9, said tank being formed by the curved partition 10 as illustrated. Located on the wall or partition 4 is the thermostat 6 provided with the valve 7 controlling the port or passage 8 connecting said spaces or tanks 3 and 9. The radiator 12 is provided with a side tank 35 connected at its upper end with the tank 5, and said radiator is also provided with another side tank 36 connected at its upper end with the tank 9. From the bottom of the tank 35 leads the pipe 19 to the pump 13 and from said pump 13 leads the pipe 16 into the jacket portion 2 as illustrated. The partition 17 separates the jacket portion 2 from the jacket portion 18, and the pipe 25 joins said portions 2 and 18.

The pipe 16 is provided with the small bypass 41 joining said pipe with the jacket portion 18 as best shown in Figure 2. Located inside the jacket portion 18 is the thermostat 20 provided with the valve 21 located in the chamber 22 preferably disposed outside of the jacket portion 18. Leading from said chamber 22 to the tank 36 is a pipe 23, and leading from said tank 36 to the tank 35 are the radiator tubes 39. The tank 9 communicates with the tank 36 at the upper portion of the latter as illustrated. 26 indicates the filler cap closing the neck or chamber 27 associated with the tank 5, and joining said tank 3 and the chamber or neck 27 is the curved pipe or passage 29. Joining the tank 9 and chamber 27 is the pipe 30 and leading from the chamber 27 to the atmosphere is the vent pipe 40 as shown.

The operation of this improved cooling system is as follows:—When the motor is not running the system is filled through the cap 26 to the level of the pet cock 37 and when the motor starts if liquid in the system is below the temperature at which the thermostatic valves 7 and 21 are set to operate. said valves will be closed. The liquid will therefore while the engine is heating up be withdrawn from the radiator 12 through the passage 19, pump 13, and forced through the passage 16 into the jacket portion 2; and from the jacket portion 2 the liquid will be forced through the pipe 1 into tank 3 which is of a sufficient capacity to hold all of the liquid withdrawn from the radiator 12 under the conditions stated. Said liquid not passing through the radiator will, of course, soon be heated up by the operation of the engine until one or both of the valves 7 and 21 are opened and any air accumulating in the tank 3 can escape through passages 29 and 30 into the chambers 9 and 36. Any air that may have accumulated in the side tank 36 or tank 9 will be free to pass through the radiator tubes 39 into the tank 35 whence it may pass upwardly into and from the tank 5 and into the said chamber 27. From said chamber 27, said air may escape through the vent pipe 40 to the atmosphere. The passage 29 is curved and closed at its upper end as shown, and is carried up into the chamber 27 in order to prevent the liquid in tank 3 from splashing out over into the radiator tank 9 through passage 30.

When the liquid has thus attained a predetermined temperature through the operation of the engine, the thermostatic valve 21 will open and the circulation of the liquid

will be as follows:—Said liquid will pass from the lower portion 18 of the jacket through the pipe 23 into the tank 36 of the radiator 12, through the lower tubes 39 of said radiator into the tank 35, when it will be partially cooled. The partially cooled liquid will next pass from the tank 35 through the connection 19 into the pump 13, out of said pump through the connection 16 into the upper portion 2 of the jacket. A portion of said partially cooled liquid will also pass from the pipe 16 through the by pass 41 into the lower portion 18 of said jacket. As the upper portion 2 of the jacket continues to receive liquid the latter will likewise pass out of said portion 2 through the pipe 25 back into the lower portion 18 of said jacket, and this action will continue until the temperature of the partially cooled liquid has reached such a predetermined point as will cause the valve 7 to open, whereupon the heated liquid will flow through the port 8 into the tank 9 and thence into the side tank 36 and through the tubes 39 of the radiator 12, and thus be cooled to the normal degree.

Of course, the thermostatic valves 7 and 21 may be set to operate at the same temperature. Under this set of conditions the circulation would be simultaneously through the pipes 1 and 23 into the radiator tank 36, through the radiator tubes 39 into the tank 35 and out of the tank 35 through the pipe 19, pump 13, pipes 16 and 41 back into the engine jacket. It is of course also possible, when so desired, to altogether omit the thermostat 6 and valve 7. When desirable the entire system can be filled with liquid thus providing an additional amount of cooling fluid to absorb the excessive heat given off by the motor under short periods of overload. Such an excess of liquid is advantageous where the capacity of the radiator core is not sufficient to carry off the heat.

It will now be clear that this system possesses the advantage of enabling one to rapidly warm up the engine to its normal working temperature in cold weather, due to the relatively small quantity of cooling liquid that may be carried in the system. Another advantage of the system resides in the fact that the radiator core is normally empty and drained when the system is being warmed up, and therefore, all danger of freezing the core in cold weather is avoided. Still another advantage of the system is found in the gravity feed through the pipe 23 from the portion 18 of the jacket to the radiator thus ensuring an automatic circulation when the liquid is low in the system due to an abnormal loss of water therefrom and thus at the same time preventing any overheating of the engine. Still another advantage of this system is found in the variable number of tubes 39 that are active under different conditions of working and which number vary with the amount of liquid that needs cooling at any given time. That is, the number of cross passages 39 of the radiator 12 that receive hot liquid will depend upon the amount of liquid flowing out of the jacket, and this fact tends to bring into actual operation only that number of cooling passages 39 which are necessary to provide the required amount of cooling surface under any given set of conditions. This action insures against overcooling the liquid in cold weather when a relatively small amount is passing through the radiator, and it also overcomes the danger of freezing the liquid when the circulation is slow. In other words, if the thermostatic valve 21 is opened in the beginning to only a slight extent, only a few of the cross passages 39 will be active so that the liquid will not be overcooled. As the thermostatic valve 21 opens wider as it will do as the liquid becomes hotter, the amount of liquid flowing into the tank 36 will be increased and the cross passages brought into operation will be increased in the same proportion and thus will the liquid still not be overcooled, while at the same time, it is prevented from being overheated. In this way, this system operates automatically to make the cooling surface of the radiator vary with the needs of the conditions at each period of time.

A further advantage of this system lies in the fact that volatile non-freezing solutions can be used without an excessive loss from evaporation.

A still further advantage of this system resides in the fact that thermostatic metal is used in the place of thermostatic containers filled with liquid, which latter as is well known soon lose their active material and become inactive, while there is no such disadvantage accompanying the use of the metallic form of thermostat.

A still further advantage of the system is to be found in the fact that the pipe 23 is so connected to the system that there is a known and constant pressure of liquid on the valve 21 from the jacket instead of a variable pressure when the pump speed changes, and therefore, the temperature at which the thermostats will operate can be ascertained and the thermostat 22 can be calibrated with accuracy. In other words, if the thermostat 22 is set to operate at say 125° with the pump running at say 300 revolutions a minute, and should the pump speed be increased to 3000 revolutions a minute, the pressure head developed by the pump on the valve 21 would not be increased to a point where the liquid in the system would have to reach a temperature of say 205° as in the prior systems before the said valve 21 could open, for its gravity head of liquid is substantially unaffected by changes of pump speeds. In the prior sys-

tem, on the other hand, the thermostatic valves work not against a gravity head which remains unaffected by the pump speeds but by pressures of liquid that are profoundly changed when the speed of the pump changes. Therefore, the valve 21 of this system will always operate at substantially the same temperature independently of the speed of the pump.

It now will be clear that it is an important feature of this invention that the liquid is only filled to the level of the cock 37, and that the tank 3 is of a capacity greater than that of the radiator 12, for under such conditions the pump cannot of itself create any pressure on the valve 21, and thus interfere with the operation of the latter.

It will further be clear that the gravity feed through the radiator through the pipe 23 constitutes another important feature of the invention, for with this feed no matter how low the liquid may get in the jacket, there will always be some left in the bottom of the radiator to feed the pump, and therefore there will always be some liquid returning to the upper portion 2 of the jacket, and preventing the overheating of the engine.

It is obvious that those skilled in the art may vary the details of construction as well as the arrangements 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 is claimed is:—

1. In a cooling system for internal combustion engines the combination of a jacket; a tank; a fluid conducting connection between said tank and said jacket; a radiator; a second fluid conducting connection between said jacket and said radiator; a passage between said tank and said radiator; thermostatic means for controlling one of said connections; and means for returning cooled liquid from said radiator to said jacket.

2. In a cooling system for internal combustion engines the combination of a jacket; a tank; a fluid conducting connection between said tank and said jacket; a radiator; a second fluid conducting connection operated by gravity between said jacket and said radiator; a passage between said tank and said radiator, thermostatic means for controlling one of said connections; and means for returning cooled liquid from said radiator to said jacket.

3. In a cooling system for internal combustion engines the combination of a jacket divided into a plurality of portions; passages for passing liquid from one portion to another portion of said jacket; a tank a fluid conducting connection between said tank and one portion of said jacket; a radiator; a second fluid conducting connection between another portion of said jacket and said radiator; a passage between said tank and said radiator; thermostatic means for controlling one of said connections; and means for returning cooled liquid from said radiator to said jacket.

4. In a cooling system for internal combustion engines the combination of a jacket; means for dividing said jacket into upper and lower portions; a passage for connecting said upper and lower portions; a radiator provided with a side tank; means for passing liquid from the upper portion of said jacket into said side tank; means for passing liquid from the lower portion of said jacket into said side tank; means to draw said liquid from said side tank; and means to pass said liquid back into said jacket.

5. In a cooling system for internal combustion engines the combination of a jacket; means for dividing said jacket into upper and lower portions; a passage for connecting said upper and lower portions; a radiator provided with a side tank; means comprising a tank associated with said radiator for passing liquid from the upper portion of said jacket into said side tank; means for passing liquid from the lower portion of said jacket into the lower portion of said side tank; means to draw said liquid from said side tank; and means to pass said liquid back into said jacket.

6. In a cooling system for internal combustion engines the combination of a jacket; means for dividing said jacket into upper and lower portions; a passage for connecting said upper and lower portions; a radiator provided with a side tank; means comprising a pair of tanks in series associated with said radiator for passing liquid from the upper portion of said jacket into the upper portion of said side tank; means for passing liquid from the lower portion of said jacket into said side tank; means to draw said liquid from said side tank; and means to pass said liquid back into said jacket.

7. In a cooling system for internal combustion engines the combination of a jacket; means for dividing said jacket into upper and lower portions; a passage for connecting said upper and lower portions; a radiator provided with a side tank; means for passing liquid from the upper portion of said jacket into said side tank; gravity acting means for passing liquid from the lower portion of said jacket into the lower portion of said side tank; means comprising a pump to draw said liquid from said side tank; and means to pass said liquid back into said jacket.

8. In a cooling system for internal combustion engines the combination of a jacket; a tank; fluid conducting connections between said jacket and tank; a second tank; a passage between said first and second named

tanks; means for controlling said last named passage; a radiator provided with cooling passages associated with said tanks and provided with a side tank into which said second tank empties; a pump; fluid conducting connections including the cooling passages of said radiator connecting said pump with said jacket; and fluid conducting connections from said pump for delivering liquid to said jacket.

9. In a cooling system for internal combustion engines the combination of a jacket; a tank; fluid conducting connections between said jacket and tank; a second tank; a passage between said first and second named tanks; automatic means for controlling said last named passage; a radiator provided with cooling passages associated with said tanks and provided with a side tank into which said second tank empties; a second side tank associated with said radiator; a pump; fluid conducting connections including the cooling passages and the second side tank of said radiator connecting said pump with said jacket; and fluid conducting connections from said pump for delivering liquid to said jacket.

10. In a cooling system for internal combustion engines the combination of a jacket; a tank; fluid conducting connections between said jacket and tank; a second tank; a passage between said first and second named tanks; means for controlling said last named passage; a radiator provided with cooling passages associated with said tanks, and provided with a side tank into which said second tank empties; a second and gravity actuated fluid conducting connection between said jacket and said side tank; a pump; fluid conducting connections including the cooling passages of said radiator connecting said pump with said jacket; and fluid conducting connections from said pump for delivering liquid to said jacket.

11. In a cooling system for internal combustion engines, the combination of a jacket divided into two portions; passages between said portions; a radiator provided with a receiving and a delivering side tank and having passages joining said tanks; fluid conducting connections between each jacket portion and the receiving side tank; a thermostatic valve controlling one of said last named connections; and means to return the liquid from the delivering side tank back into said jacket.

12. In a cooling system for internal combustion engines, the combination of a jacket divided into two portions; passages between said portions; a radiator provided with a receiving and a delivering side tank and having passages joining said tanks; fluid conducting connections between each jacket portion and the receiving side tank; a thermostatic valve controlling each of said last named connections; and means comprising a pump to return the liquid from the delivering side tank back into said jacket.

13. The process of operating a cooling system of an internal combustion engine which consists in drawing the liquid out of the radiator and storing said liquid while the engine is heating up; automatically delivering the hot liquid to the lower portions only of the radiator to be cooled after the engine is sufficiently warm to insure a satisfactory operation; and thereafter automatically causing varying portions of the cooling surfaces of the radiator to come into use, in accordance with the temperature of said liquid.

14. The process of operating a cooling system for an internal combustion engine provided with a jacket which consists in drawing the liquid out of the radiator and storing said liquid while the engine is heating up; automatically delivering the hot liquid directly from the bottom portion of said jacket to the radiator to be cooled at the bottom portions only of said radiator after the engine is sufficiently warm to insure a satisfactory operation; and thereafter automatically causing varying portions of said cooling surfaces of the radiator to come into use, in accordance with the temperature of said liquid.

15. In a cooling system for internal combustion engines the combination of a jacket provided with two separated chambers joined by a passage; a radiator; a plurality of conduits between said jacket and one side of said radiator, one of said conduits being of the gravity fluid type; and a conducting passage including a pump between the other side of said radiator and each of said chambers.

16. In a cooling system for internal combustion engines, the combination of a jacket; a radiator; a gravity fluid conducting connection between the lower portion of said jacket and the lower portion of one side of said radiator; an additional fluid conducting connection between said jacket and the upper portion of the same side of said radiator; and a return passage between the upper portion of said jacket and the other side of said radiator.

17. In a cooling system for internal combustion engines the combination of a jacket; a radiator provided with a cooling circuit including a storage tank; a gravity fluid conducting connection from said jacket to the lower portion of one side of said radiator; a fluid conducting connection from the lower portion of the other side of said radiator to said jacket; and means for controlling the area of the cooling surface that is active in accordance with the heat to be dissipated from the system.

18. In a cooling system for internal com-

bustion engines, the combination of a jacket; a radiator provided with a cooling circuit including a storage tank; a gravity fluid conducting connection from the lower portion of said jacket to the lower portion of said radiator on one side; a fluid conducting connection from the lower portion of the other side of said radiator to said jacket; and automatic means for controlling the area of the cooling surface that is active in said radiator in accordance with the heat to be dissipated from the system.

19. In a cooling system for internal combustion engines the combination of a jacket; means for limiting the amount of liquid in the system; means including a storage tank for maintaining the hydrostatic pressure in the jacket substantially constant; and automatic means for controlling the flow of said jacket subjected to said pressure.

20. In a cooling system for internal combustion engines the combination of a jacket; means for limiting the amount of liquid in the system; means including a storage tank for maintaining the hydrostatic pressure in the jacket substantially constant; means for passing liquid out of the jacket under the action of gravity; and means subjected to said pressure for controlling said second named means.

21. The process of operating a cooling system for an internal combustion engine associated with a jacket and a radiator having cooling surfaces, which consists in drawing liquid out of said radiator and storing said liquid while the engine is heating up; passing hot liquid by gravity directly from the bottom portion of said jacket over the lower portions only of said surfaces; and causing the area of said surfaces in contact with said liquid to increase with the heat in said liquid.

In testimony whereof I affix my signature.

WELLINGTON W. MUIR.