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COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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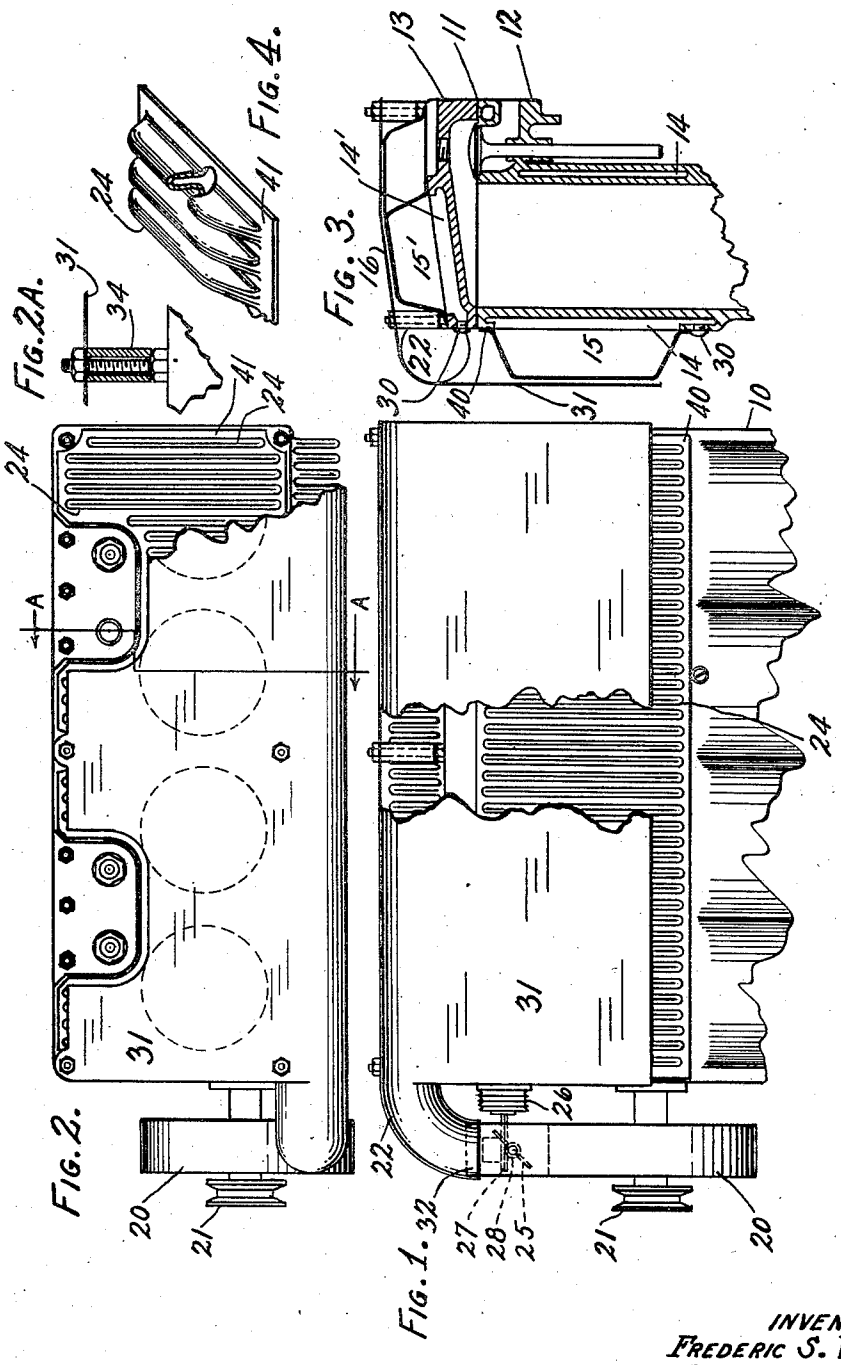

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COOLING SYSTEM FOR INTERNAL-COMBUSTION ENGINES

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2 Claims. (Cl. 123—173)

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This invention relates to an improved cooling system and structure for gas engines. The features will be made clear from the structure and its mode of operation to be explained with the help of the specific example to be described.

Some troubles in prior art uses are: When the cylinder head needs to be taken off, the cooling system needs to be drained and this is not convenient; desirable cooling fluids are not ordinarily sealed in the cooling systems so there is frequent doubt as to their continuing character, due to the liability of loss by evaporation or leakage or adulteration or all of these; the radiator, its usual "water" pump, and their connections to the engine jacket, and the connection for fluid between the cylinder block jacket and its head jacket circulation spaces are liable to cause some troubles of one kind or another; such parts interfere with a desirable simplification of structure and design particularly in automobiles.

The improvements in this art can be best disclosed by the specific example to be explained with the accompanying drawing,

Fig. 1 is a side view of the new structure applied to an engine, parts being broken away;

Fig. 2 is a similar plan view of the same;

Fig. 2A is a detail view showing a manner of removably attaching an air hood cover;

Fig. 3 is a section on line A—A of Fig. 2; and

Fig. 4 is a detail view of a radiator member.

The invention will be described in connection with an automobile engine but is, of course, not necessarily limited to this main use.

Enough of the engine 10 is shown in Fig. 3 to indicate the cylinder block 12 and cylinder head 13, meeting on line 11. This cylinder block has a cooling jacket 14 and the head has a cooling jacket 14'. These jackets are preferably separated, as indicated, in the sense that they do not communicate one with the other for any liquid exchange. The advantage of this is that the head may be removed by the repair man without necessarily draining the liquid from either jacket.

The jacket 14 is formed in part by an outer plate 40 preferably of good heat conducting metal and with many corrugations 24 for a large cooling area. Copper or copper alloys are suitable metals to shape to make the plate and corrugations in one piece, the metal being drawn deeply for the suitable protuberances or corrugations 24 indicated. The outer wall of jacket 14, on one side of the engine block in the example shown, is furnished by this corrugated plate 40. In a

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like manner the outer wall of the head jacket 14' is furnished with a similar plate 41.

These plates may be fastened and sealed at the margins to the cast engine metal as by welding or in any other feasible way. In this manner a considerable increase in space in the corrugations, indicated at 15 and consequently greatly increased area for jacket 14 and correspondingly at 15' for jacket 14', is provided for each jacket. A fusible plug 30 screwed in for jacket 14 and another plug 30 for jacket 15, provides convenient means to seal each jacket after it has been filled with liquid as through a plug opening. If desired the fusible plugs may be located at the top instead of the bottom, to be used as filling, instead of drain openings.

The structure and its arrangement is adapted to work with any of the various kinds of liquid commonly used in radiators. In addition it is adapted to work with some such substance as paraffin or lard which has a boiling point well above the normal operating temperature of an engine and which solidifies to a wax-like consistency at normal atmospheric temperatures. When the jacket or jackets are filled with such a substance in the liquid state, it need not be drained out and it will of course take the fluid form by the heat of the engine to function as the cooling fluid. There are advantages in extending the scope of choice of substances to use in the cooling system. My structure gives this advantage.

The corrugations 24 of the jacket are means for expanding to provide for differences in volume of the liquid as it heats or as it solidifies. Any suitable substance in liquid form, is supplied to each jacket, preferably enough to completely fill the jacket. Then the liquid is permanently sealed by closing the filling opening. It need never be drained out. Once it is in the jacket it can stay there. No vapor can get out. Only in the case of an accident or if the engine is overheated to a dangerous point need the jacket be unsealed. In such event the dangerous heat will fuse plug 30, one for each jacket 15 and 15' as seen in Fig. 3, for a blow out of pressure. This is a safeguard. Instead of the fusible plug means, a pressure relief valve which is normally closed may be used.

The whole outer wall of jacket 14' is furnished by plate 41 but not so for jacket 14. The jackets and the corrugations on the outer walls of jackets 14 and 14' are adapted to be so located with respect to any particular engine, that they

will not interfere with operating parts of the engine, such as valves and spark plugs. They should be of such extent, particularly the corrugation height, as to provide a sufficient surface to efficiently cool the liquid in the jackets. The idea is to provide for a reasonably close balance, so that both block and head will be kept at an efficient engine operating temperature. In each jacket enough thermal circulation of liquid will occur to keep near enough to a constant temperature for the liquid even though the whole jacket is not provided with outside corrugations. For example in Fig. 3, the right hand part of the jacket has no corrugations because they would interfere with the valve rod mechanism in that case. The liquid in that part will have a thermal circulation, however, with the left hand parts where enough corrugation surface is provided for the cooling effect.

An air jacket or hood **31** preferably made up of sheet metal fastened in the position shown, see Figs. 1, 2A and 3, is provided for a cooling air path across the radiator corrugations. Air is fed from a fan **20**, driven by pulley **21**, through pipe **22** to give a forced air blast action. The air enters by pipe **22** and travels between the corrugations **24** and out at the bottom for liquid jacket **14**, while it passes corrugations **24** and out at the open far side, see Fig. 3, for liquid jacket **14'**. A thermostat **26** is attached to the engine block at the front in the particular example. It works a rack bar **27** operating a pinion **28** to adjust valve **25** in pipe **22**. This adjustment is made to shut off the cooling air until the engine is warmed up and to then help maintain a fairly constant engine temperature.

It will be seen, Fig. 1, that pipe **22** has a slip joint **32**. The hood **31** may be fastened on as indicated in Fig. 2A. Here stud bolts such as ordinarily used to fasten the cylinder head are elongated. Then a sleeve or spacer **34** serves to hold hood **31** with a nut on top. Thus the bolts serve to fasten both the head and the hood with a head nut and hood nut on the same bolt. In the example there are six such bolts, see Fig. 2. The hood is cut away to expose the spark plugs. One opening for a plug is shown in Fig. 3 and the other three are seen exposed in Fig. 2. It will be seen from Figs. 2 and 3 that the cooling system in no way interferes with convenient access to spark plugs and valve mechanism.

The operation will be understood from what has been said in connection with the structure described. It will be briefly summarized. Assume the four cylinder engine **10** of the example, provided with the cooling structure of the example, the same liquid may be sealed in for very long use without loss by evaporation or the leaks such as occur at joints and in pump systems. The air to cool the engine is forced along a path similar to that in the plan of an air system. This improved cooling system, however, is a liquid system but without the usual liabilities of loss by leakage or evaporation. When access is needed to the pistons, valves, or cylinders for service as carbon removal or valve grinding, the simple removal of the hood **31** and cylinder head will give access and without disturbing the liquid of the

cooling system. The structure used on an automobile has a space saving advantage compared to the customary radiator. It also does not require a water pump or hose connection. It has advantages heretofore given only by air cooled engines but in the improvement many disadvantages of air cooled engine systems are avoided. In the drawings it will be seen that where the radiator metal is applied to the engine, wall portions of the customary water cooled engine casting is omitted and less metal is needed. That is to say, in many cases the engine and radiator metal considered together may be of substantially less weight than the customary arrangement of engine and radiator. Also less liquid is required than in the normal cooling system. These are samples of the useful results in the use of the structure.

Having disclosed my invention, I claim:

1. The combination of an engine with cylinder block and removable head each provided with liquid cooling jackets, one for the block and one for the head, the outer wall of the jacket for the block having a substantial portion of its whole area formed with heat rediating protuberances to greatly increase its area, such block jacket being adapted to receive liquid and seal the liquid therein independently of the jacket for the head, the jacket for the head having a similar construction as its outer wall and adapted to seal liquid in it independently of the liquid in the other jacket, and fusible plugs, one in each jacket construction to relieve pressure upon overheating.

2. The combination of an engine with cylinder block and removable head each provided with liquid cooling jackets, one for the block and one for the head, the outer wall of the jacket for the block having a substantial portion of its whole area formed with heat radiating protuberances to greatly increase its area, such block jacket being adapted to receive liquid and seal the liquid therein independently of the jacket for the head, the jacket for the head having a similar construction as its outer wall and adapted to seal liquid in it independently of the liquid in the outer jacket, emergency blow off devices, one in each jacket construction to relieve pressure upon over-heating, and a hood construction over that part of said jackets made with the heat radiating protuberances to provide paths for cooling air.

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