Oct. 11, 1932. D. T. MacLEOD 1,881,776

COOLING SYSTEM

Filed July 7, 1928 3 Sheets-Sheet 1

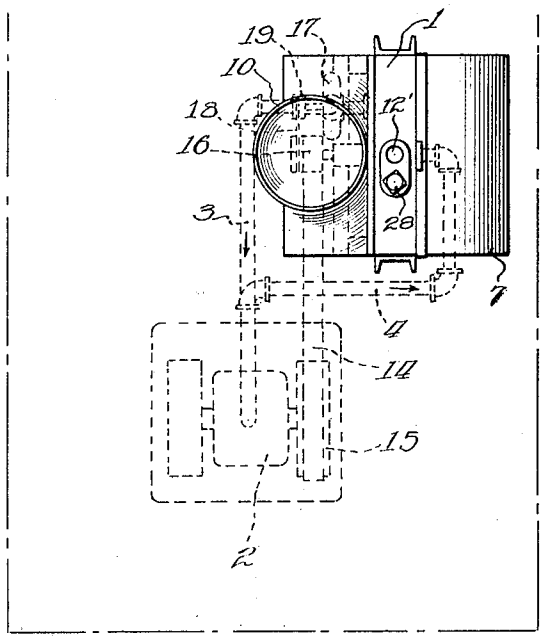


Fig. 1.

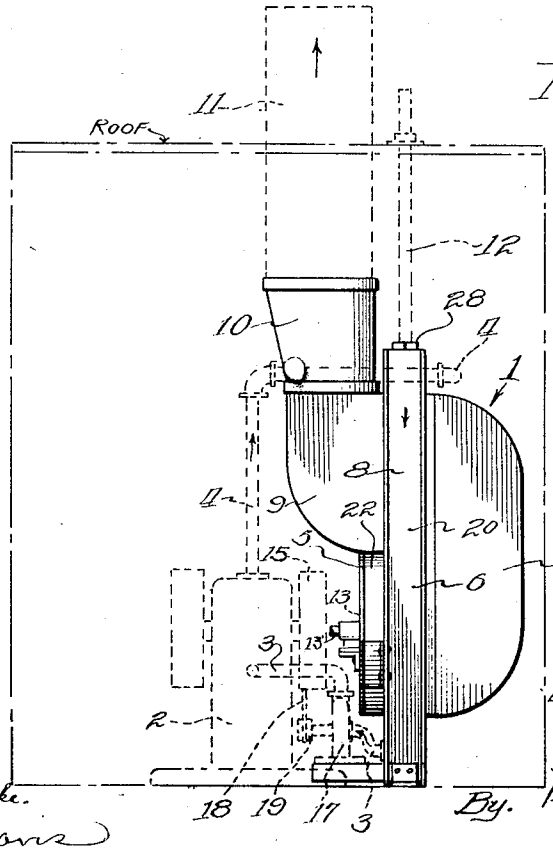


Fig. 2.

Witnesses.
Arthur M. Franke.
Fred M. Dorr

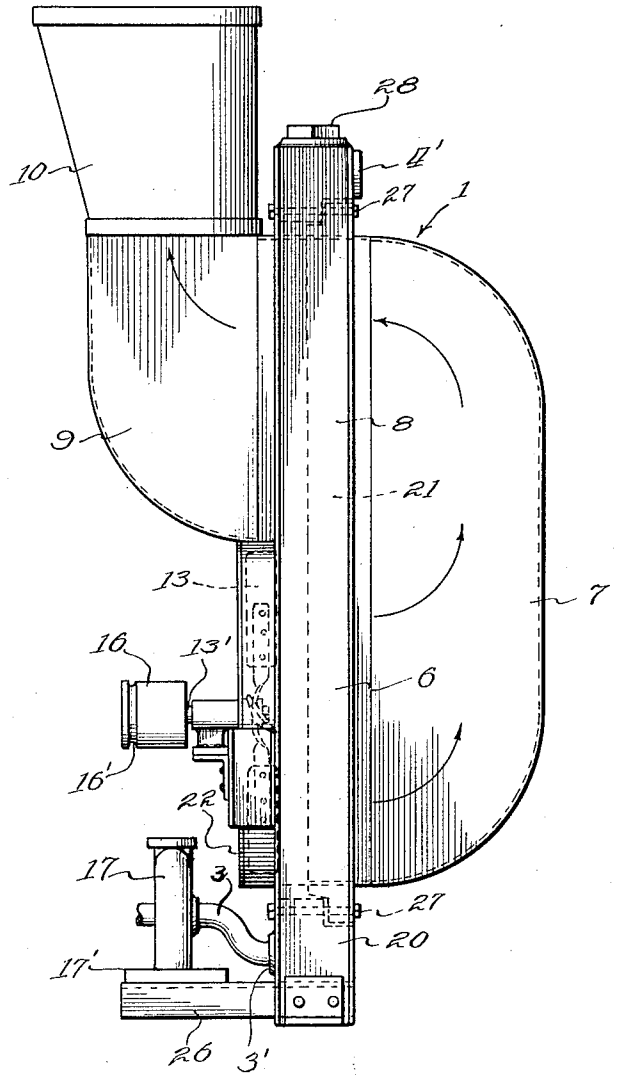
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Fig. 3.



Witnesses.
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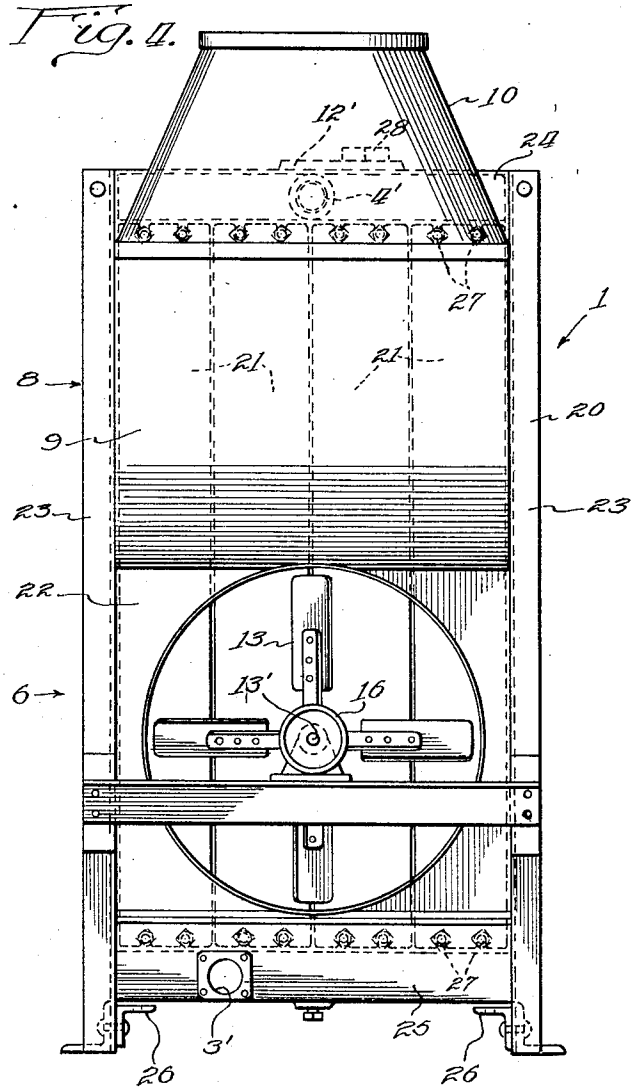
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Filed July 7, 1928 3 Sheets-Sheet 3

Fig. 4.



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Patented Oct. 11, 1932

1,881,776

UNITED STATES PATENT OFFICE

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COOLING SYSTEM

Application filed July 7, 1928. Serial No. 291,087.

This invention relates to means for transferring heat from one physical medium to another and more especially to devices commonly known as radiators such as used, for instance, in connection with internal combustion engines and the like.

The main objects of the invention are to provide a complete combined radiator and circulating unit of improved form and construction; to provide a radiator device in such form and adapted for such operation as to increase the heat transfer effect per unit of water or other heat carrying medium; to provide a long travel path both for the water and for the air in a radiator of this kind; to provide for movement of these media in mutually opposite directions substantially; to utilize the natural draft effect of a column of warm air for supplementing the fan effect; to provide such a radiator adapted for heavy duty on a minimum supply of water; to provide such a device as a whole in compact and unitary form adapted for minimum ground space consistent with accessibility and convenience in control and upkeep; and to provide a vertical unit radiator of the character described in upright series stage form. These and other objects will more fully appear.

The following is a brief description of a vertical unit type of radiator with a fan combined therewith. This was developed primarily for installation in the oil fields where there are many engines operating from 30 to 80 H. P. in pumping plants, and for other uses where a thermo-siphon system is used in connection with a water tank placed either on the roof or on a trestle adjacent thereto. While a thermo-siphon system operates reasonably well under ordinary conditions on a pumping well, when operated under a heavy load the motor usually runs very hot. Furthermore, when moving the installations from one location to another it is necessary to dismantle the wooden tanks which are commonly used for water storage purposes, and this occasions serious delay, which the present invention overcomes. The radiator herein described and claimed is designed on the counter-current principle whereby the hottest water comes in contact with the hottest air when the latter is leaving the radiator, and the cooled water about to leave the radiator comes in contact with the coldest incoming air. The radiator is designed to obtain primarily a longer travel of the water than is usual in the ordinary square type of radiator, and also to obtain a longer travel of the air than is usual, and to reduce the size of the fan required and the power consumed. In the case of a small vertical unit for a 40 H. P. engine the radiator is 24″ wide and 40″ high, and the fan 20″ in diameter requiring approximately 1¾ H. P., whereas the usual type of radiator would be 30″ square and would use a 26″ fan, requiring about 2½ H. P.

The apparatus here shown uses a blower type of fan, whereas a suction type of fan has usually been used heretofore. This fan drives the air through the lower portion of the radiator and through a sheet metal front connection and through the upper portion of the radiator. A shallow type of core is used, and hence more efficient results are obtained from the air delivered. Furthermore by connecting a stack through the roof to the discharge casing, not only does the stack assist the small size fan in pulling the air through the radiator core, but in cold weather under some conditions it is practicable to remove the belt from the fan pulley and use only natural draft for the purpose.

An illustrative embodiment of this invention is shown by the accompanying drawings in which:—

Figure 1 is a plan of the radiator and operating mechanism or engine, the latter being shown by dotted lines and the outline of the room also being indicated by dot and dash lines.

Fig. 2 is a side elevation of the equipment shown in Fig. 1, the roof and stack being shown in dot and dash outline.

Fig. 3 is a much enlarged side elevation of the radiator proper, substantially as viewed in Fig. 2.

Fig. 4 is a rear elevation of the device shown in Fig. 3, as viewed from the left with the pump and its supporting plate omitted.

In the construction shown in the drawings, referring first to Figs. 1 and 2, the improved radiator unit 1 and the internal combustion engine 2 are built separately and are mounted diagonally adjacent on the floor. They are connected by pipes 3 and 4 for circulation of water through the engine jacket and the radiator as will be apparent. Pipe 3 carries cooled water from the base of the radiator to the lower part of the engine jacket, and pipe 4 carries hot water from the upper part of the jacket to the top of the radiator. Air for cooling the radiator is admitted in the lower part at 5, under forced draft. It passes directly through the lowermost stage 6 of the radiator, thence upward through the front casing member 7, thence backward through the second stage 8 of the radiator to the discharge chamber 9 from whence the air in its heated state is discharged upward through the connector 10 into the stack 11 leading upward through the roof to the open air. In order to provide for the escape of steam from the radiator 1 a vent tube 12 is provided therefor also extending to the open air. This tube also serves as a stand-pipe reservoir for a limited extra supply of water to replace evaporation or other loss.

In order to provide a positive and forced draft into the radiator intake 5, a fan 13 of the blower type is mounted therein and operated by connection to the engine, the belt 14 being carried by the engine fly wheel 15 and the relatively small pulley 16 on the fan shaft 13′. A rotary pump 17 is connected in the water circuit as in the pipe 3. This pump is driven by a belt 18 carried on the pump pulley 19 and on the outer edge of fan pulley 16, which is grooved at 16′ to receive the narrow V-belt 18. The pump rests on a cross plate 17′.

The radiator unit as a whole, referring now to Figs. 3 and 4, comprises mainly a rectangular frame 20, a plurality of interchangeable upright core sections 21, a fan casing 22, and said members 7, 9 and 13. The frame 20 includes a pair of upright side bars 23, a top manifold 24 and a bottom manifold 25, foot members 26, and the cross plate 17′ for pump 17. The frame 20 is tall and narrow and the sections 21 connecting said manifolds are correspondingly long, thus providing for the series stage "vertical unit" operation, air passing through the sections reversely at the top and bottom respectively, as indicated by the arrows.

The top manifold 24 has an aperture at 12′ for connecting the pipe 12 and another aperture at 4′ for connecting the pipe 4. The manifold 25 has an aperture 3′ for connecting pipe 3. The connection 10 is rectangular and oblong at its lower end to fit the top of member 9, but at the top it is round to receive the pneumatostatic draft pipe 11. The sections 21 are held in place by the bolts 27.

The water is driven from pump 17 through the upper section of pipe 3 to the jacket of engine 2, thence through pipe 4 to entrance 4′ at the top of the radiator, thence down through the core sections 21 past stages 8 and 6 to the exit 3′ at the bottom of the radiator and thence through the lower section of pipe 3 back to the pump. The rapid flow of the water through the serial stage radiator makes for economy of space and water and permits a relatively small fan to suffice.

The initial cost of the outfit as a whole is also minimized due to the smaller permissible size of unit resulting from a more intensive use of given volumes of air and water and a wider range of the temperature cycle for the water. It is readily installed in connection with a plant already in use and without disturbing the setting of the old engine.

It will be noted that the water connection from the engine runs into the top cast iron section or manifold of the radiator, and that directly over same is a large vent pipe connection, which in the event of any steam developing due to overload will immediately vent the radiator through the roof instead of through the usual overflow connection. This vent pipe also serves the purpose of an expansion tank when the volume of water is increased due to temperature of perhaps 200° or more, and it also serves as a make-up pipe whereby to a limited extent loss of water by evaporation is replaced sufficiently to keep the circulation system full and operative. These points are important in fields where only bad water is obtainable, and where water has to be treated, and would be wasted through the overflow pipe on the ordinary type of radiator. Adjacent to the vent pipe is an overflow filler connection 28 and loosening the plug in this connection will always indicate whether or not the system is filled with water. The pipe 12 may communicate with a water reservoir not shown on the roof.

The radiator proper is made up of a sectional core such for instance as shown in Patent No. 1,606,204 so that in the event of any damage or leaks developing in any section such section can be removed and repaired and replaced. Plugging the holes in the top and bottom header castings permits using the radiator during this repair interval.

It is intended that this type of radiator, because of these numerous features may have a wide application in connection with the existing engines as well as new installations. The principles involves are basic and sound and the advantages indicated are of real value for practical operation.

These units may well be developed in standard sizes for 40, 60, 80, 100 and 120 H. P. units, and larger units may be made if desired. In fact, sectional type radiators of this general design have been made for 450 H. P. Diesel engine requirements.

Although but one specific embodiment of this invention is herein shown and described, it is to be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of the invention as defined by the following claims.

I claim:

1. A radiator of the class described comprising a frame including top and bottom headers, a core element disposed between and connecting said headers, a front casing providing a passageway connecting the lower and upper parts of said core element for multiple passage of air through said element, and an upwardly facing air discharge casing secured to the back side of the upper part of said frame whereby a natural draft is induced by reason of convection.

2. A radiator of the class described adapted for independent mounting, said radiator comprising a frame, including side bars and top and bottom headers therebetween, a core located between the headers and connected therewith, supporting members connected with the side bars beneath the bottom header and extending to one side of the radiator, a cross member extending between and secured to said supporting members, a fan for the radiator on the same side as the cross bar and carried by the radiator, a water circulating pump for the radiator on the same side as the cross bar and mounted thereon.

3. A radiator of the class described comprising upper and lower headers, a vertically elongated core disposed between and connecting said headers, a front casing extending between said headers for the full vertical extent of said core and providing a passageway connecting the upper and lower parts of said core for multiple passage of air through said core, a fan casing disposed on the opposite side of the core from the front casing and in proximity to the lower portion of said core, a fan in cooperative relation to said casing for forcing air transversely through the core, then up through the casing and then in a reverse direction transversely of the core, and a discharge chamber disposed on the same side of the core as the fan casing but adjacent the upper part of the core for receiving and carrying off the air passing through the upper part of the core.

Signed at Chicago, Illinois, this 5th day of July, 1928.

DANIEL T. MacLEOD.