Feb. 18, 1930. F. HUBER 1,747,172

COOLING SYSTEM FOR HORIZONTAL MOTORS

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Fig. 1.

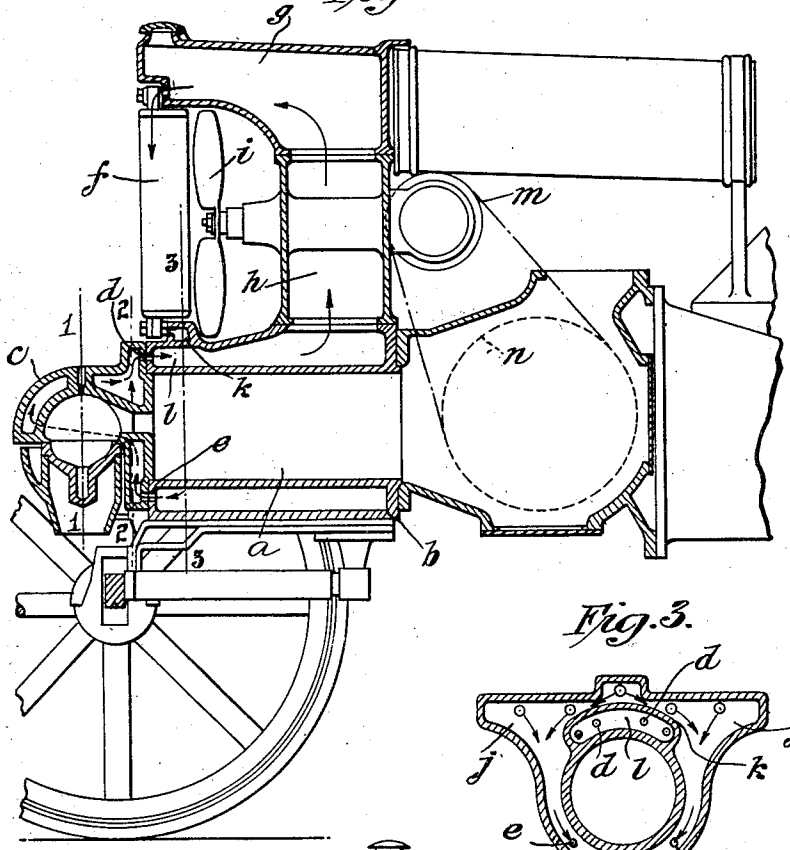
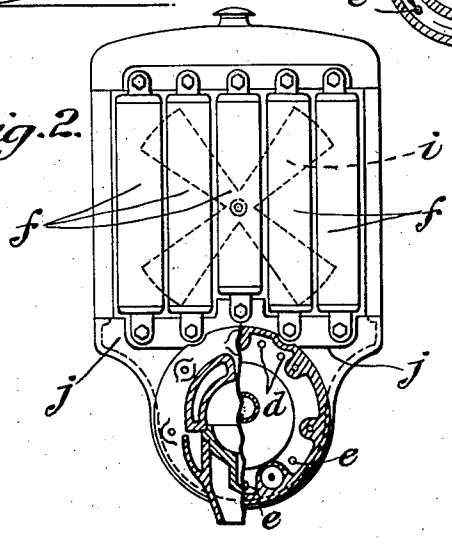


Fig. 3.

Fig. 2.



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Fig. 4.

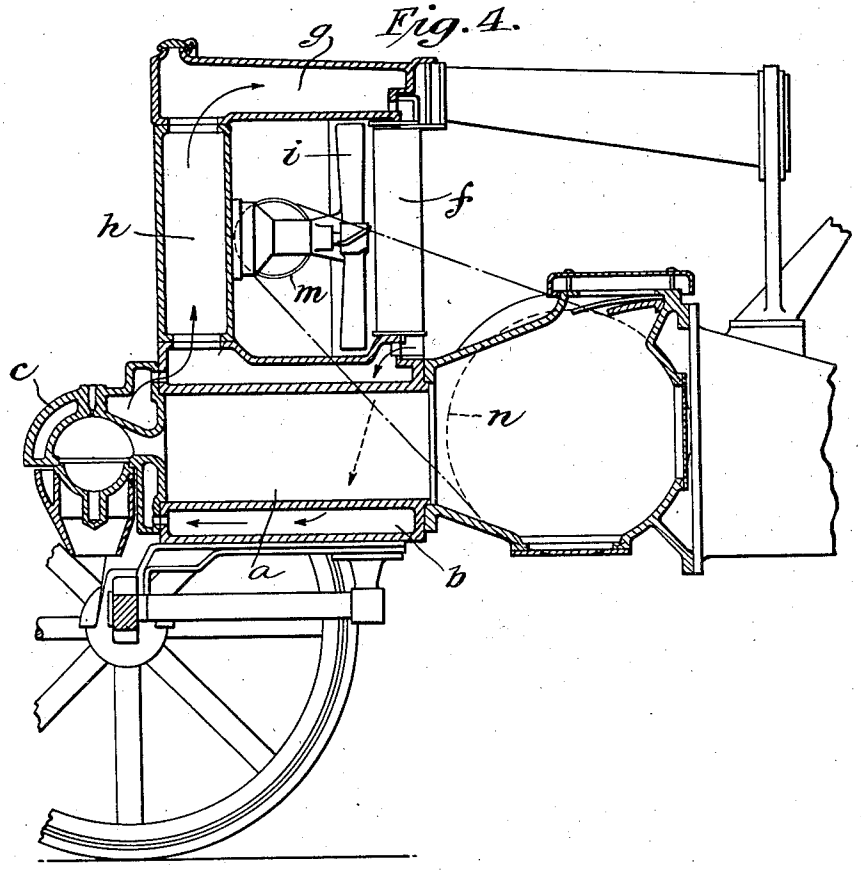
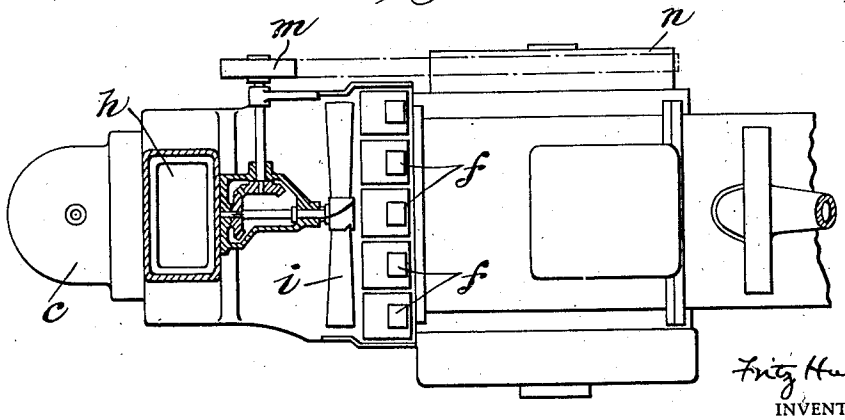


Fig. 5.



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Fig. 6.

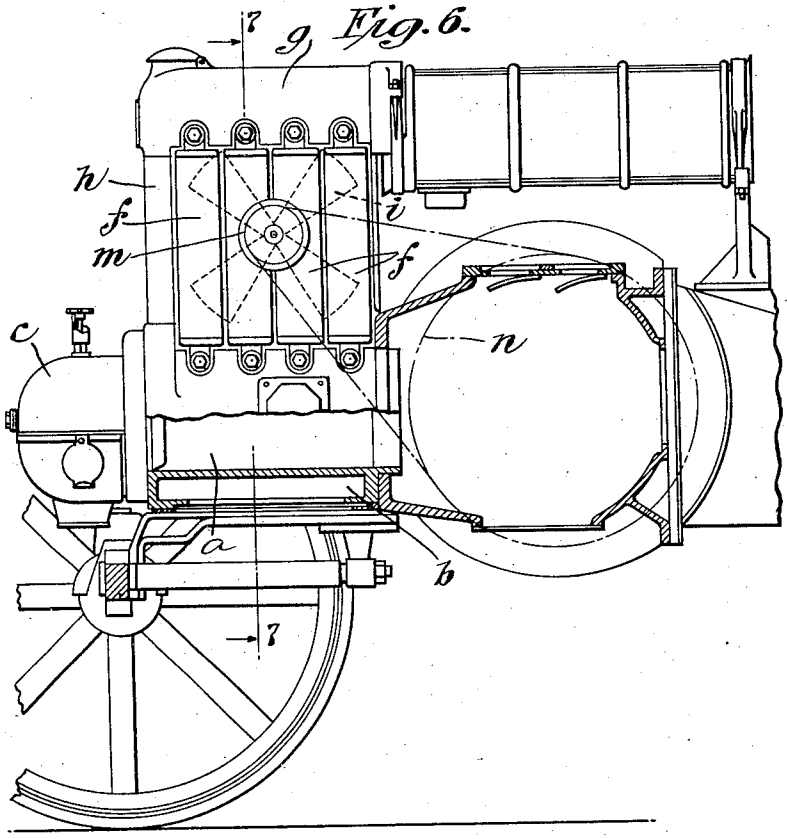
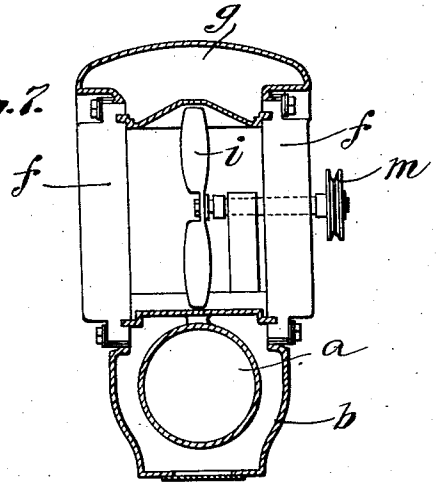


Fig. 7.



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UNITED STATES PATENT OFFICE

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COOLING SYSTEM FOR HORIZONTAL MOTORS

Application filed February 14, 1929, Serial No. 339,816, and in Germany December 2, 1927.

This invention relates to a cooling system for horizontal heavy oil motors, such as are used for commercial vehicles and particularly for tractors.

A water evaporation system is at present generally employed for cooling motors of this type. Such cooling system affords the obvious advantage that it can be so mounted as not to interfere with the removability of the cylinder head—a requirement which in motors of the type in question is of much importance for the reason that its cylinder head has to be taken off from time to time for the removal of the combustion-residue which is deposited with accumulates therein. Moreover, since such vehicles as are equipped with these motors are often used under conditions in which no technically trained personnel is available, as for instance in the case of tractors used in agriculture, the removability of the cylinder head must be provided for in such simple manner that unskilled persons may be able to do the work.

The evaporation system of cooling, on the other hand, has the disadvantage that a great deal of the water used is lost, thus generally necessitating the carrying of a considerable reserve supply of water for work in the field; whereas, with other types of vehicles, equipped with vertical explosion engines, the recooling of the radiator water is usually effected in tubular or celular radiators under conditions in which there is practically no loss of water.

The object of the present invention is to provide a tubular radiator which can be used in connection with horizontal heavy oil motors, in order to effect a saving of water, and at the same time is so constructed that it can be installed in place without in any way interfering with the removability of the cylinder head.

Another object of the invention is to provide, for the most efficient circulation of the cooling water, a radiator in which the water rises and passes into the radiator from the hottest part of the motor, generally the cylinder head, without however any direct connection between the riser pipe of the radiator and the cylinder head to interfere with the removability of the latter.

With these ends in view the invention comprises, briefly stated, the attachment of the lower ends of the radiator tubes to and their connection with the water jacket of the motor cylinder, which thus serves as the bottom tank of the radiator, and, secondly, in the provision of passages which when the cylinder head is in place will connect its jacket with the forward end of the cylinder jacket and of means permitting the heated water as it comes from the upper of these passages to rise to the top tank of the radiator from which it descends through the radiator tubes.

Three constructions, differing in their details but all illustrating practical embodiments of the invention, are shown, by way of example, in the accompanying drawings, in which—

Figure 1 is a view, partly in side elevation and partly in longitudinal vertical section, of certain of the main elements of a horizontal motor equipped with my improved radiator; Fig. 2 is a front end view of the same, with half sections on the lines 1 1 and 2 2 of Fig. 1, respectively; Fig. 3 is a section on the line 3 3 of Fig. 1, looking from the rear end of the motor; Fig. 4 is a view, similar to Fig. 1, showing a modification of the top of the cylinder jacket and of the radiator; Fig. 5 is a plan view of such modification, with parts removed and with other parts shown in section; Fig. 6 is a view, similar to Figs. 1 and 4, showing a further modification; and Fig. 7 is a section on the line 7 7 of Fig. 6.

Referring to the drawings, *a* is the cylinder of the motor, *b* is the cylinder jacket and *c* is the cylinder head. The cylinder head, which is also double-walled to provide a water jacket, is attached to the forward end of the cylinder by bolts as usual, and its jacket is connected, top and bottom, with the jacket of the cylinder by passages *d* and *e*, respectively, provided by registering openings in the adjacent end walls of the two parts. The cooling system comprises, in addition to the cylinder jacket, the tubes *f* which constitute

the cooling elements, the top tank *g*, a riser or pipe *h* connecting the cylinder jacket with the top tank, and a fan *i*.

As shown in Figs. 1–3, the top of the cylinder jacket *b* is expanded on each side, at *j*, at its forward end; and to this end, which serves as a manifold, the lower ends of the radiator tubes *f* are attached and connect therewith in the usual or in any suitable manner. The upper ends of these tubes are similarly attached to and connect with the forward end of the top tank *g*. The riser or pipe *h* connects the rear end of the cylinder jacket with the top tank. The upper part of the cylinder jacket is here partitioned by an inner wall *k* to provide a channel *l* through which the heated water entering the jacket from the cylinder head by the passages *d* is conducted rearwardly to the lower end of the riser *h*. The fan *i*, carried by a shaft which extends rearwardly through the riser *h* and is enclosed therein, is driven through suitable bevel gears (not shown) by a belt pulley *m* connected by belt with a pulley *n* mounted on the crank-shaft of the motor. The circulation of the cooling water through the water jackets and radiator, as indicated by the arrows, is as follows: From the top of the jacket of the cylinder head, where it is heated to the highest temperature, the water passes through the passages *d* into the cylinder jecket and thence through the channel *l* to the pipe *h*, and, rising therein to the top tank, enters and passes down through the tubes *f* and thence around the motor cylinder and through the passages *e* into the bottom of the jacket of the cylinder head.

In the modification illustrated in Figs. 4 and 5, the relative position of the radiator tubes and the riser is reversed. The tubes *f* are attached to the upper part of the cylinder jacket at its rear end, which as shown is expanded laterally to form a manifold therefor, and to the rear end of the top tank, while the riser *h* connects the forward end of the cylinder jacket to the forward end of the top tank. The fan *i*, mounted immediately forward of the radiator tubes, is carried by a forwardly extending shaft which is driven through bevel gears by belt pulley *m* from pulley *n* on the crank-shaft of the motor. The circulation of the cooling water is substantially the same as before. Here, however, the heated water entering the forward end of the cylinder jacket from the cylinder head rises directly therefrom through the pipe *h* to the top tank and descends therefrom through the radiator tubes, thereby rendering unnecessary the provision of any special channel within the cylinder jacket.

In the further modification, shown in Figs. 6 and 7, the riser *h* connects the cylinder jacket with the top tank at their forward ends, the heated water from the cylinder head and forward end of the cylinder jacket rising directly therein as in the first modification, and the tubes *f* are attached in two longitudinal banks to the opposite sides of the jacket and tank. In this case the fan *i*, mounted in the open space between the two banks of tubes, is driven by belt-pulley *m* fixed upon its transversely extending shaft.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a motor of the type described having a jacketed cylinder and cylinder head, of a cooling system of the closed circulating type comprising a tank mounted above the motor cylinder and connected by a riser and by cooling elements directly with the jacket of the cylinder and indirectly through the jacket of the cylinder with the jacket of the cylinder head.

2. The combination, with a horizontal oil motor having a jacketed cylinder and cylinder head with connecting passages top and bottom, of a cooling system of the closed circulating type comprising a tank located above the motor and connected by a riser and by cooling elements with the jacket of the cylinder back of the cylinder head, providing a circulation of the cooling medium from the upper part of the jacket of the cylinder head to the jacket of the cylinder and thence through the riser to the tank and from the tank through the cooling elements to the jacket of the cylinder and thence to the lower part of the jacket to the cylinder head.

3. A cooling system for horizontal oil motors comprising a water-jacket for the motor cylinder, a water-jacket for the motor cylinder head connected top and bottom with the jacket of the motor cylinder, a tank located above the motor cylinder and connected with its water-jacket by a riser and by cooling elements, and means for conducting the cooling medium entering the jacket of the cylinder through the upper connection from the jacket of the cylinder head to the lower end of the riser and for conducting the cooling medium from the lower ends of the cooling elements through the jacket of the cylinder to the lower connection with the jacket of the cylinder head.

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