May 31, 1932. H. WALKER 1,860,638

FIRE ENGINE

Filed April 2, 1930

Fig. 1.

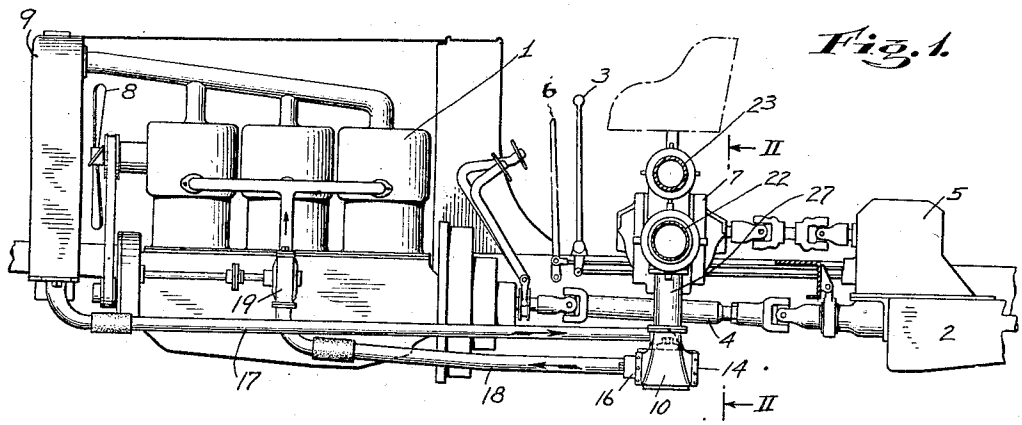


Fig. 2.

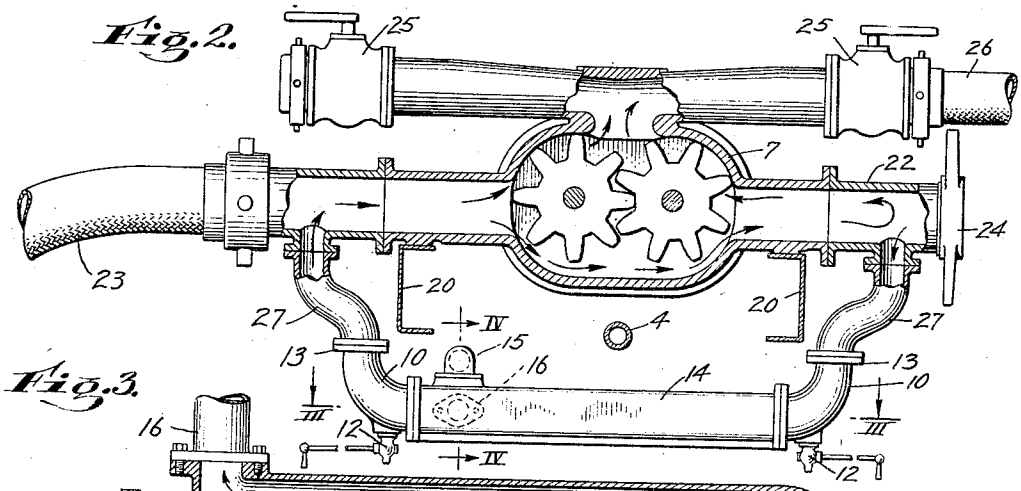


Fig. 3.

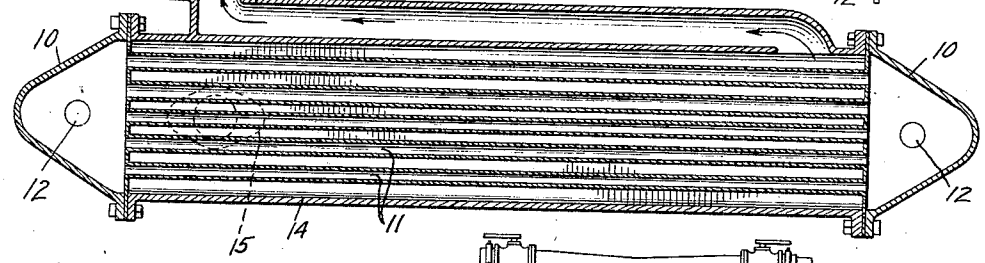


Fig. 4.

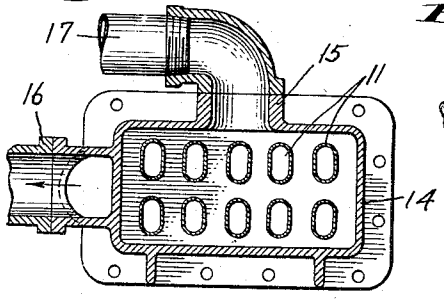
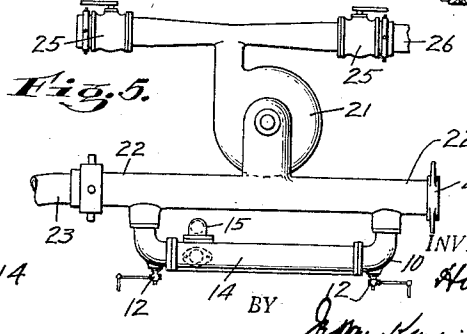


Fig. 5.



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UNITED STATES PATENT OFFICE

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FIRE ENGINE

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The invention relates to automotive fire engines or pumpers, particularly those in which the propelling engine, which also operates the pump, is water-cooled or liquid-cooled and its purpose is to compensate for the loss of cooling effect which occurs when the engine is in operation driving the fire pump. The vehicle being stationary on such occasions, there is less air flow through the engine radiator and overheating on that account is likely to occur. The object of the invention is to utilize the temperature of the hydrant or pump water for providing additional cooling effect at such times but without diminishing or affecting the fire-pump output and without resort to large or cumbersome water passages or chambers for this purpose, thus, in a compact device, preserving the capacity of the pump quite the same as though such additional cooling were not effected. To this end the invention involves the use of a heat exchanger connected to the pump and engine according to the principles hereinafter explained, and as exemplified in the accompanying drawings illustrating the form of the invention at present preferred.

In said drawings, Fig. 1 is a side elevation of so much of an automotive fire engine as is necessary to understand the invention.

Fig. 2 an elevation partly in section and more or less schematic in form, of the fire pump and its connections.

Fig. 3 a horizontal section on line III—III of Fig. 2.

Fig. 4 a section on line IV—IV of Fig. 2, and

Fig. 5 a modification.

It will be understood that in motorized fire apparatus there is a propelling engine, a transmission gear set 2 with a shift lever 3, by which the drive ratio of the engine to the propeller shaft 4 and traction wheels is controlled, and a power take-off represented by the gear casing 5 controlled by lever 6. This take-off, when in use, causes the engine to drive the fire pump 7, as will be understood from the drawings, and is used only when the vehicle is stationary, drawn up along side of a hydrant or other source of water. At such times the engine cooling is accomplished solely by the effect of the air fan 8 drawing air through the radiator 9, which is included, as usual, in the closed circulating cooling system of the engine. The engine cooling accomplished in this way, by fan only, is not ordinarily sufficient to keep the engine from overheating, the vehicle being stationary and therefore deprived of the draft incident to the normal movement of the radiator through the atmosphere.

To avoid such overheating, various schemes have been suggested, all of them however involving more or less restriction on the water flow through the fire pump and resulting in a less vigorous stream from the latter than if such extra cooling had not been taken from it. The present invention accomplishes the desired extra cooling effect without imposing any appreciable restriction whatever on the output on the pump and being wholly automatic becomes effective whenever the pump is set in use.

To accomplish this object any suitable form of heat exchanger is used such, for example, as that separately shown in Figs. 3 and 4, and which comprises two water passages in close heat transferring relation to each other, one being included in the engine cooling circuit and the other being arranged to conduct a flow of hydrant water taken from the fire line, preferably on the suction side of the pump. As will be apparent from the drawings the hydrant water passage is constituted by the header boxes 10 connected with each other through a series of multiple tubes 11; these boxes have drain cocks 12 through either one of which the passages may be emptied of water to avoid freezing and they also have coupling or connection flanges 13 for connection to the pump mechanism, as presently described. The other water passage is constituted by the space within the casing 14 which surrounds the multiple tubes 11, which may be externally ribbed, if desired, and has its entrance on the top side marked 15 and its outlet on the forward side marked 16. The top side entrance is connected through the pipe 17 with the base of the radiator 9 and the outlet 16 to the return pipe 18 leading to the engine water jackets

through the engine-driven circulating pump 19, which is usually present. Although referred to as a water circuit, it will be understood that within this term is included any liquid suitable for engine cooling purposes.

The fire pump 7 is mounted transversely on the vehicle chassis 20 and may consist of any suitable type of pump. Fig. 2 indicates it as a gear pump and Fig. 5 as a centrifugal pump, being there marked 21. In either case, it is provided with at least two inlet connections 22, one preferably on each side of the vehicle and to which the supply hose from the hydrant is to be connected, as indicated at 23. Normally only one of these connections is used at a time and the one not in use is closed by its cap 24 and is termed the dead end of the pump. The pump also has two outlet or discharge connections 25, one on each side of the vehicle to one or both of which the fire hoses, such as 26, are to be connected. The pump may and generally does have other appurtenances not necessary to be shown in the present case.

The heat exchanger is mounted directly below and parallel to the transversely disposed fire pump in which position the drain cocks 12 are easily accessible, and each of its coupling flanges 13 is connected by the curved drop pipes 27 to the two opposed water inlets 22 of the pump, the drop pipes being long enough to locate the heat exchanger just below the propeller shaft 4. In this arrangement a flow of hydrant water is established through the heat exchanger from its point of connection with the particular inlet connection 22, which happens to be the dead end, to its opposite point of connection with the other inlet 22, which is then connected by the hose 23 to the hydrant or water source, the flow being due to the head established in the dead end by the effect of the water velocity created by the pump, the water rushing toward such dead end in the direction of the arrows and causing a reverse flow through the heat exchanger, also as indicated by the arrows. Such flow, due to velocity head in the fire line, occurs without adding any appreciable work on the pump and engine as will be apparent and it is assisted, more or less, by the so-called thermo-syphonic effect resulting from the fact that the hydrant water passing through the multiple tubes is warmed therein by the heat of the engine jacket water and consequently tends to rise into the fire line to be replaced by cool water therefrom. Such thermal flow would take place even in the absence of any flow due to velocity head and will be seen therefore to be supplemental thereto and also to be the result, in part at least, of the location of the heat exchanger at a lower level than the pump. Flow through the exchanger thus occurs from two causes, neither of which imposes any appreciable added burden on the pump and since use is made of the hydrant water on the suction side of the pump, such an exchanger can be compactly disposed on the vehicle without complicating the pump delivery mechanism and related parts, or in any way impeding access to the automotive engine or other mechanism. So far as the passage for the hydrant water is concerned, the action of the heat exchanger is reversible, that is to say, if the intake hose 23 were connected on the opposite side of the pump and the cap 24 on the opposite side from that shown, then the hydrant water flow through the exchanger would be the reverse of that shown, but the cooling effect would be the same and it will be apparent from the drawings, the dimensions of which are substantially to scale, that the results referred to are accomplished with relatively small water passages, making an apparatus well suited by its compactness and lightness in weight to form a part of automotive fire equipment.

Its desirability for apparatus of this character, where simplicity is so essential, is further enhanced by the fact that control valves are entirely unnecessary. The ends of the hydrant water passage being in free communication with the fire line at all times and connected therewith at points of different velocity head, the cooling flow through said passage is automatically initiated in response to operation of the pump and since the flow is proportional to the rate of pumping the engine temperature is effectively controlled at all times and without requiring manual adjustment or valve manipulation, which not only take time when even seconds are valable, but are likely to be overlooked.

While Fig. 5 illustrates the application of the same principles to a centrifugal fire pump, as already stated, it will be apparent that the nature of the pump is immaterial, since in any case there will be a dead end where the velocity head will be available for creating flow of hydrant water through the exchanger and the invention is in no respect limited to the style of pump employed, although the gear pump shown in Fig. 2 is preferred.

I claim:

1. The combination with an automotive engine having a cooling-water circuit and a power take-off for driving a fire pump, of a heat exchanger comprising one water passage included in said cooling-water circuit and another adjacent water passage having its two ends connected to the fire line at points therein, on the same side of the pump and between which there is a pressure difference due to the velocity head in said fire line.

2. The combination in a self-propelled fire engine, of the propelling engine connectible to the traction wheels and having a cooling-water circuit including a water pump, a power take-off for driving a fire pump, and a heat exchanger comprising one water pas-

sage included in said engine cooling-water circuit and another water passage having its ends connected to the fire line at points both on the same side of the fire pump, one of said points of connection being subject to velocity head in said fire line whereby water flow is established through said heat exchanger from said point of connection to the other point.

3. The combination with an automotive engine having a cooling-water circuit and a power take-off for driving a fire pump, of a heat exchanger comprising one water passage connected with said cooling water circuit and another water passage having both its ends connected to the fire line, on the same side of the pump, and arranged to permit thermo-syphonic flow of water to said fire line by reason of the heat transferred from said cooling-water circuit.

4. The combination with an automotive engine having a cooling water circuit and driving a pump, of a heat exchanger comprising one water passage included in said circuit and another water passage having its ends connected with the pump-line and both on the same side of the pump, said exchanger being located at a lower level than the pump to promote thermo-syphonic flow through said other passage.

5. The combination with an automotive engine having a cooling-water circuit and a power take-off for driving a fire pump, of a heat exchanger comprising one water passage connected with said cooling-water circuit and another water passage having both its ends connected to the fire line, at points on the same side of the pump, one of which points is subject to a velocity head in said fire line suited to establish water flow from said point through said other passage to the other point, and said other passage being also arranged to permit thermo-syphonic water flow therethrough by the effect of heat received from said cooling water circuit, whereby both the velocity head and the thermal condition promote heat absorption from the engine circuit.

6. The combination with an automotive engine having a cooling-water circuit and a power take-off for driving a pump, of a heat exchanger having one water passage connected with said cooling water circuit and another water passage having both its ends connected to the suction side of the pump and receiving and conducting water by virtue of the velocity head at one of its said points of connection.

7. In apparatus of the kind described, an automotive engine driving a pump having double opposed suction openings to constitute water inlets, a heat exchanger connected to and betweeen said inlets and means for transferring engine heat to said exchanger.

8. In apparatus of the kind described, an automotive engine adapted for driving a pump and having a cooling-water circuit, a heat exchanger connected to said circuit and having a water passage connected between points of different pressure on the suction side of the pump; said exchanger being located below said pump.

9. The combination with an automotive engine having a cooling-water circuit, a power take-off and a fire pump driven thereby and provided with a water inlet and a dead end, of a heat exchanger having one water passage connected with said circuit and another water passage having its one end connected to the water inlet and its other end to the dead end.

10. In a motor fire pumper, the combination with an automotive engine having a cooling-water circuit and connections for driving a fire pump, of a heat exchanger comprising one water passage included in said circuit and another water passage connected with the suction side of the fire line, one point of connection being between the pump and the source of water and the other being beyond the pump where the suction velocity establishes a pressure head.

11. In a motor fire vehicle, the combination of a propelling engine adapted for driving the traction wheels and having a power take-off, a fire pump transversely disposed on the vehicle having water inlets on opposite sides and a heat exchanger also transversely disposed on the vehicle and below said pump and connected thereto, one part of said exchanger forming a passage for conducting pump water and another part being connected in cooling relation to the engine.

12. In an automotive fire pumper the combination of a propelling engine, a fire pump transversely disposed on the vehicle frame and adapted to be driven by said engine, water inlets for said pump extending on opposite sides therefrom and beyond the vehicle frame, a heat exchanger connected to said extended inlets and means for transferring engine heat to said exchanger.

13. In automotive fire apparatus the combination of a propelling engine having a cooling water circuit and adapted to drive a fire pump and having a power take-off from its propeller shaft for such purpose, the combination of a heat exchanger located in rear of the engine and adjacent said fire pump and including two heat transferring water passages, one of which is connected in said cooling water circuit and the other of which is connected to the fire line to receive hydrant water therefrom.

14. In combination an automotive fire pumper having a propelling engine and a cooling-water circuit, a pump having intake and outlet connections for attachment to hose to complete the fire line, a power take-off from the engine for driving the pump, a water pas-

sage arranged in parallel with said fire line with its ends in free communication therewith at all times, said ends connected to the line at points of different velocity head to promote water flow through said passage in response to operation of the pump and a second water passage constituting a part of said cooling-water circuit and arranged in heat-exchanging relationship to said first passage.

15. The combination with an automotive engine having a cooling water circuit and a power take-off for driving a fire pump, of a heat exchanger comprising an outer water passage included in said cooling water circuit and an inner, adjacent water passage having its two ends connected to the fire line at points therein on the same side of the pump and between which there is a pressure difference due to the velocity head in said fire line.

16. In automotive fire apparatus, the combination of a water-jacketed engine having a continuous cooling water circuit and adapted to drive a fire pump, two water passages located adjacent the pump and arranged in heat exchanging relation to each other, said continuous cooling water circuit including the engine water jacket, a radiator, a connection to the top of the same from said jacket, a connection from the bottom of the radiator to one end of one of said passages and a connection from the other end of said passage back to the jacket, the other of said passages passing pump water.

In testimony whereof I have signed this specification.

HUBERT WALKER.