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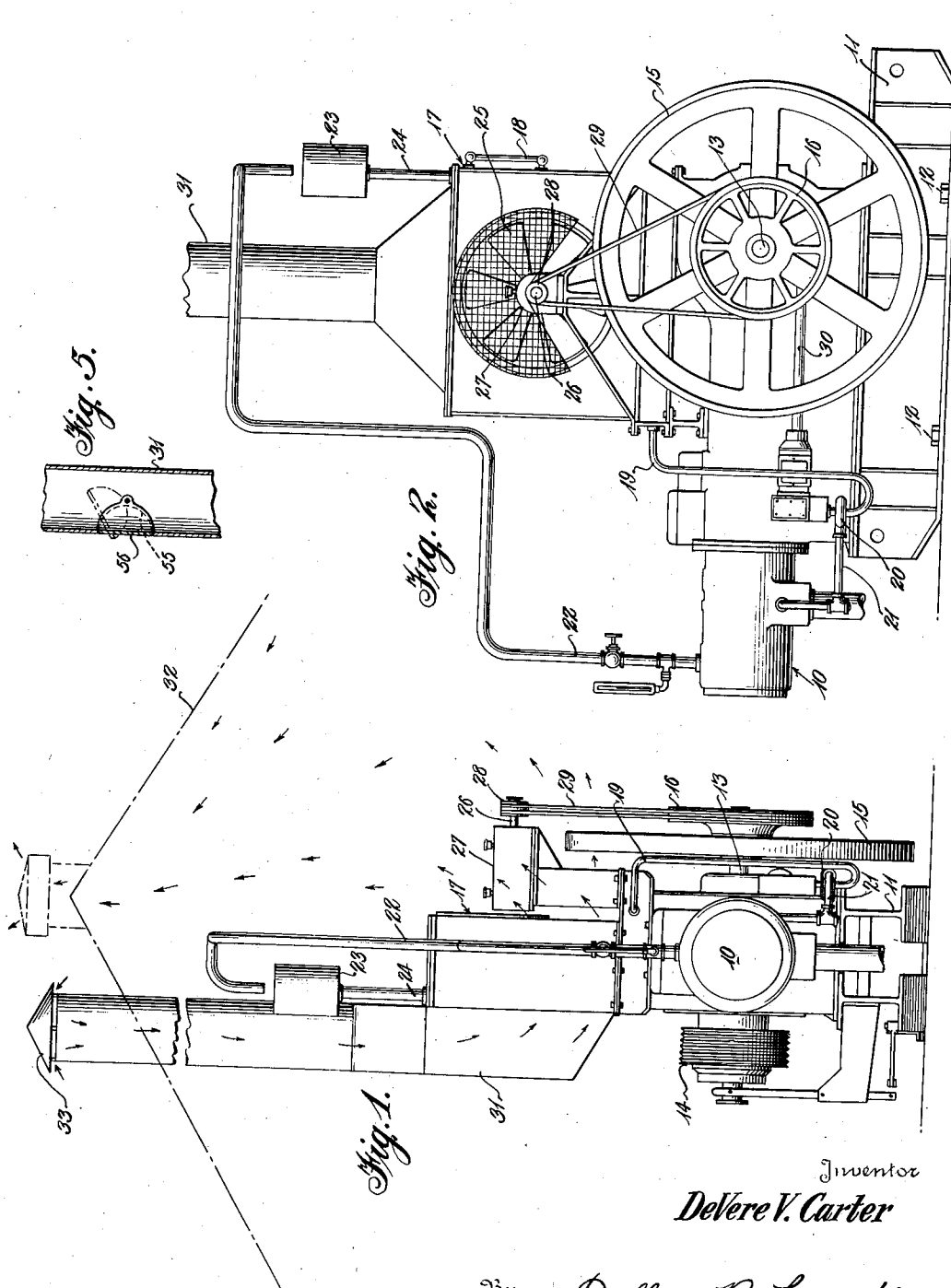
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2,200,214

ENGINE COOLING SYSTEM

Filed Jan. 7, 1939

2 Sheets-Sheet 1



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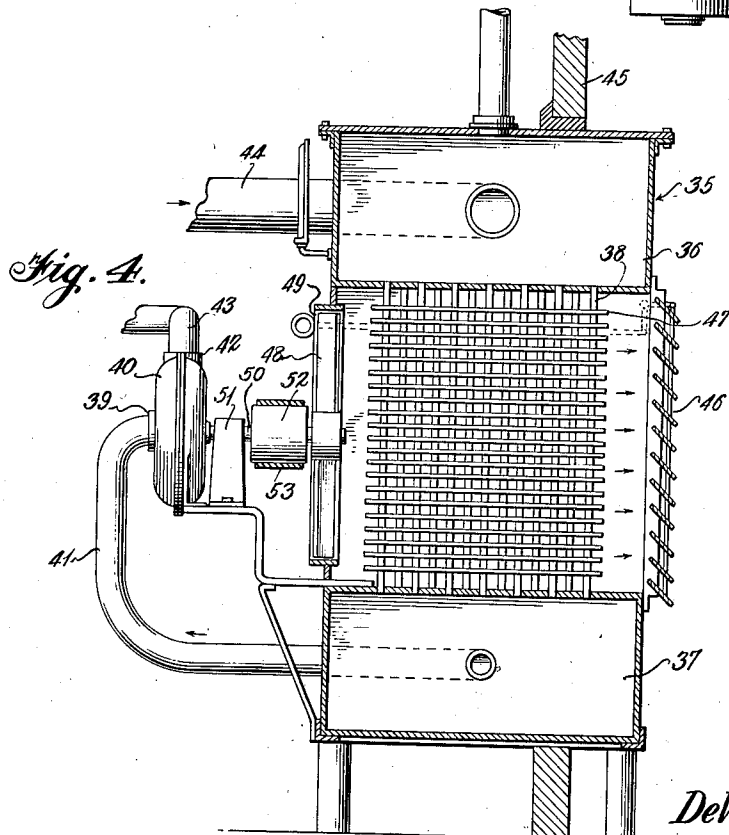
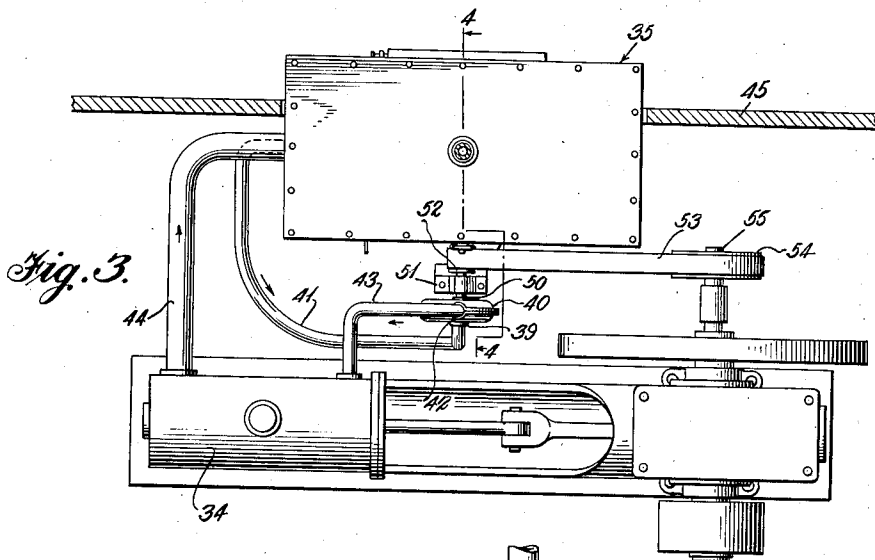
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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

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## ENGINE COOLING SYSTEM

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3 Claims. (Cl. 237-12.1)

This invention relates to a cooling system for heavy duty stationary engines of the fluid jacketed type and particularly to such a system operable in an enclosure to modify the temperature thereof.

Heavy duty stationary engines have a wide variety of applications in a number of important industries and in their many uses these engines have been provided with various cooling means and have been variously housed. This invention, however, is concerned chiefly with fluid cooled heavy duty engines of the type that are mounted within a housing, usually of a size only sufficient to accommodate the engine, driven equipment and one or more operators.

Equipment of this latter type has been generally used in the petroleum industry for pumping crudes through pipe lines. In this industry it is customary to pump oil through long pipe lines extending in some instances many miles between the wells and the refining plants and heavy duty stationary engines are commonly used to actuate the oil pumps. It has been found, however, that aside from the various pumps at the well and at the refinery, intermediate pumps must be provided along the line so that the pressure may be maintained. These pumps are usually driven by a heavy duty fluid cooled stationary engine and the engine and pump are commonly covered by a corrugated metal shelter of a size only sufficient to accommodate the equipment and operator. Such intermediate power supply stations along an extended pipe line are commonly termed "booster stations."

These "booster stations" are frequently located a great distance from each other and in more or less uninhabited localities, so that the sheds in which the engines are housed are, in many instances, completely exposed to the elements. Accordingly, the loosely constructed sheds may be rendered exceedingly cold in winter and excessively warm in summer.

Heretofore, there has been no method of warming the interior of these "booster stations" in winter, except by the installation of a heating plant; the cost of which is ordinarily too great to be financially feasible.

In summer, there has also been found considerable need for some method of modifying the engine room temperature, since at that time the cumulative effect of radiation from the engine, exhaust pipe and thin metallic walls subjected to strong sunlight may render the confined air unbearably hot.

When engines of the type here under consid-

eration are employed at points more or less remote from habitations, the problem of supplying a cooling medium has been of considerable importance. It has long been desired to provide a means for cooling the heavy duty engines employed in a manner such that the maximum economy in the use of the cooling medium may be attained.

In cooling the heavy duty engines, it has heretofore been the practice to provide a water storage tank outside of the engine house into the open top of which is delivered the heated water issuing from the water jackets of the engine. The water is cooled by being exposed to the outside air and after being cooled, is drawn off from the bottom of the tank and recirculated through the engine jackets. This cooling system, although reasonably satisfactory in that the engine is maintained at a suitable operating temperature, has the disadvantage of necessitating the exposure of a large surface of water to the outside air and losses by evaporation have been very great. In fact, the cooling is largely brought about by evaporation. Such losses frequently make it necessary to add several barrels of water to the cooling system within a single day. It is clear that when one of the engines of the type under consideration is operating in a locality remote from a large water supply, the amount of water attainable may be limited, or even if there is a sufficient supply, it may be difficult to transport the same for use in cooling the engine.

Not infrequently the water obtainable has been found to contain a high percentage of impurities such as calcium salts and the like. This condition causes a deposit within the water jackets of the engine and the deposit may be so great as to interfere with the proper functioning of the cooling medium. To remove such scale it is necessary to stop the engines and to disassemble the same, resulting in the effective loss of the power unit from the system and the consumption of considerable time.

Accordingly, it is an object of the present invention to provide a cooling system for stationary engines in which there may be a substantial economy of water consumption and in conjunction with said system to provide means for modifying the temperature of the shed in which the equipment operates. The present invention contemplates the provision of a fluid cooling system for stationary engines including a cooling unit spaced from but in substantially closed circuit with the fluid jacket of an engine. The unit is positioned intermediate the interior and exterior

of the room and the cooling of the fluid is effected by the passage of air in indirect heat exchange relationship therewith. By controlling the direction of flow of the air with respect to the interior of the shed, variations in the temperature thereof may be effected.

It is a further object of this invention to provide a cooling unit of the type in which the fluid from the engine is forced by means of a pump, through a heat exchanger in indirect heat exchange relationship with a current of air induced by a fan which may be reversible in order that flow of air in either direction may be caused by suitable operation thereof. The heat exchanger is placed in direct communication with the outside of the engine room, so that by driving the fan in one direction, air from within the room may be passed through the heat exchanger to cool the fluid passing therethrough and thereafter expelled to the outside air. When the fan is caused to operate in this manner, the room will be cooled to a substantial extent, since fresh outside air is constantly drawn into the room. When the fan is reversed, fresh air is drawn from the outside atmosphere through the heat exchanger and then into the room. When this is done, the air is heated as the fluid in the heat exchanger is cooled and the room temperature will be raised to render the engine house more comfortable during the winter months.

Thus, it will be seen, that the room temperature may be either raised or lowered as outside atmospheric conditions may dictate, thereby rendering the engine house far more comfortable for the operator and at the same time cooling the engine in a manner more efficient than that heretofore practiced.

Other objects and advantages will be apparent from the following detailed description of preferred embodiments of the invention when considered in connection with the annexed drawings in which:

Figure 1 is an end elevation of an engine and fluid cooling system therefor, showing a duct between the roof of the engine room and the heat exchanger;

Figure 2 is a partial side elevation of the system shown in Figure 1;

Figure 3 is a plan view of an engine and fluid cooling system showing the heat exchanger mounted in the wall of the engine room;

Figure 4 is a vertical section taken along the line 4-4 of Figure 3; and

Figure 5 is a partial elevation of the duct of Figure 1, showing a modification of the structure thereof.

Referring now to the drawings and more particularly to Figures 1 and 2 thereof, there are shown portions of an engine room which may be of the type suitable to accommodate only the engine, equipment driven thereby, and one or more operators. Within this room is engine 10 of the fluid jacketed internal combustion type resting on I-beams 11 which are fastened to the floor of the room at 12. Engine 10 is provided with a drive shaft 13 to which is keyed a suitable clutch 14 and a fly wheel 15. Adjacent the fly wheel and also keyed to shaft 13 is a sheave or pulley 16.

Above the engine 10 and suitably supported thereby is a heat exchanger unit 17 provided with vertical internal tubes, suitable headers to which the same are connected, and a liquid level indicator 18.

The lower header of heat exchanger 17 is con-

nected by a conduit 19 to the intake of pump 20. Another conduit 21 connects the exhaust of pump 20 to the intake of the water jacket of the engine 10. Leading from the exhaust of the water jacket of engine 10 is a conduit 22 which discharges into expansion tank 23 connected by conduit 24 to the upper header of heat exchanger unit 17.

Disposed within the housing of heat exchanger unit 17 is a fan 25 mounted on a shaft 26 suitably journaled in box 27. Keyed to shaft 26 is a pulley 28 which is driven from pulley 16 by a belt 29. The pump 20 is driven by a lay shaft 30 of the engine 10.

At the side of the heat exchanger 17 remote from the fan, the housing is connected to an air duct 31 which extends from the heat exchanger 17 through the roof 32 of the room into the outside air. A rain cap 33 is provided which may be of any suitable design.

The operation of the cooling system shown in Figures 1 and 2 will be apparent from the following discussion. When the engine 10 is functioning, the lay shaft 30 will be actuated to operate the pump 20. This will cause a circulation of the cooling fluid through the water jackets of the engine and the heat exchanger.

As the fluid passes down through the tubes of heat exchanger 17, it will come into indirect heat exchange relationship with a current of air which will be passed across the tubes as a result of the action of fan 25. Thus, the fluid is cooled. It will be noted that since the fan and pump are both driven from the engine 10, their relative speeds will be constant irrespective of the speed of the engine. This results in the maintenance of the cooling fluid at a substantially constant temperature over a wide range of operating speeds.

By thus maintaining the temperature substantially constant and because of the relatively small surface of fluid exposed to the air in expansion tank 23, it will be seen that evaporation of fluid will be rendered a negligible factor and that the cooling system will operate over long periods of time without the necessity of adding more of the cooling medium thereto.

Air may be withdrawn from the room through the heat exchanger for cooling the engine house; or for heating the same, air may be drawn into the room as shown by the arrows in Figure 1 by driving fan 25 in opposite directions. For reversing the fan, it is only necessary to cross the belt 29 at a point intermediate the pulleys 28 and 16.

Of course, the structure in Figure 1 is subject to modification as positioning conditions within the room may dictate. Thus, the air duct 31 may be placed at the opposite side of heat exchanger unit 17 and the fan may be driven from the clutch side of the drive shaft.

Figure 5 shows a modification of the structure of the air duct 31 of Figures 1 and 2. In this figure an opening 55 in the duct 31 is provided at a point intermediate the heat exchanger and the roof of the engine house. Within the opening 55 is pivotally mounted a cover plate 56 conforming in contour to the duct 31. The cover plate 56 may be pivotally adjusted to any position from parallel to the axis of the duct to transverse the same.

When the cover plate 56 is employed it is possible to either heat or cool the room without reversing the fan in the manner mentioned in connection with Figures 1 and 2. By placing

the cover plate 56 in a position parallel to the axis of the duct 31, the opening 55 is occupied thereby and the duct is constituted a continuous conduit through which air may pass. This is the adjustment used when the room is to be cooled. The warm air is drawn through the heat exchanger from the room and expelled through the duct into the outside air.

When heating is desired, the cover plate is adjusted to a position transverse the duct so that a portion of the air passing therethrough is caused to by-pass into the room while the remainder passes into the outside air.

Thus the air drawn from the room is passed through the heat exchanger to be warmed, and then a portion thereof is by-passed into the room for heating purposes. It should be noted that air will be constantly recirculated through the heat exchanger so that the room may be heated beyond the point attainable by a single circulation of the type discussed in connection with Figures 1 and 2. Even though a portion of the air is recirculated, because of the fact that cover plate 56 does not fully close the duct 31 even when transverse thereof, some of the heated air is permitted to escape through the duct. This acts to draw fresh air into the room so that the same may be concurrently ventilated and heated.

A modified form of the present invention is shown in Figures 3 and 4 of the drawings. In this instance, an engine 34 of design generally similar to that of the engine 10 shown in Figures 1 and 2, is provided with similar water jackets. It is located alongside a cooling unit 35. The cooling unit 35 consists of a pair of headers 36 and 37 between which run a series of pipes 38. Between header 37 and intake 39 of centrifugal pump 40 there is provided a conduit 41. Centrifugal pump 40 is of the axial intake and radial exhaust type, and at the exhaust 42 thereof, there is connected a conduit 43 which is connected to the water jacket of the engine 34. Between the engine 34 and header 36 there is another conduit 44.

It will be noted that the cooling unit 35 is disposed within the wall 45 of a building (not shown) so that a portion thereof extends outside the building and the remainder is within the same. By this expedient, there is a direct communication between the inside and outside of the building through the bank of tubes 38. A series of shutters 46 are provided at the outside portion of the chamber within which the tubes 38 are disposed. By the operation of these shutters, it is possible to control the amount of air which will pass across the tubes. Additionally, the shutters 46 act as deflecting plates to inhibit the entry of rain and the like, which moisture would have a corrosive effect upon the tubes 38. Positioned between the tubes are a series of fins 47 which act to direct the air in a plurality of narrow passages across the tubes. In order to effect a circulation of air across the bank of tubes 38, fan 48 is provided at an opening 49 in the side of the heat exchanger 35 opposite the shutters 46. The fan 48 is mounted on a shaft 50 suitably journaled at 51 and driven by a pulley 52 keyed to shaft 50 and actuated by a belt 53 driven from a pulley 54 on drive shaft 55 of the engine 34.

At the end of the shaft 50 opposite the fan 48 is mounted the centrifugal pump 40, the blades of which are driven by said shaft 50.

It will be noted that the pump and fan may be operated in either direction by a simple crossing of the belt 53.

The operation of the device shown in Figures 3 and 4 is quite similar to that of the embodiment shown in Figures 1 and 2. The fluid is circulated in response to the action of the pump and as the fluid passes through the bank of tubes 38, air comes into indirect heat exchange relationship therewith, resulting in a cooling of the fluid and a concurrent heating of the air. Thus, when the fan is operating to force the air in the direction as shown by the arrows in Figure 4, the room will be cooled at the same time that the fluid is cooled, whereas when the fan is reversed, outside air will be drawn through the shutters 46 across the tubes 38 cooling the fluid passed through the said tubes 38 and after being heated will be drawn into the room to modify the temperature thereof.

By virtue of the mounting of the cooling fan and water pump upon a single shaft for unitary rotation, the rate of circulation of the water is synchronized with the speed and hence the cooling effect, of the fan. Also, by disposing the fan and pump at opposite ends of the shaft a better balance of the shaft is obtained. Delivery of the water to the pump in line with the shaft results in smoother operation of the pump substantially free from unbalance.

Other changes in structure and design in the apparatus described above obviously may be made without departing from the spirit of my invention.

This application is a continuation in part of copending application Serial No. 87,786, filed June 27, 1936.

I claim:

1. In a method of cooling a heavy duty fluid jacketed stationary engine operating within an enclosed engine room while concurrently modifying the temperature of the room, involving circulating a cooling medium through the fluid jacket and a heat exchanger, and passing air between the interior and exterior of the room through said heat exchanger in indirect heat exchange relationship with said cooling medium, the step of reversing the direction of flow of said air whereby to modify the temperature of the room in accordance with the direction of flow of said air.

2. A cooling unit for use in connection with a heavy duty fluid jacketed stationary engine secured to a floor and operated within an enclosed engine room wherein a cooling medium is caused to flow through a circulating system including the fluid jacket and a heat exchanger, and air is circulated through said heat exchanger in indirect heat exchange relationship with said cooling medium, said engine room having means defining an air passage between the exterior and interior thereof, said cooling unit comprising a heat exchanger disposed within said passage, a pump for circulating the cooling medium through said circulating system, a reversible fan for causing a circulation of air between the interior and exterior of said room through said passage, said fan and pump being driven from a single shaft on the engine, and means in said passage for selectively deflecting into the room a portion of the air passing through the passage.

3. Means for cooling a stationary engine while concurrently modifying the temperature of the surrounding atmosphere comprising, an engine room, a fluid cooled engine operable therein, a heat exchanger mounted in a side wall of said room and communicating with the interior and exterior thereof to define a passageway for air,

said heat exchanger being positioned remote from said engine, fluid conduits connecting said engine and said heat exchanger, a pump for effecting the circulation of fluid through said engine, heat exchanger and connecting conduits, a fan assembly including a fan mounted directly adja-

cent said heat exchanger and adapted to propel air in opposite directions at will through said heat exchanger, a flexible belt for driving said fan and means for driving said belt from said engine.

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