June 15, 1954 L. M. KAZIAL 2,681,052

PREHEATER FOR INTERNAL-COMBUSTION ENGINES

Filed Dec. 21, 1951

FIG. 1

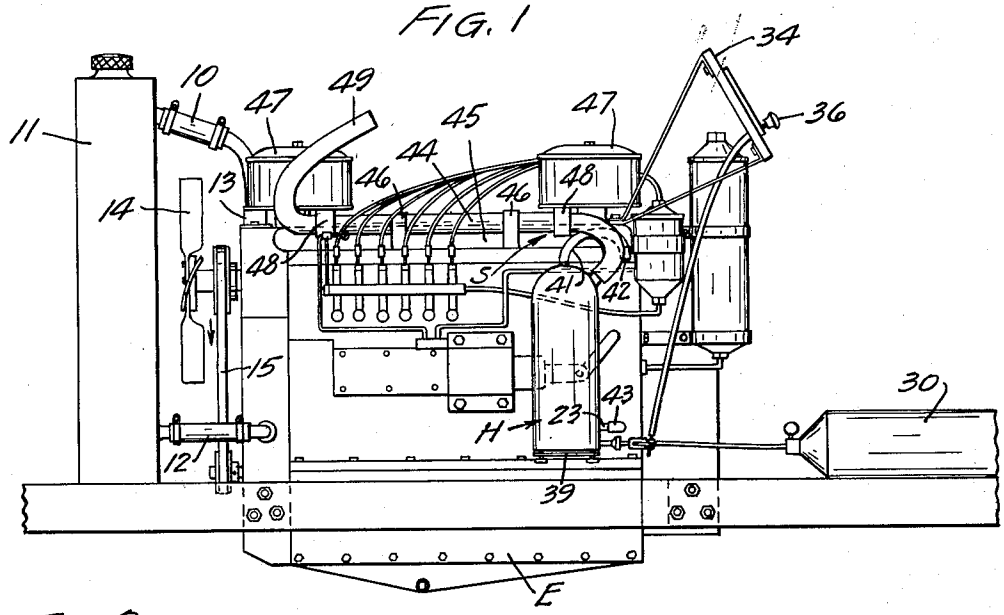


FIG. 2

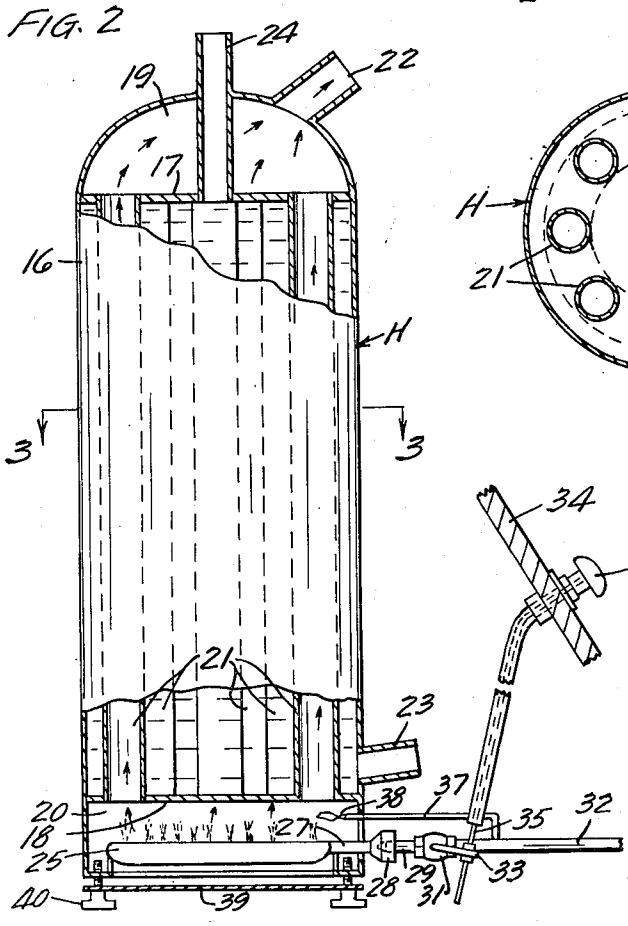
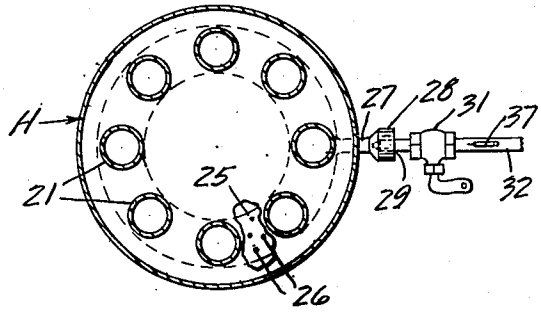


FIG. 3



INVENTOR

LOUIS M. KAZIAL

BY

Williamson & Williamson

ATTORNEYS

Patented June 15, 1954 2,681,052

UNITED STATES PATENT OFFICE

2,681,052

PREHEATER FOR INTERNAL-COMBUSTION ENGINES

Louis M. Kazial, Minneapolis, Minn., assignor of one-fourth to Thomas W. Walsh, one-fourth to Frank J. Thill, and one-fourth to John J. Nozel, all of St. Paul, Minn.

Application December 21, 1951, Serial No. 262,683

5 Claims. (Cl. 123—142.5)

1

This invention relates to pre-heaters for internal combustion engines having a fluid circulatory system and more particularly to a permanently installed pre-heater which is adapted to be maintained in standby condition during non-use of the engine.

It is a principal object of the invention to provide for a pre-heater which will be mounted for continuous standby use closely adjacent the engine and which will function in an efficient manner to economically maintain an internal combustion engine in condition for ready starting, even when the surrounding air is extremely cold.

It is a further object of the invention to provide for a pre-heater for internal combustion engines in which only that portion of the circulating cooling fluid lying within the engine itself and the heat exchanger will be heated and circulated by convection currents, while at the same time pre-conditioning the air intake device on the engine so that the first quantity of cool air entering the engine during starting will be pre-heated to likewise assist in easy starting.

It is a still further object to provide my pre-heater with a main burner element adapted for ignition by a pilot light which will bring the entire engine, including the air intake device, to a condition approximating that of summer weather for easy starting of said engine.

These and other objects and advantages of the invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to similar parts throughout the several views, and in which:

Fig. 1 shows a side elevation of a typical internal combustion engine of the diesel type to which is attached my pre-heater element in adjacent relation therewith;

Fig. 2 is a detailed view of the heat exchange portion of my pre-heater in side elevation with portions at the top and the bottom in vertical section to show more clearly the internal structure thereof; and

Fig. 3 is a horizontal section of the heat exchange element shown in Fig. 2 looking in the direction of arrows 3.

The internal combustion engine, which may be of the diesel type, is shown in Fig. 1 and indicated generally by the letter E. The engine E is equipped with the usual fluid circulatory cooling system which comprises a fluid pump (not shown), internal channels for the tortuous travel of cooling fluid for contact with the internal walls of the engine, a fluid connector 10 interposed

2

between the upper part of the engine E and the top of radiator 11, the internal coils of the radiator 11 (not shown), and a lower connection 12 between the radiator 11 at the lower part of the engine E to complete the fluid system. A thermostat of ordinary construction may be interposed between the radiator 11 and the engine E as at 13. A fan 14 of ordinary construction is interposed between the engine E and the radiator 11. In the ordinary operation of the engine E in warm weather, the pitch of the fan blades are as shown in Fig. 1 and the disposition of the exhaust of my invention in relation to the air currents created thereby is predicated upon the assumption that the pitch of the fan will remain the same and will operate in the direction of the arrow adjacent fan belt 15. It is understood, however, that in some engines and more particularly in the diesel type of engine the fan 14 may be replaced with a fan having the blades pitched in reverse so as to blow air through radiator 11, which air has been partially heated by proximity to the engine E, rather than sucking in the completely cold atmospheric air as would be the case where the pitch remains the same as that illustrated.

My invention comprises a heat exchanger shown in detail in Fig. 2 which is indicated generally by the letter H. The heat exchanger has an outer casing 16 which is waterproof and tight at all of its joints. Disposed internally near the top thereof is a header plate 17 and near the bottom thereof is header plate 18. A chamber 19 is created thereby at the top of the casing 16 and combustion chamber 20 is formed at the bottom of the casing 16. Interposed between the headers 17 and 18 are heat exchange tubes 21 so that the chambers 20 and 19 are in communication therethrough. The opening 22 is formed at the top of the casing 16 to form an outlet for exhausting gases which pass upwardly through the tubes 21 and into the chamber 19. The space surrounding the heat exchange tubes 21 and lying between header plates 17 and 18 constitutes the liquid containing portion of the heat exchanger. The liquid circulating therethrough enters at the lower portion thereof through connector 23 and out of the top through connector 24. It is understood, of course, that cool liquid entering the connector 23 will be heated and will rise by convection currents so as to circulate through the heat exchanger H and out of the connector 24. Disposed within the chamber 20 is a burner element 25 which has orifices 26 as shown through the cut-away portion of Fig. 2. Communicating with the

burner element 25 is a pipe 27 and an air mixer 28. The air mixer in turn has disposed therein a nozzle 29 through which gaseous fuel may flow from a source of supply as at 30 in Fig. 1. I have found that propane gas is useful for my purpose since it will vaporize sufficiently even in cold weather to operate my burner 25 and still will not acquire too great an internal pressure within the supply tank 30 during warm weather. A control valve 31 is interposed between the connecting line 32 and the nozzle 29 so as to vary the amount of fuel supplied the burner 25. The valve 31 has a lever 33 which may be operated remotely from a panel board 34 through which a manual cable element 35 is attached to a control such as knob 36. It is understood, of course, that the control 36 may be in the form of a dial or other manual means for causing the lever 33 to move to various positions. Connecting with the fuel supply line 32 and unaffected by the valve 31 is a small tube 37. This tube terminates in an orifice 38 to supply fuel to a pilot light for continuous burning whether or not the burner 25 is lit. Closing off the bottom of the outer casing 16 is a plate 39 which may be attached thereto as by thumb nuts 40. It may be seen that the burner 25 is thus completely enclosed within the casing 16 and the fire hazard from accidental ignition of gas and oil upon or around the engine is thus minimized.

Referring now to Fig. 1 the heat exchanger H is mounted in an upstanding manner at the side of the engine E and is equipped with a liquid connector 41 which extends from the outlet pipe 24 to the connector 42 communicating with the internal cooling channels at the upper part of the engine E. Likewise, inlet pipe 23 at the bottom of heat exchanger H communicates through connector 43 with the internal channels at the lower part of the engine E. At the exhaust opening 22 a structure S, defining an enclosed channel and supporting means, communicates therewith for conducting exhaust gases from the casing 16 to the atmosphere. In its preferred form this structure is a metallic tube 44 having good thermal conducting properties. The air intake manifold 45 lies in a horizontal manner near the top of the engine E. The metallic tube 44 is fastened to the intake manifold 45 by metallic supports 46 so as to establish a thermal conduction between the tube 44 and the manifold 45. The metallic tube 44 may likewise be in thermal contact through supports 48 with the air cleaners 47 which communicate with the intake manifold 45. During normal running operation of the engine heat caused by combustion thereof will be transmitted to the air intake manifold and thus assists in preheating the air. It is obvious, of course, that when the engine has been stopped for some time in cold weather the intake manifold will be chilled and will not serve to pre-heat the air until such time as the entire engine becomes warm. With my device, however, the intake manifold is maintained in a warm condition at all times and the air coming therethrough will be immediately pre-conditioned for starting without having to wait for the engine to be warmed in its entirety. The end 49 of metallic tube 44 is reversed in direction so that the opening aligns substantially with the direction of air flow from the fan 14 as shown in Fig. 1. It is, of course, understood that where the pitch of the fan is reversed as previously described, the end 49 will be oriented in the opposite direction. The reason for this is to prevent choking of the exhaust gases of the pre-heater burner or pilot light during the running of the engine which choking will, of course, upset the air and gas ratio established at the flame and may even extinguish the flame if not corrected for as described. It is understood that where space conditions are favorable the end 49 may extend upwardly if out of the air flow from the fan 14.

In the operation of my device the pilot light 38 is lit and remains lit continuously during the cold weather starting period. The flame at the end of pilot light 38, even though small, will take the chill off the circulating fluid and under normal circumstances will make it possible for the engine to start, although not in the easiest manner. When it is desired to pre-condition the engine for easy starting the operator may adjust the control knob 36 so as to cause the burner 25 to light when fuel, such as a hydrocarbon gas from supply tank 30, is metered through valve 31. Under normal circumstances the burner 25 is lit for a predetermined period before attempting to start the engine. In extremely cold weather, however, the burner 25 may be kept with an intermediate flame throughout the entire period between stopping the engine and starting it again. The device is flexible enough to admit of several procedures according to the severity of the weather conditions.

It is thus seen that I have provided a preheater for internal combustion engines, especially of high compression types, in which the circulating fluid warms the entire engine, thus making lubricating oil more fluid, and at the same time pre-heats the air intake device so that the first air which reaches the combustion chambers will not be chilled so as to prevent ignition.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What I claim is:

1. In a pre-heater for conditioning prior to starting thereof in cold weather an internal combustion engine having a front circulatory cooling system and an air intake mechanism, the combination of an upstanding fluid heat exchanger mounted closely adjacent a side of said engine and having liquid communication with said cooling system of the engine from a lower position thereat through the fluid heat exchanger to an upper position at the engine, and having a passageway for combustion gases therethrough in a thermal exchange relationship with said liquid, a fuel burner positioned at the lower portion of said heat exchanger and connected with a source of fuel supply, an extension of said passageway defining an enclosed channel for leading exhaust combustion gases from said heat exchanger to the atmosphere, and a thermal connector joining said extension with said air intake mechanism for thermal conduction thereacross whereby said engine will be thermally conditioned for ready starting not withstanding cold ambient temperatures.

2. In a pre-heater for conditioning an internal combustion engine having a fluid circulatory cooling system, prior to starting thereof in cold weather, the combination of an upstanding fluid heat exchanger mounted closely adjacent a side of said engine, having liquid communication with said cooling system of the engine from a lower position at the engine through the fluid heat exchanger to an upper position at the engine, and having a passageway for combustion gases therethrough in a thermal exchange relation-

ship with said liquid, an intake manifold and an air cleaner communicating therewith on the engine, a fuel burner at the lower portion of said heat exchanger connecting with a source of fuel supply, a structure defining an enclosed channel for leading exhaust combustion gases from said heat exchanger to the atmosphere, a thermal connector joining said structure with said intake manifold and said air cleaner for thermal conduction thereto whereby said engine will be thermally conditioned for ready starting notwithstanding extremely cold ambient temperatures.

3. In a pre-heater for an internal combustion engine having a circulatory fluid cooling system, the combination with internal channels defined by the walls of the engine, a radiator for cooling the fluid, a fluid connection between the upper portions of the radiator and the engine channels and between the lower portions of the radiator and the engine channels, a thermostat for restricting the flow of cooling fluid interposed between said radiator and said channels, and an air intake manifold; of an upstanding heat exchanger mounted closely adjacent the side of said engine, said heat exchanger having fluid communication with said internal channels, a fuel burner connected to a source of fuel for heating said fluid, and an exhaust opening at the top of said heat exchanger for egress of the exhaust gases from said burner, an exhaust pipe attached to the heat exchanger for communication with said opening, and mounting means having high thermal conductivity for attaching said exhaust pipe to an area of said intake manifold for transferring heat from exhaust gases of said burner through said exhaust pipe and to said intake manifold, whereby said intake manifold and that portion of the circulating fluid within the engine and heat exchanger will be pre-conditioned for easy starting of the engine.

4. In a pre-heater for an internal combustion engine having a circulatory fluid cooling system, the combination with internal channels defined by the walls of the engine, a radiator for cooling the fluid, a fluid connection between the upper portions of the radiator and the engine channels and between the lower portions of the radiator and the engine channels, and a thermostat for restricting the flow of cooling fluid interposed between said radiator and said channels, and an air intake manifold; of an upstanding heat exchanger mounted closely adjacent the side of said engine, said heat exchanger having fluid communication with said internal channels, a fuel

burner connected to a source of fuel for heating said fluid, a pilot light connected to said source of fuel, and an exhaust opening at the top of said heat exchanger for egress of the exhaust gases from said burner, a control for operating said burner, an exhaust pipe attached to the heat exchanger for communication with said opening, and mounting means having high thermal conductivity for attaching said exhaust pipe to an area of said intake manifold for transferring heat from exhaust gases over said burner through said exhaust pipe and to said intake manifold, whereby said intake manifold and that portion of the circulating fluid within the engine and the heat exchanger will be pre-conditioned for easy starting of the engine.

5. In a pre-heater for an internal combustion engine having a circulatory fluid cooling system, the combination with internal channels defined by the walls of the engine, a radiator with rotatable fan adjacent thereto for cooling the fluid, a fluid connection between the upper portions of the radiator and the engine channels and between the lower portions of the radiator and the engine channels, a thermostat for restricting the flow of cooling fluid interposed between said radiator and said channels, and an air intake manifold; of an upstanding heat exchanger mounted closely adjacent the side of said engine, said heat exchanger having fluid communication with said internal channels, a fuel burner connected to a source of fuel for heating said fluid, a pilot light for igniting said fuel burner, and an exhaust opening at the top of said heat exchanger for egress of the exhaust gases from said burner, a control for operating said burner, an exhaust pipe attached at one end to the heat exchanger for communication with said opening and at the other end open to the atmosphere in the direction of air movement through said fan, and mounting means having high thermal conductivity for attaching said exhaust pipe to an area of said intake manifold for transferring heat from exhaust gases of said burner through said exhaust pipe and to said air intake manifold whereby said air intake manifold and that portion of the circulating fluid within the engine and heat exchanger will be pre-conditioned for easy starting of the engine.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,246,727	Donning	Nov. 13, 1917
1,357,598	Thompson	Nov. 2, 1920