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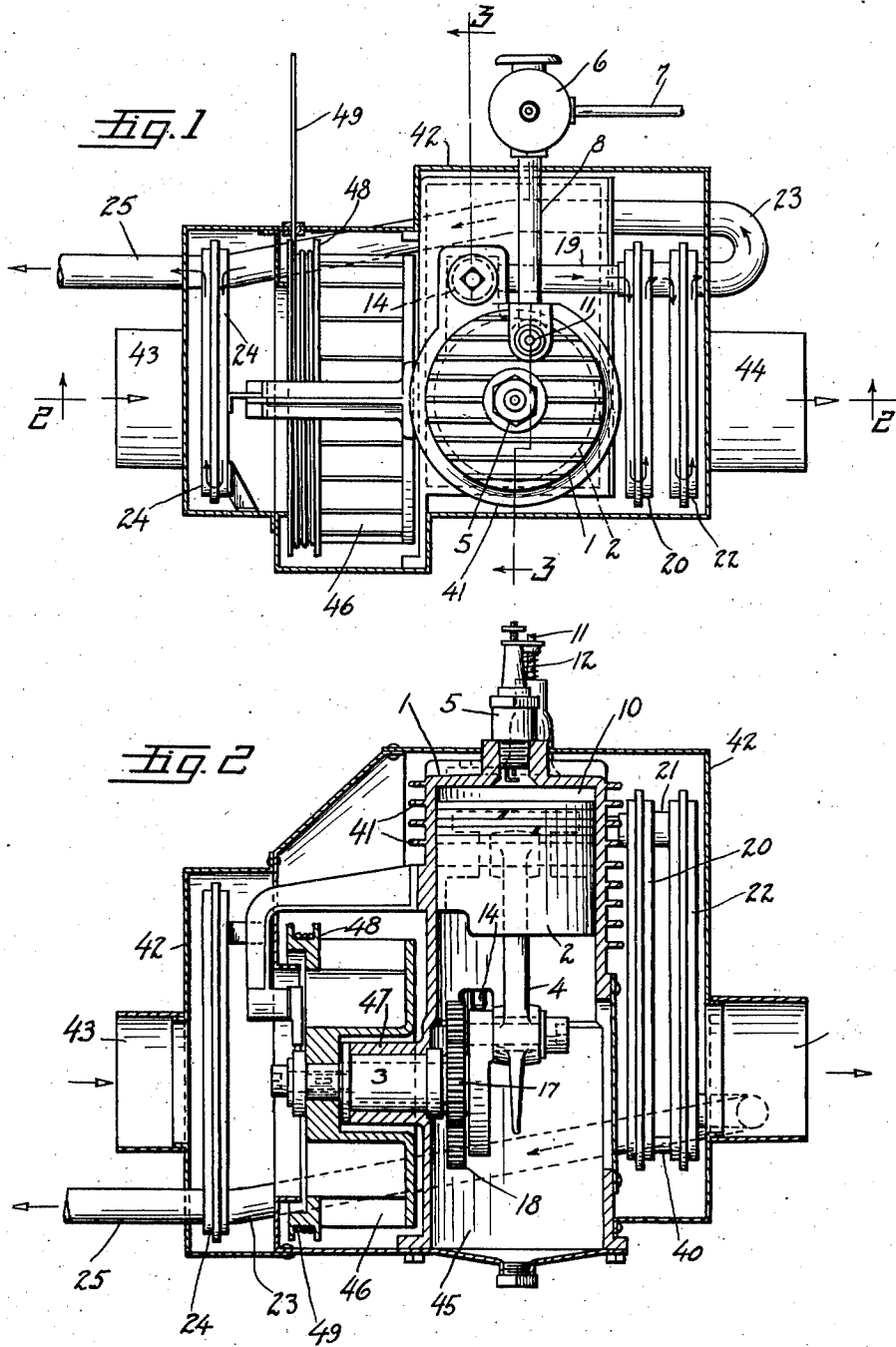
J. J. SUNDAY

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HEATING SYSTEM

Filed April 18, 1938

2 Sheets-Sheet 1



INVENTOR.

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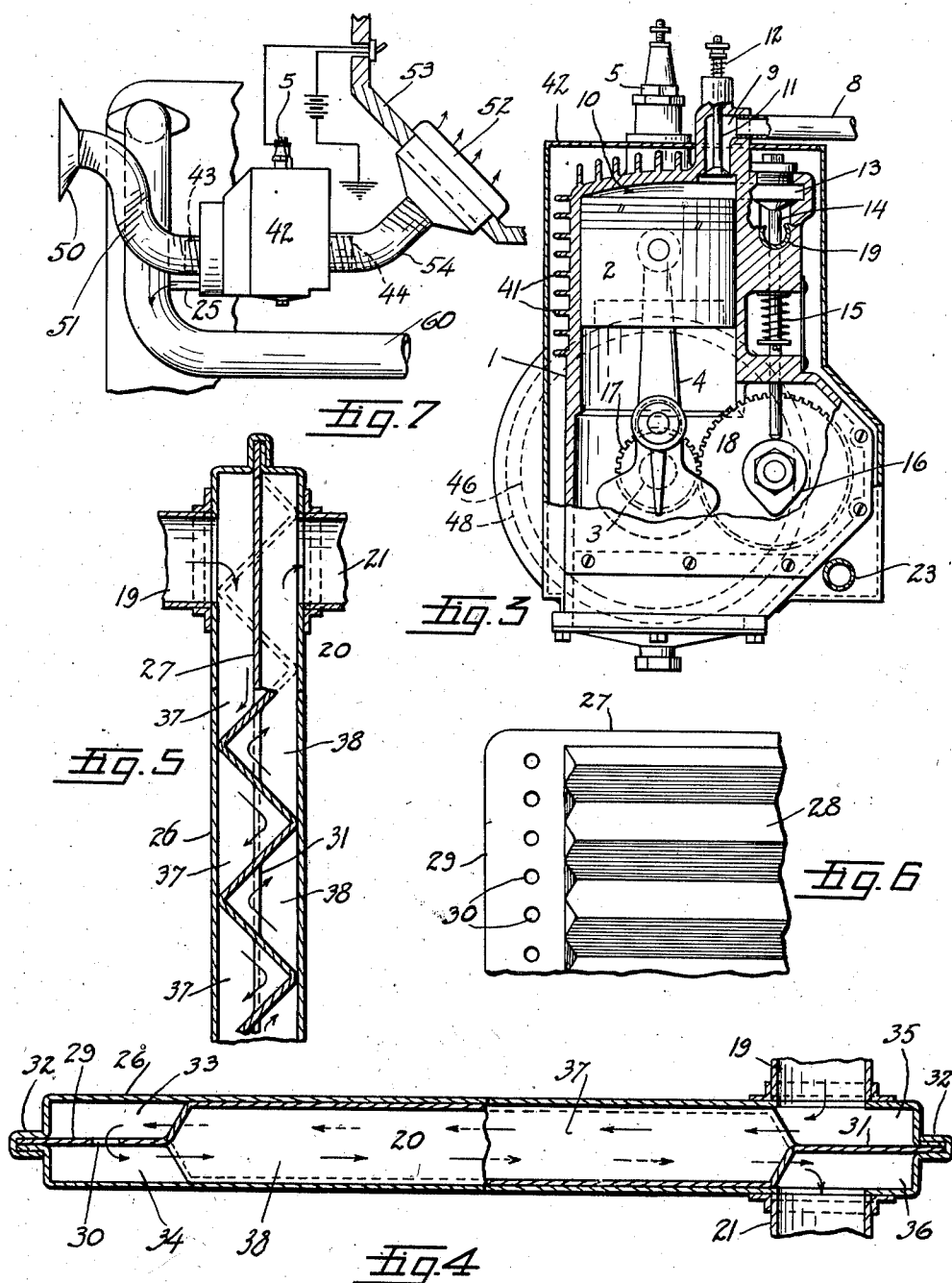
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UNITED STATES PATENT OFFICE

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HEATING SYSTEM

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4 Claims. (Cl. 237—12.3)

This invention relates to a heating system and more particularly to a heating system for burning fluid fuels, and in particular liquid fuels such as gasoline and other petroleum distillates, alcohol and the other hydrocarbons.

It is an object of this invention to produce a heating system which operates under its own power to convert the fuel into heat units and effect a heat exchange with the fluid, such as air for a house or automobile, or other medium which is to be heated.

Another object of this invention is to produce a heating system which is highly efficient both in the burning of the fuel and in the transferring of the heat to the fluid or other medium to be heated.

This invention also contemplates a heating system which is admirably adapted for heating an automotive vehicle. In the presently known types of automobile heaters, such as the hot water heater and the exhaust type of heater, there are many inherent disadvantages, for example, both the hot water and the exhaust type of heater are dependent for heating upon the running of the automobile engine. When the automobile engine is not running, it is practically impossible to obtain the necessary heat from these types of heaters. Another disadvantage of both these heaters, and particularly the exhaust type of heater, is that the amount of heat given off by the heater varies pretty much with the speed of the motor, the speed of the car and the temperature of the outside air and cannot be very well controlled. At low temperatures, say around 0° F., and particularly at high speeds, it is difficult with the ordinary hot water heater to obtain sufficient heat and particularly where the air to be heated is drawn in from the outside. With the exhaust type of heater at such cold temperatures it is difficult at low speeds, say of 30 miles per hour or less, to obtain sufficient heat to bring the air within the car to the right temperature whereas at higher speeds the exhaust heater becomes overheated and delivers air into the vehicle body at a temperature far too high for the comfort of the occupant.

This invention also contemplates a heating system which will overcome the above-mentioned defects inherent in the presently used hot water and exhaust type automobile heater and which operates independently of the engine which serves as the prime mover for the vehicle.

In the drawings:

Fig. 1 is a top plan view of the heating system with the heater casing shown in section.

Fig. 2 is a vertical section along the line 2—2 of Fig. 1.

Fig. 3 is a section along the line 3—3 of Fig. 1.

Fig. 4 is a horizontal section through one of the exhaust gas radiators.

Fig. 5 is a vertical section through the exhaust gas radiator.

Fig. 6 is a fragmentary detail of one of the baffles within the radiator.

Fig. 7 is a general layout showing the heater installed in an automobile for heating the same.

For the purpose of burning fuel to convert the same into heat, it is proposed to utilize an internal combustion engine. Any internal combustion engine can be used such as the four or two cycle internal combustion gasoline engine and the Diesel type internal combustion engine. By way of description there is shown a four cycle internal combustion engine of the poppet valve type comprising a cylinder 1, piston 2, crankshaft 3, connecting rod 4, spark-plug 5 and carburetor 6. The carburetor 6 is of any well-known conventional type. Fuel, preferably a liquid such as gasoline, is supplied to the carburetor 6 through the fuel line 7 where it is mixed with air. The fuel and air mixture is conducted through the pipe line 8 into the intake port 9 and thence into the combustion chamber 10. The fuel intake port is controlled by the poppet valve 11 which is normally held closed by the spring 12. The burned fuel and air mixture is discharged from the combustion chamber 11 through the exhaust port 13 which also is controlled by a poppet valve 14 which is normally held closed by the coil spring 15. The poppet valve 14 is controlled by the cam 16 which is operated off of the main crank-shaft by the meshed gears 17 and 18. The timing of the ignition and operation of the engine is achieved in the conventional and well-known manner.

The exhaust port 13 connects with exhaust pipe line 19 which communicates with radiator 20. Radiator 20 is connected by pipe line 21 with radiator 22 and radiator 22 is connected by pipe line 23 with radiator 24. Radiator 24 connects with pipe line 25 through which the exhaust gases are finally discharged into atmosphere. The radiators 20, 22 and 24 for descriptive purposes are shown as identical. Thus the description of one will suffice for all three radiators.

As shown in Figs. 4, 5 and 6, each radiator comprises an outer shell 26 which houses a baffle

27. The baffle 27 is shown in detail in Fig. 6 and comprises the intermediate corrugated portion 28 and the flat vertically extending side portion 29 provided with a plurality of perforations 30 and the flat, vertically extending impermeate side portion 31.

The side portions 29 and 31 are clamped along their outer edges in the lock seams 32 of the outer shell 26. The corrugated portion 28 extends from one side of the shell 26 to the other. Thus the baffle divides the interior of the shell into two vertical passageways 33 and 34 along one vertical side of the shell and two vertically extending passageways 35 and 36 along the other vertical side of the shell and a plurality of transversely extending passageways 37 which communicate at one end with the passageway 34 and at the other end with the passageway 36. The corrugated portion 38 of the baffle also provides a plurality of transverse passageways 38 which communicate at one end with the vertical passageway 35 and at the other end with the vertical passageway 33. Vertical passageway 33 communicates with vertical passageway 34 through the openings 30. Thus the exhaust gas upon being discharged from the combustion chamber passes through pipe line 19 into vertical passageway 35 (Fig. 4). The gases pass from passageway 34 transversely through the passageways 38 into vertical passageway 33, thence through perforations 30 into vertical passageway 34 and then pass transversely in the reverse direction through passageways 37 into passageway 36 and then outwardly through pipe 21 into radiator 22.

Since radiator 22 is the same as radiator 20, the gases pass through radiator 22 in the same course as above described with radiator 20 and as indicated by the arrows Fig. 1. The gases are discharged from radiator 22 through the pipe line 23 which communicates with the radiator 22 adjacent the bottom of this radiator. Since the exhaust gases expand and are cooled upon being discharged into radiators 21 and 22, a certain amount of water condenses from the exhaust gases. For this reason a small tube 40 connects radiators 20 and 22 adjacent the bottoms of these radiators. Hence, any condensation from radiator 20 flows through tube 40 into radiator 22 and flows from radiator 22 through the exhaust pipe line 23. The exhaust gases are conducted by exhaust line 23 to radiator 24. Radiator 24 is of the same construction as radiators 20 and 22. After passing through radiator 24 where the gases are further expanded and further cooled, the exhaust gases and any water condensation are discharged through exhaust pipe 25 into the exhaust line 60 of the automobile driving engine.

The cylinder is provided with a plurality of heat radiating fins 41. The cylinder, crank-case, and the radiators 20, 22 and 24 are completely covered by the housing 42 having an air inlet opening 43 and an air outlet opening 44. It will be noted that radiator 24 is positioned adjacent air inlet opening 43 so that the air entering the housing 42 flows about the radiator 24 where it is initially heated by a heat exchange with the exhaust gases in the radiator 24 before the exhaust gases are finally discharged from the outlet pipe 25. Thus it will be seen that the exhaust gases upon being discharged through the outlet pipe 25 are cooled approximately to the temperature of the air flowing into the housing 42 through the inlet 43. After being preheated by heat exchange with radiator 24, the air flows through the housing 42 about cylinder 1, crank-

case 45, and radiators 24, 22 before being discharged through the outlet opening 44. The air is thus further heated by heat exchange with these members. The housing 42 can be made from a plurality of sheet metal stampings covered with a suitable heat insulating material or can be made directly from any suitable heat insulating and sound deadening material. The flow of air through the housing 42 is preferably effected by a sirocco type of blower 46 which is fixed on the outer end of the crank-shaft 3. The crank-shaft 3 is journaled in the bearing 47. The fan 46 also acts in the nature of a flywheel.

Any suitable arrangement can be used for starting the combustion engine. A common and well-known form of starter comprises the reel 48 of the well-known overrunning clutch type provided with a cord 49 which is wound about the reel 48. Upon pulling outwardly on the cord 49 the reel causes the crank-shaft to revolve and the piston to reciprocate in the usual fashion to start the combustion engine. As soon as the engine starts the crank-shaft overruns the reel 48 and the cord 49 upon being released automatically rewinds upon the reel 48.

The inlet 43 is connected with an intake funnel 50 by means of the air line 51. The outlet 44 is connected with a suitable register 52 mounted in the floor board 53 of the vehicle body by means of the air line 54.

It will be noted that the combustion engine is operated practically exclusively for the converting of fuel, such as gasoline, into heat units. Of the heat units generated by the burning of the fuel only a very small percentage is converted into power. In fact, only sufficient heat units are converted into power to reciprocate the piston and rotate the fan 46. However, the rotation of the fan 46 circulates the air through the housing 42 and thus cools the combustion engine so that it will not overheat and become inoperative. In other words, although it requires a small amount of power to turn the fan 46, the circulation of the air through the housing 42 by the fan makes for a more efficient heat exchange through the cylinder walls between the heat generated in the combustion chamber and the air to be heated. The heat which is converted into mechanical energy to rotate the fan is not lost but is given up again in the form of heat to the air stream forced through the housing by the fan. Friction in the engine also generates heat which also is taken up by the air stream passing through the housing. The entire purpose of the combustion engine is to convert fuel into heat without converting any more of the heat into power or mechanical energy than is necessary to make the combustion engine self-operating and then to transfer substantially all this heat to the air to be heated as it passes through the housing 44. The amount of heat generated by the combustion engine can be controlled by speeding or slowing down the operation of the engine.

I claim:

1. In an automotive vehicle including a prime mover in the form of an internal combustion engine, a heating system operating independently of the said prime mover comprising a cylinder defining a combustion chamber having an inlet for the fuel to be burned and an outlet for the exhaust gases of combustion, valves for controlling the said inlet and outlet, a piston in said cylinder for compressing the fuel preparatory to combustion, means for igniting the com-

pressed fuel whereby the compressed fuel burns in the combustion chamber to create heat, heat radiating means communicating with the exhaust port of the cylinder through which the exhaust gases of combustion pass and are expanded preparatory to being exhausted to atmosphere, said heat radiating means including a portion positioned adjacent the inlet opening of the below-mentioned housing about which the incoming fluid to be heated passes in heat exchange relation whereby the exhaust gases prior to being discharged to atmosphere are cooled to a temperature substantially less than the temperature of the fluid to be heated as it is discharged through the outlet opening of the said housing, a housing for the said heat radiating means and the heat radiating surface of the said cylinder having an inlet and an outlet port, and means actuated by said piston for inducing a flow of a fluid to be heated through the said housing in heat exchange relation with the said cylinder and the said heat radiating means whereby the major portion of the heat of combustion of said fuel is taken up by said fluid and utilized to heat said vehicle.

2. In an automotive vehicle including a prime mover in the form of an internal combustion engine, a heating system operating independently of the said prime mover comprising a cylinder defining a combustion chamber having an inlet for the fuel to be burned and an outlet for the exhaust gases of combustion, valves for controlling the said inlet and outlet, a piston in said cylinder for compressing the fuel preparatory to combustion, means for igniting the compressed fuel whereby the compressed fuel burns in the combustion chamber to create heat, a radiator communicating with the exhaust port of the cylinder through which the exhaust gases pass and cooled preparatory to being exhausted to atmosphere, said radiator including a portion on the outlet side of the below-mentioned housing through which the exhaust gases are initially passed while upon being exhausted from the cylinder and while at high temperature and another radiating portion on the intake side of the below-mentioned housing through which the exhaust gases are subsequently passed while at a lower temperature to heat the incoming fluid preparatory to being discharged to atmosphere whereby the exhaust gases passing out of said housing are at a lower temperature than the fluid to be heated as it passes out of said housing, a housing for the said radiator and heat radiating surface of the said cylinder having an inlet and an outlet port, and means for inducing

a flow of a fluid to be heated through the said housing in heat exchange relation with the said cylinder and the said radiator whereby the major portion of the heat of combustion of said fuel is taken up by said fluid and utilized to heat said vehicle.

3. A heating system comprising a cylinder defining a combustion chamber having an inlet for the fuel to be burned and an outlet for the exhaust gases of combustion, a piston in said cylinder for compressing the fuel preparatory to combustion, energy storing means actuated by the piston on the power stroke of the piston and in turn operating the piston on the compression stroke, means for igniting the compressed fuel whereby the compressed fuel burns in the said combustion chamber to create heat, said energy storing means being the only load on the said piston whereby only an inconsequential portion of the heat energy generated by the burning of the fuel is converted into mechanical energy, a radiator communicating with the exhaust port of the engine through which the exhaust gases pass, a housing for the radiator and the heat radiating surface of the said cylinder for conducting a fluid to be heated by, and in heat exchange relation with, the said heat radiating surfaces of the said cylinder and radiator, and inlet and outlet openings in the said housing for the fluid to be heated.

4. A heating system comprising a cylinder defining a combustion chamber having an inlet for the fuel to be burned and an outlet for the exhaust gases of combustion, a piston in said cylinder for compressing the fuel preparatory to combustion, energy storing means including a fan actuated by the piston on the power stroke of the piston and in turn operating the piston on the compression stroke, means for igniting the compressed fuel whereby the compressed fuel burns in the said combustion chamber to create heat, said energy storing means being the only load on the said piston whereby only an inconsequential portion of the heat energy generated by the burning of the fuel is converted into mechanical energy, a radiator communicating with the exhaust port of the engine through which the exhaust gases pass, a housing for the radiator and the heat radiating surface of the said cylinder, said fan inducing a flow of fluid to be heated by, and in heat exchange relation with, the said heat radiating surfaces of the said cylinder and radiator, and inlet and outlet openings in the said housing for the fluid to be heated.

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