Nov. 14, 1944. H. J. DE N. McCOLLUM 2,362,571

HEATER

Filed Sept. 2, 1942 2 Sheets-Sheet 1

Fig. 1

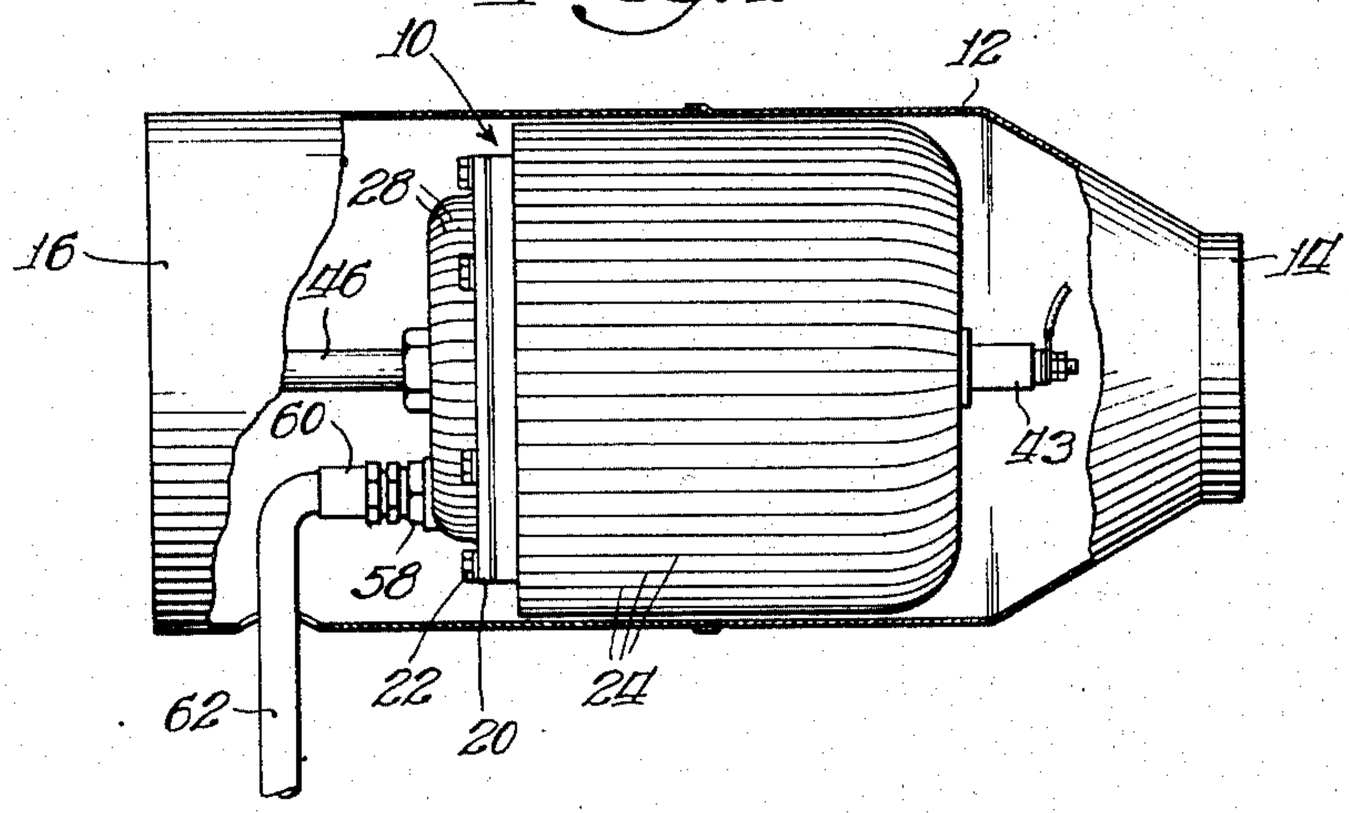
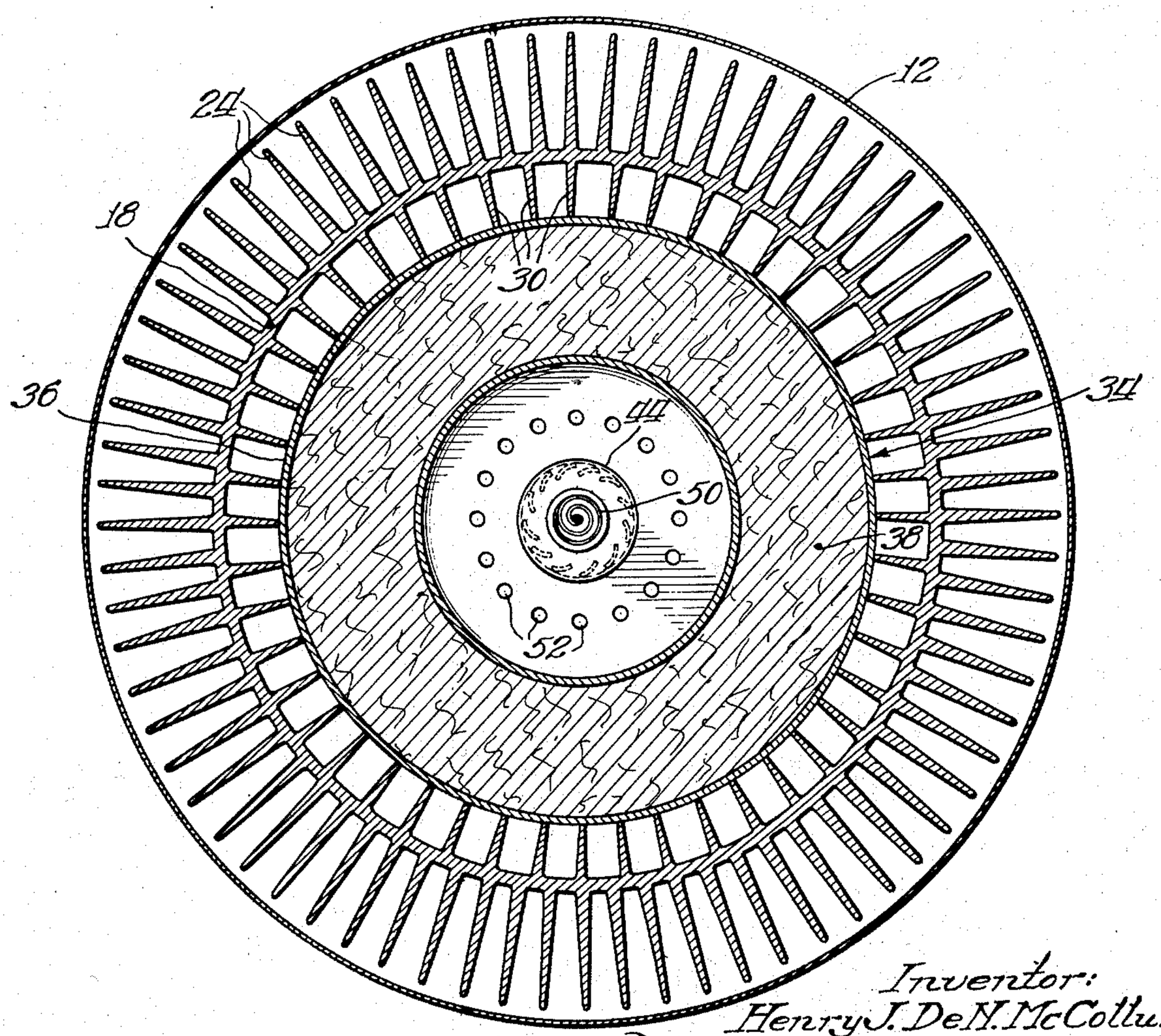


Fig. 3



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HEATER

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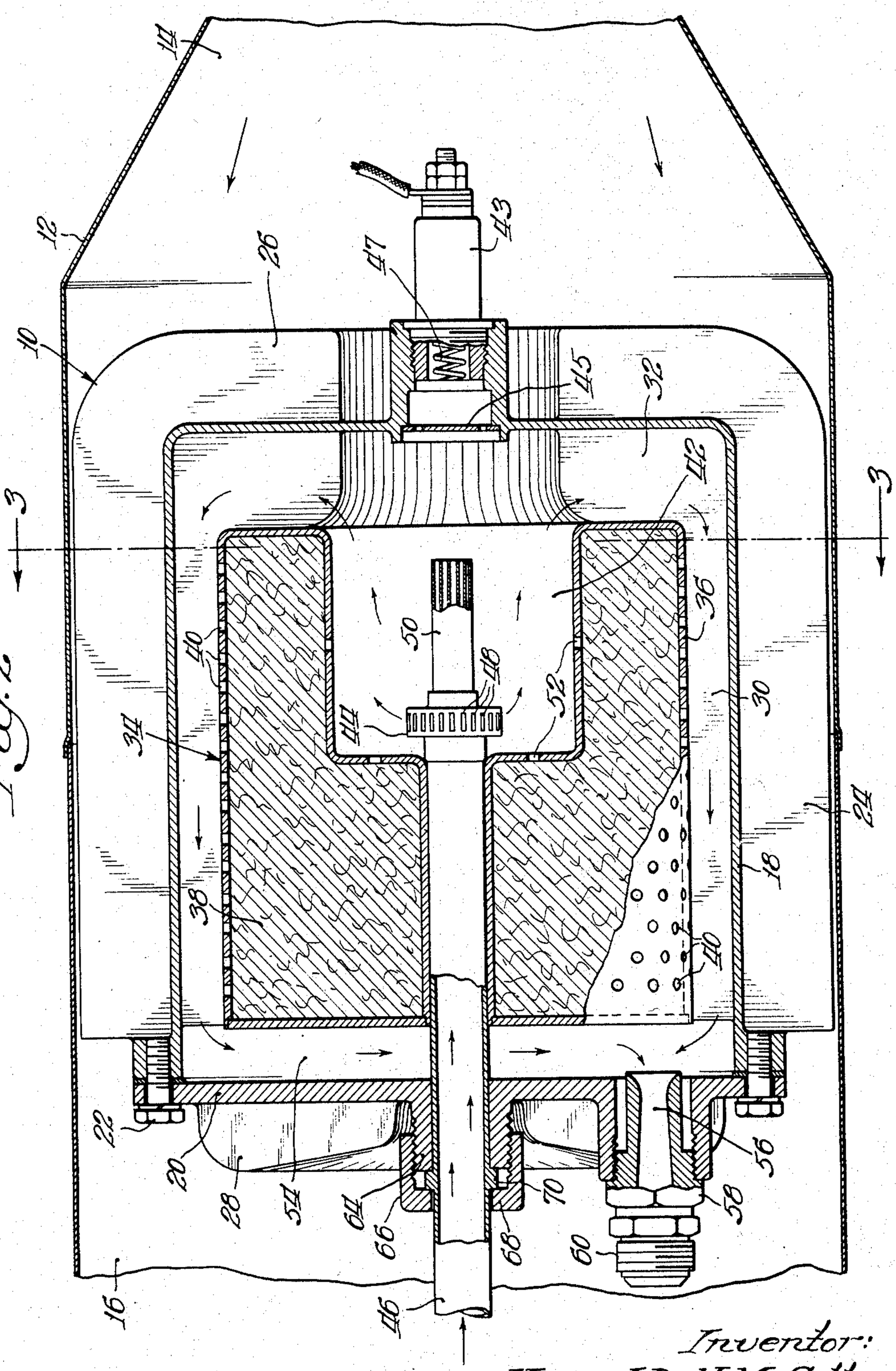

Fig. 2

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Patented Nov. 14, 1944 2,362,571

UNITED STATES PATENT OFFICE

2,362,571

HEATER

Henry J. De N. McCollum, Chicago, Ill.

Application September 2, 1942, Serial No. 457,001

8 Claims. (Cl. 126—116)

My invention pertains to heaters and is more particularly concerned with the provision of a heater of the internal combustion type.

An object of my inventiton is to provide a new and improved heater of the internal combustion type having means for pre-heating the combustible mixture.

Another object of my invention is to provide a new and improved heater of the internal combustion type having a new and improved combustion chamber arrangement.

Another object of my invention is to provide a new and improved heater of the internal combustion type which is extremely compact and efficient.

Another object of my invention is to provide a new and improved heater which may be inexpensively manufactured by conventional methods and with the use of conventional equipment.

Another object of my invention is to provide an efficient and lightweight heater which is particularly adapted for, but not limited to, use in aircraft.

Other objects and advantages will become apparent as the description proceeds.

In the drawings:

Fig. 1 is a view showing a side elevation of an embodiment of my invention and wherein part of the casing has been broken away to show more clearly constructional features;

Fig. 2 is a longitudinal section on an enlarged scale of the heater shown in Fig. 1; and

Fig. 3 is a transverse section taken on the line 3—3 of Fig. 2.

In Fig. 1, I have illustrated my invention as being embodied in a heater 10 enclosed in a casing 12 for directing the flow of ventilating air over the heater in such relation that the temperature of this ventilating air is raised by heat created in the heater 10. The casing 12 has a ventilating air inlet 14 which may be supplied with air by a ram, blower, or any other suitable means. The casing 12 is also provided with a ventilating air outlet 16 which may open directly into an airplane cabin or any other space to be heated, or may be connected to a system of ducts for distributing the heated ventilating air in any desired manner.

The heater 10 comprises a hollow casting 18 of aluminum or other suitable material. The casting 18 has an open end which is closed by a plate 20 secured to the casting 18 by bolts 22 or in any other suitable or appropriate manner. The plate 20 is preferably cast of aluminum or other metal having relatively high heat conductivity. The casting 18 has integral, exterior fins 24 which extend lengthwise of the casting 18 and have radially directed in-turned ends 26. The plate 20 is also provided with integral radially arranged fins 28. The fins 24 and 28 transmit heat to the ventilating air directed thereover by the casing 12 and are so proportioned and arranged as to prevent over-heating of the casting 18 and plate 20 and minimize the creation of local hot spots therein.

The casting 18 is provided with integral internal fins 30 which extend lengthwise of the casting 18 and have radially directed inlet ends 32. A muffler 34 is located in the casting 18 and comprises a sheet metal shell 36 containing a quantity of stainless steel wool 38, or glass wool, or other suitable sound deadening or heat resistant material. The shell 36 is provided with openings 40 forming acousti-couplings between the passages for the products of combustion and the interior of the muffler 34.

The muffler shell 36 is constructed and arranged to provide a combustion chamber 42 located interiorily thereof. A burner tube 44 is located in the combustion chamber 42 and is supplied with a combustible mixture through a pipe 46. The burner tube 44 is provided with openings 48 through which the combustible mixture passes into the combustion chamber and these openings are preferably so arranged as to give the combustible mixture a whirling motion as it enters this chamber.

The combustible mixture entering the combustion chamber 42 is ignited by an electrical igniter 43 which is supplied with electric current from any suitable source. This igniter is of the hot wire type and a perforated plate 45 is provided to protect the hot wire 47 from the direct flow of the combustible mixture. It will be understood that the igniter 43 is preferably provided with the usual thermostatic switch for breaking the circuit of this igniter whenever the heater attains normal operating temperature and thereafter combustion is maintained by the re-igniter 50, which may be of any usual or suitable type.

The walls of the combustion chamber 42 are illustrated as being provided with openings 52, which form acousti-couplings between this chamber and the interior of the muffler 34. These acousti-couplings assist in the absorption of noises created in the combustion chamber and cooperate with the acousti-couplings 40 in minimizing the operating noise created by the heater.

The hot products of combustion flow out of the right-hand end of the combustion chamber 42

and enter the spaces between the inlet ends **32** of the internal fins **30**. These gases first flow radially outward and then to the left, as viewed in Fig. 2, between the longitudinal portions of the fins **30**. These fins absorb heat from the gases and transit this heat to the exterior fins **24**, which in turn give up this heat to the ventilating air. The cooled gases of combustion then pass into outlet space **54** and are discharged through a Venturi-like restriction **56** provided in a fitting **58** threadedly attached to the plate **20**. The fitting **58** is provided with a swivel coupling **60** for attaching this fitting to any suitable exhaust conduit **62**.

In the operation of my invention, the combustion chamber **42** is supplied with a combustible mixture through pipe **46** which is connected to an engine supercharger or a carburetor under superatmospheric pressure, or with any other suitable source. Instead of depending upon a source of combustible mixture under pressure for supplying this mixture to the combustion chamber **42**, the exhaust pipe **62** may lead to a suitable source of suction which will serve to draw the combustible mixture into the combustion chamber **42**. In some installations the flow of combustible mixture into the combustion chamber and the flow of combustion gases therefrom may be induced jointly by means for supplying combustible mixture under pressure to the combustion chamber and means for sucking the gases of combustion therefrom. The combustible mixture is ignited by the igniter **43**, which is connected either to the electrical system of the aircraft or is provided with its own battery or other source of electricity. The combustion occurring in the combustion chamber **42** creates heat therein and this heat is communicated to the walls of the combustion chamber. The hot gases of combustion flow out of the combustion chamber into the spaces between the inlet ends **32** of the interior fins **30**. These gases then pass to the left, as viewed in Fig. 2, between the longitudinal portions of the fins **30**.

Most of the heat is absorbed from these gases by the fins **30** and is transmitted to the fins **24**, which in turn give up this heat to the ventilating air directed thereover by the casing **12**. It is to be noted that this ventilating air is projected against the end wall of the casting **18** and that this is the most efficient arrangement, since this end wall is heated to the highest temperature by the combustion of the fuel. The inlet end of this casing may be connected with a ram or blower, or other suitable source of air under pressure, or alternatively the outlet end **16** may communicate with a suction blower or other suction producing device.

Any heat remaining in the gases of combustion when they reach the outlet space **54** is absorbed by plate **20** and transmitted to the ventilating air by fins **28**. The cooled gases of combustion are then discharged to atmosphere through restriction **56** and exhaust pipe **62**. The muffler **34** absorbs audible vibrations present in the combustion chamber **42** or entrained in the combustion gases flowing between the fins **30** and contributes materially to the silence of operation of my invention. This muffler is exposed to the heat created in the combustion chamber **42** and to the hot gases discharged therefrom and is maintained at high temperature.

An important feature of my invention lies in the provision for preheating the combustible mixture supplied to the combustion chamber **42**. It will be noted that the inlet pipe **46** for this combustible mixture passes through the plate **20** in intimate contact with the walls of a tubular extension **64** to which pipe **46** is attached by a tubular nut **66** having an in-turned flange **68** engaging an annular enlargement **70**, forming an integral part of, or rigid with, the pipe **46**. The pipe **46** and the combustible mixture flowing therethrough absorb heat from plate **20**, muffler **34** and the gases located in exhaust space **54** and this preheating of the combustible mixture increases the efficiency of the combustion in the combustion chamber **42** and the efficiency of the heater as a whole.

In my novel heater the combustion chamber **42** is located in a recess formed in the muffler **34** and the walls of this combustion chamber are remote from the ventilating air and are maintained at high temperature. This feature also contributed to the efficiency of combustion in this combustion chamber and the efficiency of the heater as a whole.

The embodiment of my invention which I have illustrated and described is formed of a few relatively simple parts which may be economically manufactured by mass production methods with conventional equipment and by conventional processes. These parts may be readily assembled and the completely assembled heater is compact, efficient and light in weight. The design of the individual parts is such that they are inherently strong and they may be as rugged as required for any particular type of service.

While I have illustrated and described only a single embodiment of my invention, my invention is not limited to the details illustrated and described. My invention may assume numerous forms and is to be construed as including all modifications and variations falling within the scope of the appended claims.

I claim:

1. In a heater of the class described, the combination of a muffler having a recess formed in one end thereof, a pipe extending through said muffler and supplying a combustible mixture to said recess, heat exchange means enclosing said muffler and providing a passage for burned gases around the exterior of said muffler, and means for directing ventilating air over said heat exchange means.

2. In a heater of the class described, the combination of a cylindrical muffler having a recess providing a combustion chamber in one end thereof, a conduit extending axially of said muffler and providing a combustible mixture to said combustion chamber, a casing surrounding said muffler and having a wall spaced therefrom to provide a passage for burned gases flowing from said combustion chamber, means for directing ventilating air over said casing, and a gas outlet for said casing, said outlet being located at the end thereof which is remote from said combustion chamber.

3. In a heater of the class described, the combination of means including a muffler providing a combustion chamber, said muffler including means for supplying a combustible mixture to said chamber, means cooperating with said muffler to provide a passage for burned gases leaving said combustion chamber, said passage causing said burned gases to flow in a direction opposite to said combustible mixture and to preheat the latter, and means to transfer heat from said combustion chamber and burned gases to ventilating air.

4. In a heater of the class described, the combination of a hollow, aluminum casting having a closed end and an open end, said casting having internal and external integral fins, a plate closing the open end of said casting, said plate having heat radiating fins, a muffler located in said hollow casting and having a recess providing a combustion chamber, said muffler, casting and plate providing passages about said muffler for burned gases from said combustion chamber and connecting said combustion chamber with an outlet provided by said plate, and a pipe extending through said plate and the muffler and supplying combustible mixture to said chamber.

5. In a heater of the class described, the combination of a hollow member having a closed end and an open end, a combustion chamber therein adjacent said closed end, means providing a passage between that part of the combustion chamber adjacent said closed end and the open end of said member, and means for supplying a preheated combustible mixture to said combustion chamber, said means including a pipe extending through said open end to said combustion chamber.

6. In a heater of the class described, the combination of a hollow member having a closed end and an open end and comprising a wall located between and integral with internal and external fins, a muffler located in said member and spaced from the wall thereof to provide gas passages lengthwise of said internal fins, said muffler having a combustion chamber formed in one end thereof and communicating with said passage, a plate attached to the open end of said member and in spaced relation to said muffler, a pipe extending through said plate and muffler for supplying a combustible mixture to said combustion chamber, an igniter mounted in the closed end of said member for igniting said mixture, a casing enclosing said member and directing ventilating air over the exterior thereof, and an outlet for burned gases provided by said plate.

7. In an internal combustion heater of the class described, the combination of a muffler, a heat exchanger enclosing said muffler and cooperating therewith to provide a combustion chamber and a passage for burned gases discharged from said chamber, said muffler having a passage therethrough communicating with said combustion chamber, means for supplying a combustible mixture to said last-named passage, and means for directing air over said heat exchanger.

8. In an internal combustion heater of the class described, the combination of a muffler having a sheet metal shell containing sound absorbing material, a heat exchanger cooperating with said muffler to provide a combustion chamber and passages for burned gases discharged from said combustion chamber, said shell having a passage therethrough communicating with said combustion chamber, means for supplying combustible mixture to said last-named passage for flow therethrough in a direction opposite to the flow of burned gases in said passages, said shell having small openings connecting the interior thereof with said passages, and means for directing air over said heat exchanger.

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