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VEHICLE HEATER, PARTICULARLY THE BURNER THEREFOR

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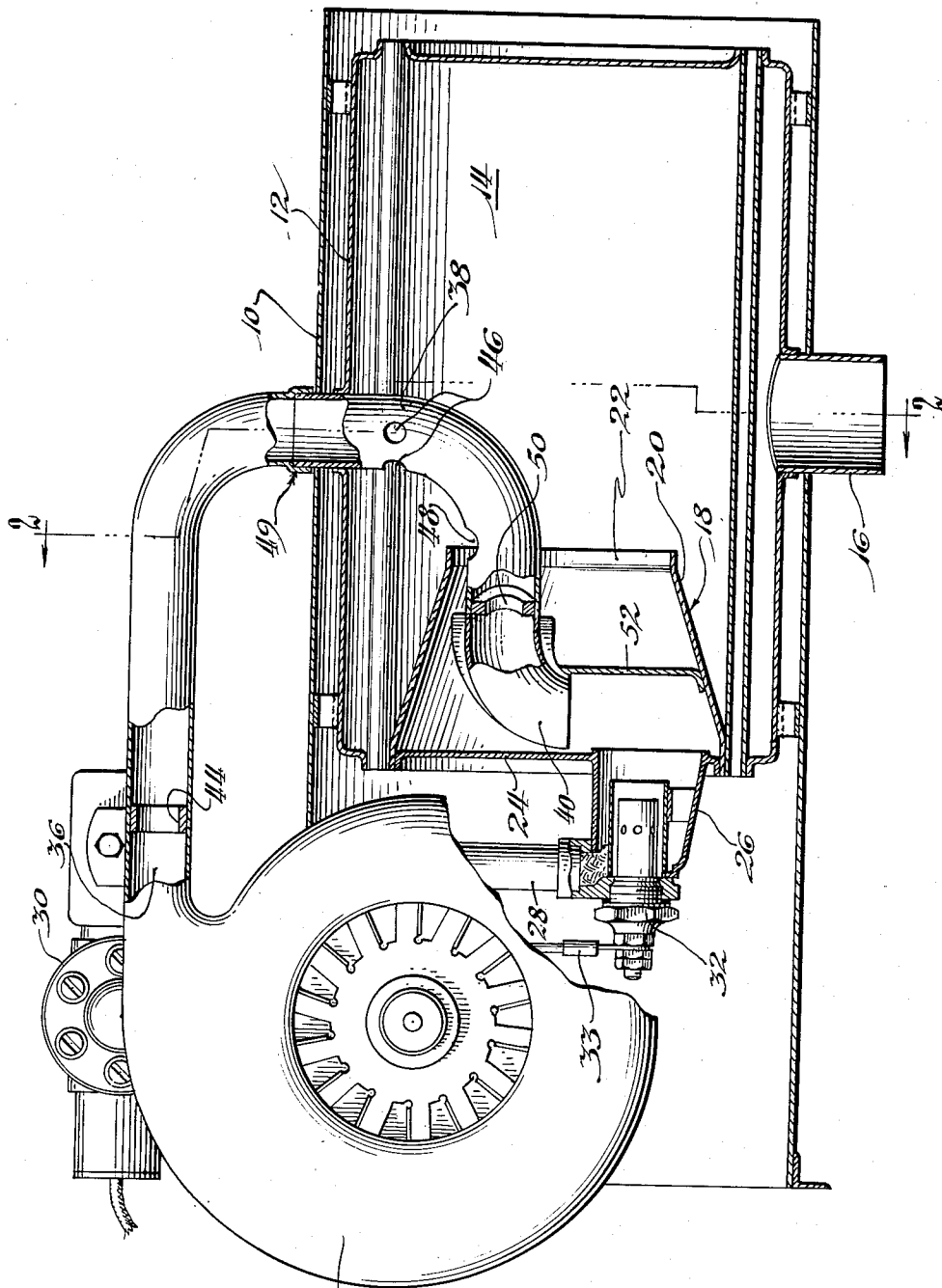


Fig. 1.

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VEHICLE HEATER, PARTICULARLY THE BURNER THEREFOR

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The present invention provides a heater and a heater burner generally similar in character to the one forming the subject matter of Patent No. 2,507,081, but with improvements and advantages which will be pointed out presently.

One of the objects of the present invention is to provide an improved vehicle heater, particularly a heater burner which has operating characteristics such that both the inlet air and the exhaust from the heater can be completely sealed so as to prevent the possibility of contamination of the outside air and in which an exhaust pipe of considerable length can be used.

Another object is to provide a novel heater which is nonpulsating even when sealed to a long exhaust pipe.

Yet another object is to provide an improved vehicle heater or heater burner, which can be used at pressures either above or below ambient.

Still another object is to provide a novel heater burner having improved starting characteristics and improved efficiency, and which is quiet in operation under all conditions.

Other objects and advantages will become apparent from the following description of a preferred embodiment of our invention, which is illustrated in the accompanying drawings, in which:

Fig. 1 is a longitudinal medial sectional view through a heater embodying the present invention;

Fig. 2 is a transverse sectional view which may be considered as taken in the direction of the arrows substantially along the line 2—2 of Fig. 1; and

Figs. 3 and 4 are side and end views, respectively, of a portion of the heater air tube before assembly.

By referring to the drawings and the previously mentioned patent, it will be apparent that a heater of the general type forming the subject matter of the present application consists of a cylindrical duct section or case 10 within which there is located a sheet metal heat exchanger 12 having an approximately cylindrical cavity 14 connected by way of the heat exchanger gas passages to an exhaust fitting 16. Hot products of combustion are supplied to the interior space 14, which serves as the combustion chamber, by a burner 18 located at one end of the space and formed of a sheet metal truncated conical member 20 such that the rearward or closed end of the burner is somewhat larger than the open end 22 thereof. The large end is closed by a disc 24 which fits the burner cone 20 and is welded thereto, this back end of the burner cone also being welded to a portion of the heat exchanger so that the burner cone 20 plus the closure plate 24 serve to seal one end of the combustion chamber.

There is a pressed sheet metal generally cup-shaped member 26 which forms a pocket to the rear of the burner cone 18, this sheet metal pocket forming member being welded around an opening in the back plate 24 such that the pocket so formed is in communication with the interior of the burner cone at the bottom thereof. It is into this pocket that fuel is introduced by way of a tube 28 which leads from any suitable fuel shutoff or control valve 30.

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The heater igniter 32 is also threaded horizontally into an opening at the rear of the pocket forming member 26 so that it lies in a position behind the main burner 18. This igniter ordinarily is connected by way of a lead 33 to a suitable source of electric power, usually at 12 volts or 6 volts, depending upon what is readily available in the vehicle, so that when the lead 33 is energized the igniter 32 will become hot. The arrangement is thus such that fuel introduced to the burner by way of the delivery tube 28 runs against a tubular shell heated by the igniter 32. A portion of the fuel is, therefore, vaporized and is ignited by the igniter 32, after which the igniter may be deenergized so that fuel continuing to flow through the tube 28 passes through the pocket formed by the member 26 and finds its way into the main burner cone 20.

Inasmuch as the burner cone is largest in diameter at its inlet, fuel flowing into the burner will tend to form a small pool at the bottom of the cone 20 against the rearward wall 24. As it is vaporized by the high temperature of the burner, the vapors are mixed with air and ignited, with the result that still burning gases leave the outlet end of the burner 22 and pass into the main combustion space 14, the hot products of combustion then flowing by way of the heat exchanger passages to the exhaust fitting 16.

An electrically driven combustion air blower of centrifugal type, indicated at 34, passes air under pressure to the inlet end of a burner combustion air tube 36. This combustion air tube extends longitudinally parallel to the heater casing 10 for a short distance and then turns at right angles and enters the heater casing at a midpoint and passes through the heat exchanger and into the main combustion space 14, as at 38. Within the main combustion space the air tube is again bent so as to extend rearwardly into the open end 22 of the burner cone 20 near the upper limit thereof. The outlet end of the combustion air tube is connected to a right angular elbow fitting 40 formed in the present instance of two sheet metal stampings welded together, and the outlet opening of the fitting 40 is arranged so as to be directed downwardly and at one side of the burner cone 18 in position against the back wall 24 at a point about on the burner horizontal center line. Thus, air is directed into the burner cone so as to flow tangentially in a downward direction, thereby producing a vortex within the burner cone. The portion of the burner cone into which the combustion air is introduced is partially isolated from the remaining portion by a vertical transverse partition 52 which extends from the center line of the burner downwardly. Communication between the rearward portion of the burner and the forward or outlet portion thereof is had only by way of the space above the center line and fuel is thus prevented from being blown out of the burner before it has had an opportunity to become well vaporized. This partition also helps the vortex to become well established by inserting that the air initially is forced to take a principally rotary component within the burner.

The heater and burner as thus far described is essentially the one forming the subject matter of the previously referred patent, and has in general excellent operating characteristics, but the improvements to be described presently have the effect of making the burner start more quickly at all extremes of temperature, and in addition operate somewhat more efficiently and, most importantly, use of extremely long exhaust pipes connected hermetically to the exhaust fitting 16 does not have the effect of producing rumble or of otherwise affecting heating operating characteristics. The improved heater, therefore, is of more universal application, since it is not necessary to confine the exhaust pipe to a certain length, nor is it necessary under any conditions to use openings in the exhaust pipe so as to stop the rumble and give smooth operating characteristics. This has the additional ad-

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vantage in that the heater can be used in a compartment which is normally maintained at a pressure somewhat above or somewhat below atmospheric, without there being danger of exhaust products contaminating the heated space.

At a point adjacent the blower outlet, the combustion air tube is provided with a restrictor 44 which is essentially a metal ring inserted into the tube 36 so as to reduce its diameter. This metal ring or restrictor has the effect of producing sufficient back pressure on the blower 34 so that high frequency pulsations which are normally produced by a centrifugal blower under certain operating conditions do not cause pulsations in the portion of the tube between the restrictor and the burner. The result is that air being delivered to the burner arrives at the combustion space flowing more smoothly.

Within the heater there are three holes 46 which have been drilled through the air tube 36 just within the combustion space 14 and generally in a horizontal direction. These holes provide a pair of openings generally facing the two sides and another opening facing toward the burner. Also, at just about the point where the air tube 36 extends into the mouth 22 of the burner cone 20, an opening 48 is drilled into the tube 36 from the top. The precise locations of these holes in the present embodiment is shown in Figs. 3 and 4. Just beyond the perforation 48 there is a second air tube restricting ring 50 similar to the ring 44 but with a somewhat smaller opening through the center thereof. This last ring has the effect of producing a back pressure in the portion of the pipe containing the perforations 48 and 46, thus causing an appreciable portion of the air flowing to the burner to be passed into the large combustion space 14 directly without entering the burner cone 20. For convenience in assembly, the air tube 36 is formed in the embodiment shown in two pieces joined just outside the heater shell at 49. The arrangement thus produces a somewhat rich mixture within the burner cone which is subsequently diluted with the result that burning is extended smoothly and to a greater extent into the large combustion space 14. There is, therefore, a considerably larger and cooler flame and less torchlike effect. The heat exchanger under these conditions operates at a more uniform temperature with less tendency to develop local hot spots. In addition, the openings 46 and 48 have the effect of interrupting the acoustical column within the combustion air tube 36, thereby making resonance within the tube improbable. The result of this detuning effect is that periodic fluctuations in pressure within the combustion space 14 do not have the effect of producing standing waves within the tube 36. Air, therefore, is delivered more uniformly to the combustion space and no sonic reverberatory effect is produced, even though a long exhaust pipe with bad acoustical properties is attached to the exhaust fitting 16.

Having described our invention, what we claim as new and useful and desire to secure by Letters Patent of the United States is:

1. In a heater of the type described, means forming a generally cylindrical combustion space with a burner at one end of said space, said burner having the form of a truncated cone, means forming a closure for the base of said cone, said burner being positioned substantially coaxial with said combustion space with the open end thereof facing inwardly of said combustion space, means for supplying liquid fuel to said burner cone, a combustion air tube extending into the side of said combustion space and thence into said burner cone in the upper portion thereof, said air tube terminating within said cone in a downwardly directed fitting positioned at one side of said burner cone so that air flowing from said tube will produce a vortex within said cone, said tube terminating at its opposite end at a position remote from said combustion space, blower means connected for delivering air to the last said termination,

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said air tube being formed to provide openings in the wall thereof within said combustion space adjacent the point of entry therinto of said air tube and additionally at the point of entry of said air tube into said burner cone, means forming a restrictor in said air tube at a point adjacent said blower, and means forming a second restrictor in said air tube at a point downstream of the last of said openings, said second restrictor being formed to provide a greater restricting effect than said first restrictor.

2. In a heater of the type described, means forming a generally cylindrical combustion space, a heat exchanger disposed so as to enclose said space, said heat exchanger having an exterior exhaust fitting connected to receive products of combustion from said heat exchanger, means forming a generally conically shaped burner, said burner being disposed at one end of said combustion space substantially coaxial with said combustion space and having one end thereof closed, said closed end being larger than said open end, said open end facing inwardly of said combustion space, fuel supply means for introducing fuel for combustion through the closed end of said burner, a combustion air tube for introducing air for combustion to said burner, said combustion air tube extending from a point remote from said combustion space to a position within said burner in such fashion as to enter said burner through the open end thereof near the upper limit of said opening, said air tube terminating in a downwardly directed fitting arranged to one side of said burner and adjacent the closed end thereof so as to produce a vortex in said burner, a partition in said burner extending from approximately the center line thereof downwardly and positioned transversely of said burner cone and spaced from the closed end of said burner cone by a distance approximately equal to the diameter of said fitting, said air tube having supplementary openings within said combustion space adjacent the point of entry of said air tube into said combustion space and adjacent the point of entry of said air tube into said burner cone, and means forming restrictors adjacent each end of said air tube, said restrictors being so dimensioned that the restrictor adjacent the outlet of said air tube has a greater restricting effect than the restrictor adjacent the inlet end of said air tube, and means for supplying air under pressure to the inlet end of said air tube.

3. In a heater of the type described for use in a vehicle, means providing a generally cylindrical combustion space with a generally conically shaped burner substantially coaxial with and within said combustion space, the larger end of said burner being closed and the smaller end opening into said combustion space to form a burner outlet, means for supplying fuel to said burner and for igniting said fuel for starting, an air tube extending from a point remote from said combustion space to a position within said burner and passing through said combustion space and said burner outlet so that a portion of said air tube is exposed to the high temperature within said combustion space and burner, means at the remote end of said air tube for introducing air under pressure to said tube, said air tube being formed to provide perforations for the escape of air for combustion at a zone within said combustion space remote from said burner and at another zone adjacent the outlet end of said burner, said air tube terminating within said burner in a manner to produce a vortex in said burner, and means forming flow restrictors adjacent each end of said air tube with said perforations being located between said restrictors.

4. In a heater of the type described for use in a vehicle, means providing a generally cylindrical combustion space with a generally conically shaped burner substantially coaxial with and within said combustion space, the larger end of said burner being closed and the smaller end opening into said combustion space to form a burner outlet, means for supplying fuel to said burner and for igniting said fuel for starting, an air tube extending from a point remote from said combustion space to a position within

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said burner and passing through said combustion space and said burner outlet so that a portion of said air tube is exposed to the high temperature within said combustion space and burner, means at the remote end of said air tube for introducing air under pressure to said tube, said tube being formed to provide perforations for the escape of air for combustion at a zone within said combustion space remote from said burner and at another zone adjacent the outlet end of said burner, said air tube terminating within said burner in a manner to produce a

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vortex in said burner, and means forming a flow restrictor in said air tube downstream of said perforations.

References Cited in the file of this patent

UNITED STATES PATENTS

2,366,416	McCollum	Jan. 2, 1945
2,482,987	McCollum	Sept. 27, 1949
2,488,218	McCollum	Nov. 15, 1949
2,507,081	Allen	May 9, 1950