C. FOX, DEC'D.

J. C. ECKERT, ADMINISTRATOR.

HEATER FOR CARBURETERS.

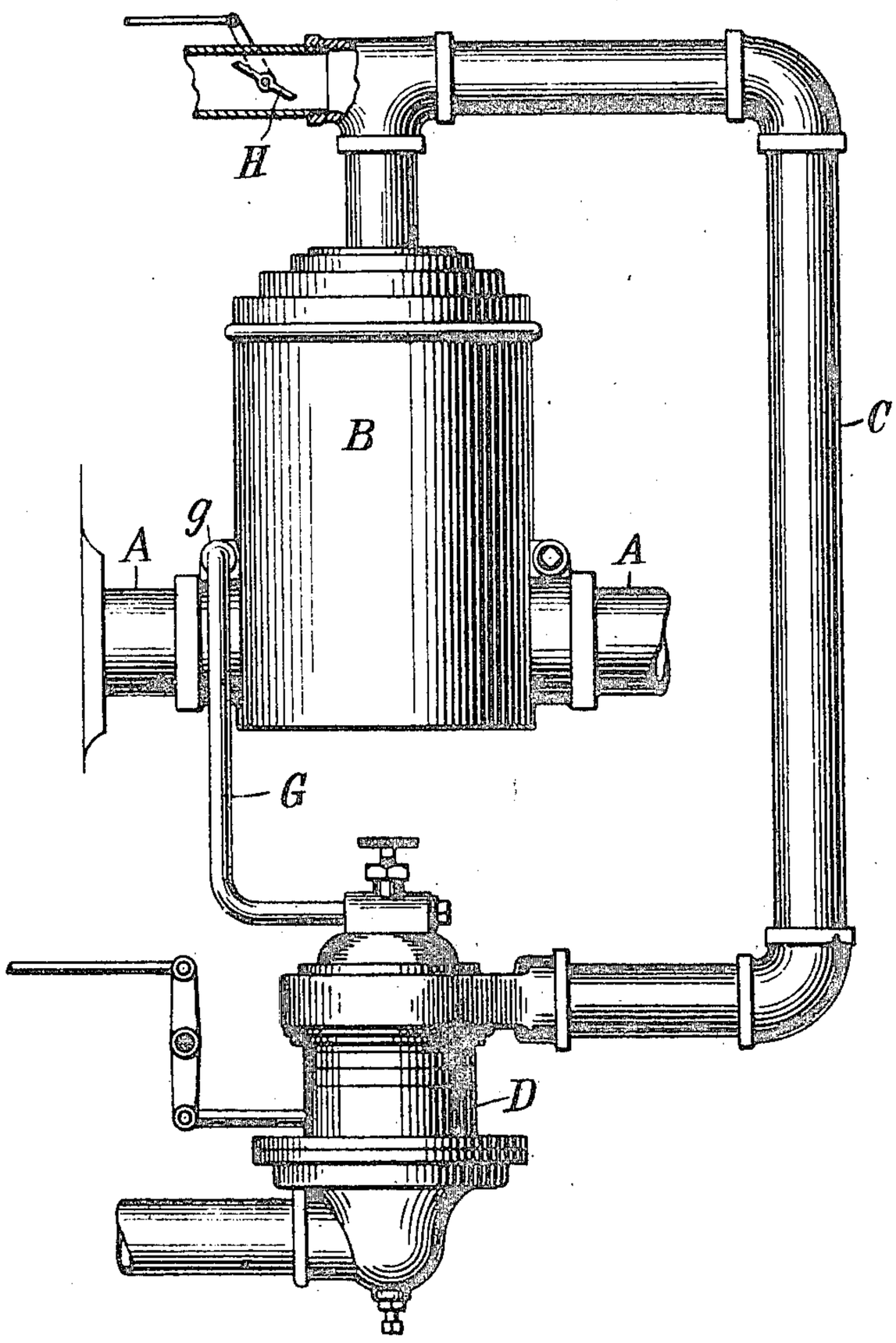
APPLICATION FILED MAY 16, 1908.

964,410.

Patented July 12, 1910.

2 SHEETS—SHEET 1.

Fig. 1



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2 SHEETS—SHEET 2.

Fig. 2

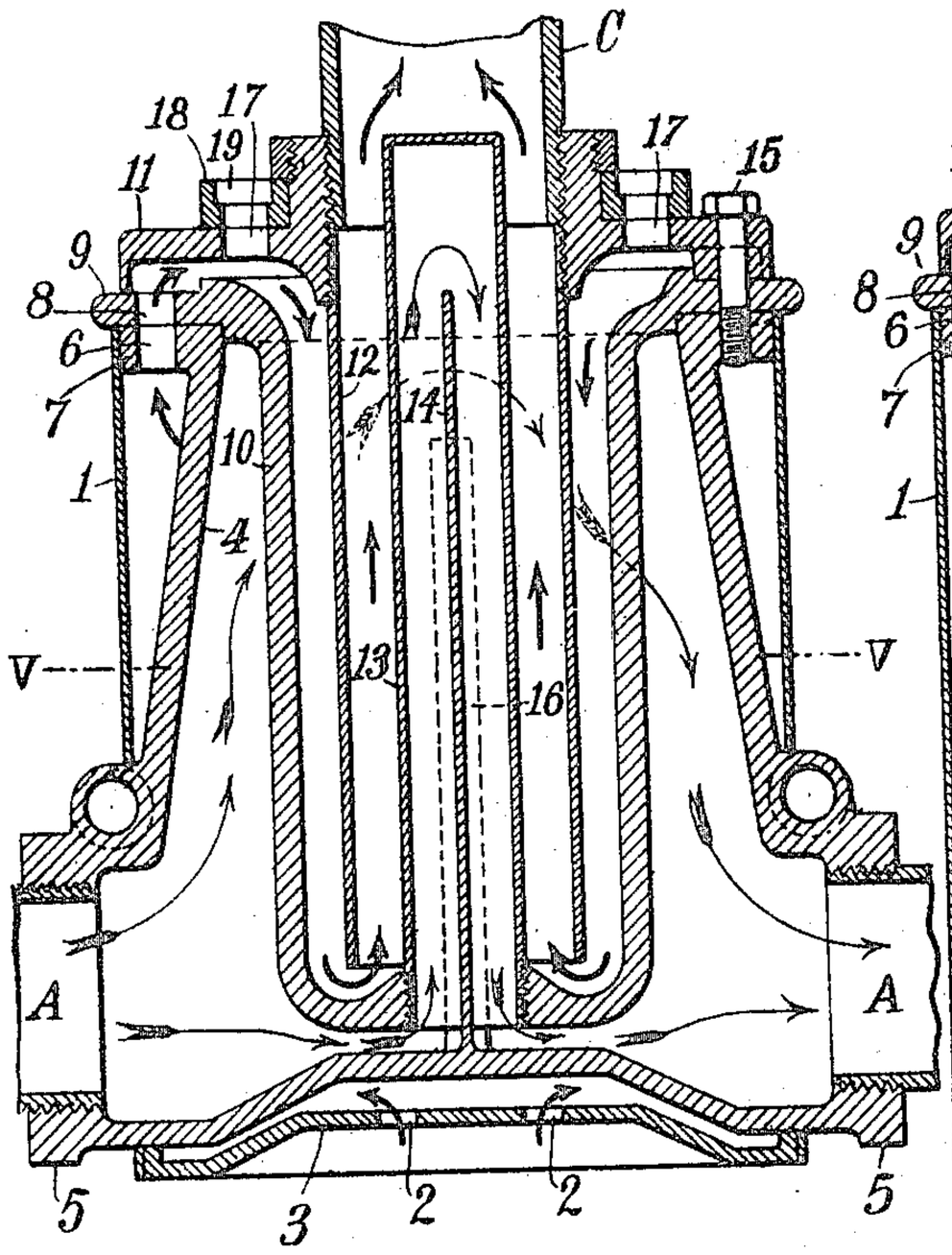


Fig. 3.

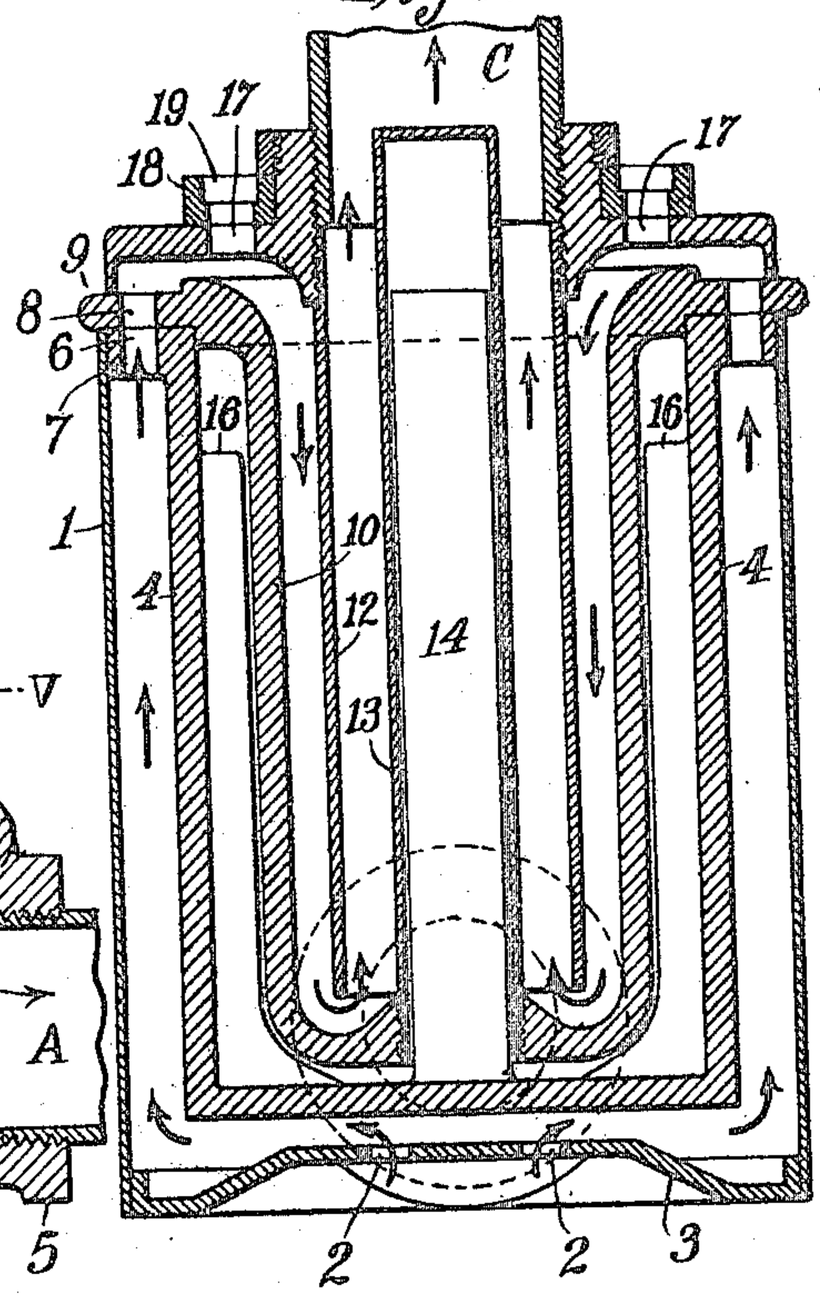


Fig. 4

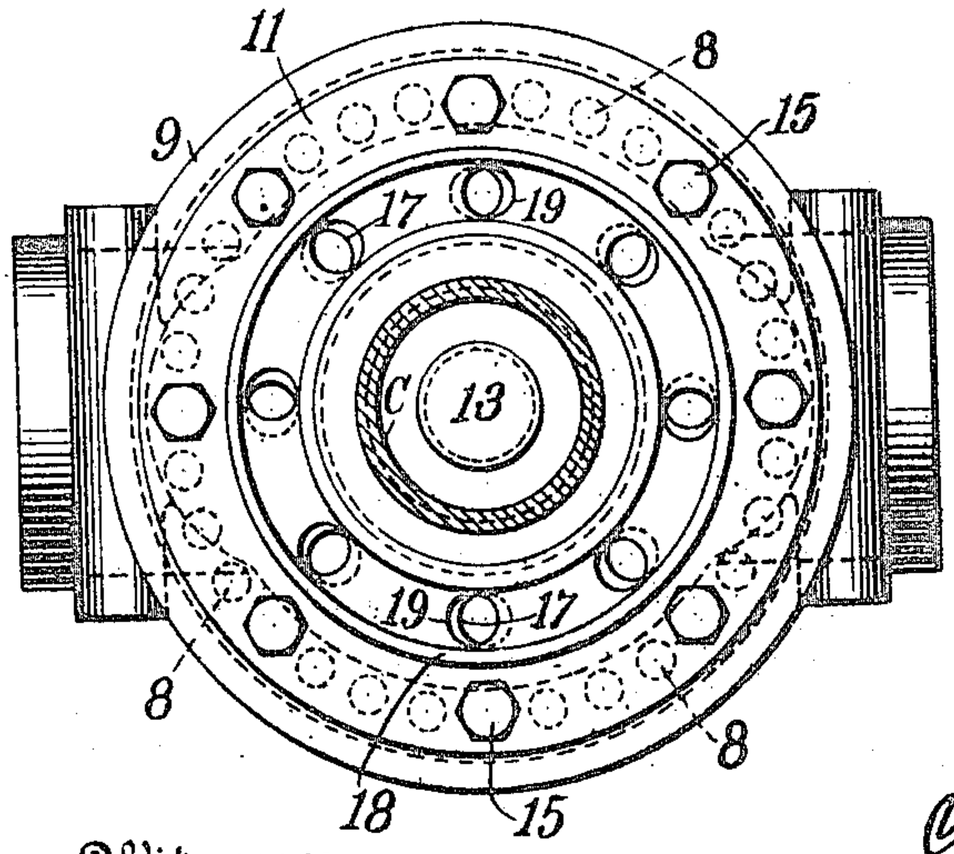
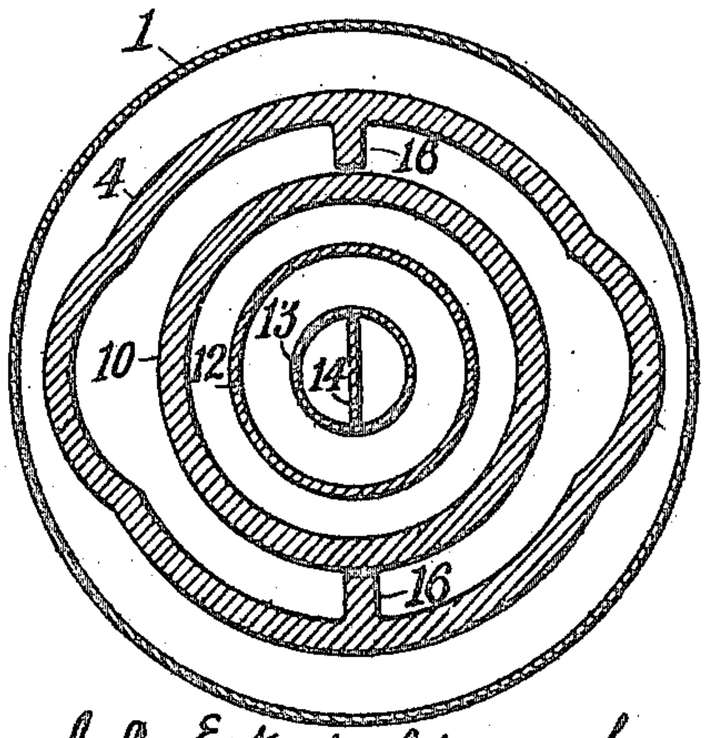


Fig. 5



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UNITED STATES PATENT OFFICE.

JAMES CLENDENIN ECKERT, OF STAMFORD, CONNECTICUT, ADMINISTRATOR OF CHARLES FOX, DECEASED.

HEATER FOR CARBURETERS.

964,410. Specification of Letters Patent. Patented July 12, 1910.

Original application filed February 20, 1906, Serial No. 301,985. Divided and this application filed May 16, 1908. Serial No. 433,312.

To all whom it may concern:

Be it known that CHARLES FOX, late a citizen of the United States, and a resident of Stamford, in the county of Fairfield and State of Connecticut, deceased, invented certain new and useful Improvements in Heaters for Carbureters, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

In an application now pending, which was filed on February 20, 1906, Serial No. 301,985, by the said Charles Fox herein named, there is shown and described in connection with a carbureter, upon which the claims in said application are based, a novel form of heater for utilizing the engine exhaust, to heat the air which is supplied to or drawn into the carbureter for producing the explosive mixture. The subject of the present application, which is a division of the former, is the air heater therein described.

It has been found by experimental investigations and by the practical use of the said heater in conjunction with the carbureter set forth, or its equivalent, that highly useful and novel results are secured, to the attainment of which the construction of the apparatus as shown and described is demonstrably essential, and for reasons which appear to be as hereinafter set forth.

This construction will therefore be described in detail by reference to the accompanying drawings, and its characteristic features of novelty pointed out.

Figure 1 is a side elevation of the preferred form of heater, shown in operative connection with a carbureter. Fig. 2 is a central vertical section of the heater. Fig. 3 is a central vertical section at right angles to that of Fig. 2. Fig. 4 is a top plan view of the heater. Fig. 5 is a section on line V—V of Fig. 2.

Referring now, more particularly to Fig. 1, B represents the heater and A the exhaust pipe of the engine (not shown) with which the apparatus is to be used, and which leads the hot gases of the exhaust through the heater. The air which goes to make up the explosive charges, after being brought to the proper temperature by absorption of heat imparted by the exhaust gases to the heater, is carried from the latter by the pipe C, to the carbureter D, while the liquid hydrocarbon is conveyed, from a suitable tank or receptacle, to the carbureter, by a pipe G. In the illustrated embodiment of the invention this pipe G is shown as formed in part by a passage *g* through the casing of the heater, whereby the oil or fuel may be warmed on its way to the carbureter. In some cases, though not all, this is advantageous.

Referring now to Figs. 2 to 5, 1 is the external casing of the heater, the general configuration of which, while largely immaterial, is preferably cylindrical, into which the external air is admitted through perforations 2 in the bottom 3. Within the casing 1, and concentric therewith, is a substantially cylindrical septum 4, forming an inner casing, closed at the bottom and provided thereat with diametrically opposite necks 5 to receive the two parts of the exhaust pipe A. The bottom of the first inner casing 4 is spaced from the bottom of the outer casing 1, as clearly shown in Figs. 2 and 3, to permit the air entering through the perforations 2 to flow up and around the casing 4, whence it flows out of the annular space or chamber through apertures 6, in the outwardly extending flange 7, on the septum 4, and the registering apertures 8, in a flange 9, on the wall of a second inner cylindrical casing 10, the bottom of which is spaced slightly above the bottom of the casing 4. On the flange 9, but spaced above the same, is an annular cover 11, to which the outlet pipe C is connected. Extending downward from said cover, in line with the outlet pipe C, and into the casing 10 to a point near the bottom of the same, is a third concentric casing or partition 12; and extending from the bottom of the casing 10, where it is in communication with the interior of casing 4, up through casing 12, is a fourth concentric casing 13, divided into two passages by a flat strip or plate 14, rising from the bottom of the casing 4, and terminating a short distance below the closed top of the casing 13. The casing 12 is carried by the cover 11, being secured thereto by screw threads, as shown, while the cover itself is secured to casings 4 and 10, by screws 15, extending through the flange 8 into the flange 7.

In the use of the device the hot gases of the exhaust enter the casing or chamber

formed by the wall 4, as indicated by the long arrows, and divide, as shown, a portion passing up around the inner walls of casing 4, over the ribs 16, extending inwardly from the septum 4 and nearly reaching the next inner septum 10, at diametrically opposite points, and thence out through the other part of the exhaust pipe A. Another part of the exhaust gases flows up through the left hand passage in casing 13, and down the right hand passage, joining the rest of the gases at the outlet at the right of the apparatus. By being compelled to follow such tortuous paths over heat conducting septa a large proportion of the heat of the exhaust is absorbed, and imparted to the air that passes through the heater to the carbureter. The course of this latter is as follows: Entering the annular chamber between the walls or casings 1 and 4, the air is drawn by the suction of the engine pistons up through the apertures 6, 8; down the annular space between septa 10 and 12, and up the annular chamber between 12 and 13, to the outlet pipe C, through which it passes to the carbureter. In its passage through the device the air is thus drawn over the surfaces of the septa 4, 10 and 13, the opposite surfaces of which form the passage for the hot gases of the exhaust. In this way the entering air is raised to a high temperature before reaching the carbureter.

The temperature of the air that goes to the carbureter may be regulated as desired, by admitting a varying proportion of cool air into the current of air flowing through the heater, or by admitting a proper proportion of cool air into the pipe C, through a damper at 11. To permit of a regulable admission of cool air into the heater, the cover 11 is provided with a series of openings 17, and over these openings is a rotatable ring 18, having similar openings 19, so that by turning the ring the latter openings may be brought more or less into register with those in the cover, thus admitting more or less cool air, as may be needed, into the current of partially heated air flowing through the heater.

If the principle of construction of the above described device be now considered in the light of the above explanation of its design and operation, it will be seen that the highly expanded products of combustion of the exhaust enter an enlarged or expansion chamber formed by the walls 4, and are discharged therefrom through constricted and tortuous passages to the discharge orifice. By this means the irregular flow and discharge from the exhaust which is received at one opening is converted into a uniform flow at the other opening, the pressure waves being thus by the progressively reduced capacity of the passage gradually converted into a uniform discharge and the sound waves correspondingly reduced. The device therefore constitutes a true muffler by which the pressure waves of the exhaust are converted into a uniform flow, and by which the volume of the exhaust gases, owing to the large extent of the radiating surfaces over which they pass, is greatly reduced by the absorption of heat therefrom. Next, it will be observed that this absorption of heat is localized, and practically the entire surface of the heat absorbing walls opposite to that in contact with the hot gases of the exhaust, is a radiating surface, imparting its heat to the air drawn through the device. There is thus combined a muffler and heater, both contributing to the useful and very desirable results of reducing the noise without such loss of power as is incident to the use of those mufflers which do not so effectively reduce the volume of the gases, and of raising the temperature of the charges of air to the points at which it is best adapted for carbureters using fuels and hydrocarbons of different kinds, such as gasolene, kerosene, petroleum distillate, or denatured alcohol. It has been found, for example, that with a suitable carbureter the air charges should be raised to a temperature of about 270° F. to obtain the best results from the use of kerosene, and that it should have a temperature of about 350° for petroleum distillate, and that under such conditions an apparently pure and fixed gas is generated that emits no smoke, hardly a perceptible odor, and leaves no deposit of any kind in the carbureter or engine.

It is not new to heat the air prior to its introduction into a carbureter by means of the exhaust, but this is done by arrangements of the exhaust and air inlet passages involving no further or definite principle than the mere proximity of the one to the other, and without taking advantage of the plan and advantages herein set forth, of combining for this purpose a muffler and heater, so that an extended but localized mass of heat absorbing and heat radiating material is availed of to transfer the heat from the exhaust to the entering air.

A heater constructed as above described has been found to give remarkably good results in practice, but it is evident from the above considerations that the specific form hereinbefore described is only typical of the various forms in which the invention may be embodied.

Claims.

1. A combined muffler and heater for internal combustion engines comprising a plurality of spaced concentric heat conducting metal walls arranged to form tortuous parallel passages bounded by said walls for air and for exhaust gases from said engine respectively and provided with an inlet and

an outlet for said gases near the bottom of said heater, and partitions in the gas passages for directing the incoming gases toward the top of the apparatus.

2. A combined muffler and heater for internal combustion engines comprising a plurality of concentric cylindrical heat conducting casings spaced from each other to form tortuous annular air passages and parallel passages divided longitudinally by partitions for heated exhaust gases, an inlet and an outlet for said gases near the bottom of said heater, and an inlet and an outlet for air.

3. A combined muffler and heater for internal combustion engines comprising a plurality of concentric cylindrical heat conducting casings spaced from each other to form tortuous annular air passages and parallel passages divided longitudinally by partitions for heated exhaust gases, an inlet and an outlet for said gases near the bottom of said heater, an inlet and an outlet for air, and means for regulating the admission of additional air through a supplemental inlet.

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