For a detailed description of the present form of my invention, reference may be had to the following specification and to the accompanying drawings forming a part thereof, wherein

Fig. 1 shows my invention in a diagrammatic form,

Fig. 2 illustrates the control of the engine by the flame damper.

My invention relates to means for heating a vehicle, such as a motor bus, driven by a hydrocarbon engine, and contemplates the production of the required heat by the re-combustion of the contents of the engine exhaust.

Referring to the drawings, R represents the body of the vehicle and R2 the propelling engine therefor. A is the exhaust pipe leading from the engine manifold. It passes to a carburetor B by which air is drawn through the intake pipe C and mingled with the exhaust gases. From carburetor B the mixture passes by pipe A1 to the burner D. This burner consists of a hollow disc-shaped casting into which the mixture from pipe A1 enters from below, and which is provided with burner nipples on its upper face. Burner D is contained in the lower half of a two-part casting or combustion chamber G which is also provided, above the burner, with a grating F of lava or other refractory material. The upper half is dome-shaped, as shown, and the two halves are provided with flanges by which they may be bolted together.

Moreover, the joint between the two halves is outside the sheet metal receptacle G2 to be hereinafter described. Thereby any leakage from the casting, such as may be caused by the extreme range of expansion and contraction to which it is subject by virtue of its wide variation in temperature, will be into the atmosphere and not into the said receptacle G2. In the center of burner D, and slightly above it, is the smaller pilot burner E which may be termed the ignition burner, since it serves to start and maintain the re-combustion of the exhaust products in burner D, while it also serves as an alternative source of heat for the vehicle when the engine is not running and when thereby the fuel supply for burner D ceases. The ignition burner E is mounted on the upturned end of a pipe K1 leading from fuel tank L and containing an injector K which draws in air through pipe K2 and mixes it with the fuel coming from tank L on its way to burner E. The fuel in tank L is expelled therefrom by air pressure in pipe L2 derived from the brake system or any other available source. The upper half of casting G is enclosed above its jointing to the lower half in a sheet metal receptacle G2 and communicates on its rear side with a group of flues or pipes H enclosed in a sheet metal duct H2 which extends from said receptacle G2 to the rear of the car body into which it opens at M. The flues or pipes H continue out through the wall of duct H2 and open into the atmosphere. The left end of said receptacle G2 connects, by opening O, with a duct P wherein is a sirocco blower T that sucks the air out from receptacle G2 through said opening O and delivers it, through duct P, into the forward end of the vehicle body. Branching from duct P is a duct J that opens into the atmosphere. At the junction of ducts P and J is a damper Q by which the blower-driven blast may be directed, either partly or wholly, either into the vehicle body, as described, or into the atmosphere through duct J. The blower T is operated in any desired manner, preferably by mounting it on a shaft S driven by the engine, whereby, so long as the engine is running and supplying, by its exhaust, the fuel for burner D, the blower is also running. Furthermore, there is a passage W between the interior of casting G and the interior of the casing which contains the engine. This passage W is controlled by a damper V. Said damper may serve to stop the engine in any desirable manner. For instance, this damper, as shown in Fig. 2, when in its vertical position closing the passage W, also acts to complete the ignition circuit of the engine by pressing springing contact a against fixed contact b. Conversely, it opens that circuit, thereby stopping the engine, when turned to its horizontal position to open the passage W and establish connection between casting G and the engine.
casing. By this means I render it impossible for the engine to supply fuel to the re-combustion burner D at a time when the passage W is open and able to lead the hot products of said re-combustion into the engine compartment.

In operation the engine when running will deliver the contents of its exhaust to burner D, together with the air needed for its combustion which it takes in at the carburetor B. This creates an intense fire in the casing G, the heat thereof being steadied by the incline descent grating F, and the products of combustion being carried through the flue-pipes H into the atmosphere. This combustion is initiated by the pilot burner E which burns constantly, being supplied with aerated fuel from tank L which is under air pressure as heretofore described. It has been previously proposed to employ a spark plug for this igniting the exhaust at the beginning, but by my improvement the pilot burner heats the exhaust up to the ignition point instantly, whereas the spark plug will not cause ignition until the exhaust has been heated by the engine itself which takes considerable time, since the contents of the exhaust at the starting of the engine are also not of a composition that will ignite readily. Moreover, while the pilot burner E will be immune to the high temperature in casing G and last indefinitely therein a spark plug kept in constant operation under these conditions will have but a short life. The location of the pilot flame E in casing G and its supply under pressure keeps it from being blown out under any circumstances. The blower T, which starts on the starting of the engine, will act to draw in at M the air within the bus body. This air will become heated as it passes in duct H along the flue pipes H and will be further heated as it passes through receptacle G over the intensely hot dome of casting G. Thence it goes through the opening O and blower T into pipe P and into the forward end of the vehicle body. The aforesaid circulation route is marked by arrows on the drawings. Thus the air within the vehicle body is kept in circulation and receives added heat during each cycle. By this means the heating is made independent of the external temperature, since it is the air from inside the body which is taken out for re-heating. If such heating were applied to fresh air from outside the vehicle, the inside temperature would be lower in colder than in warmer weather. Whatever ventilation and fresh air may be needed in the vehicle body may be obtained by separate means rather than by interference with the heating system. To moderate the body temperature the damper Q may be operated by suitable means to close, or partly close, the duct P and open J, as for instance, by manual means (not shown).

It should be explained that the object of re-burning the contents of the engine exhaust, is not primarily to provide heat for the vehicle but to purify the exhaust of its carbon monoxide and other deleterious ingredients. It may also have other functions. To permit of these functions, I, therefore, regulate, or adjust, the heating of the vehicle by keeping up the re-combustion from which the heat is derived and diverting more or less of its heating effects into the atmosphere instead of into the body of the vehicle. This is also simpler than to undertake to regulate or adjust the amount of heat produced.

At times when no heating of the body is desired, as in the summer time, the damper Q will be turned to block off duct P leading into the body, while blower T will continue to operate. It will draw the air from the rear of the vehicle over flues H and casting G and then expel it through the duct J into the atmosphere. This has two functions: It produces a cooling and ventilating draft through the vehicle and also serves to cool the casting G which is still kept hot by the re-combustion which continues its aforesaid function of purifying the exhaust, whether the body needs to be heated or not.

There are also times when heating is required and the engine is not running. This occurs in winter when the vehicle is stored for the night in the open or in a cold garage, or when it might be stalled in a snow storm with its tank of gasoline for the engine empty or nearly so. For such an emergency the pilot, or ignition burner E is made of sufficient capacity to provide, if desired, an amount of heat adequate to warm the engine and the body to the needful degree. Since the pilot burner is in the casting G it will act in the same manner as burner D to heat the casing and the air which circulates over the casing and through the duct H. At the same time the damper V may be opened, thereby stopping the engine as above described, and closing flues H by means of link G and the companion damper, when the heat—under the air pressure on tank L—will pass into the engine compartment to warm both the engine and the radiator enough to prevent freezing and facilitate restarting. When the engine is to be restarted the damper V must be re-closed, in order to start the engine and also to reopen flues H which must not be closed when the re-combustion is going on. Without the pilot flame the starting of the engine would be delayed, and, moreover, the long time required to get the exhaust into condition to be ignited by a spark-plug would be greatly extended with a corresponding increase in the outpour of carbon monoxide, which is of an excessive volume at that stage of engine operation.

It is also to be noted that my heating system eliminates all need of a muffler which is necessarily provided in all other vehicles us-
ing a hydrocarbon engine. The burner D may even exert a degree of suction on the exhaust pipe A, which the muffler, on the contrary, tends to choke by causing back pressure. The heating is also increased as the speed of the engine and vehicle is increased, being thus kept commensurate with the requirements due to windage. The apparatus shown herein is comparatively simple and cheap, and may be made compact, readily removable and easily inspected, while it also meets the wide variety of conditions involved in a complete system of heating.

In a previous application for patent (filed January 26, 1926, Serial No. 83,939) I have made claims including the broader aspects of the above-described invention, but the present embodiment is more recent and particularly concerns the form of the re-burner and its relation to the associated members having in view the commercial use of the invention.

What I claim as new and desire to secure by Letters Patent is:

1. An apparatus for heating motor vehicle bodies comprising an elongated conduit adapted to enclose the exhaust pipe of the vehicle motor, an air inlet connecting the interior of the vehicle body with the rear end of the conduit, an air pump mounted on the dash of the motor vehicle, means connecting the conduit to the pump intake and means connecting the pump outlet to the forward end of the vehicle body.

2. In a heater for a vehicle equipped with an internal combustion engine, a receptacle for supplying heated air to the vehicle, a combustion chamber having a heating surface extended into said receptacle so as to heat the air therein, a main burner within said combustion chamber, means for supplying said burner with a combustible mixture of air and exhaust gases from said engine, so as to heat said refractory heat absorber while the engine is operating, and a pilot burner for the main burner also located within said combustion chamber so as to heat said surface while the engine is not operating.

3. In a heater for a vehicle equipped with an internal combustion engine, a combustion chamber, a main burner within said combustion chamber, means for supplying said burner with a combustible mixture of air and exhaust gases from said engine, so that the walls of said combustion chamber will be heated while the engine is operating, a pilot burner for the main burner also located within said combustion chamber so as to heat the walls thereof while the engine is not operating, and an air heating receptacle heated by said combustion chamber and communicating with the interior of the vehicle body, so as to supply heated air thereto.

4. In a heater for a vehicle equipped with an internal combustion engine, a receptacle for supplying heated air to the vehicle, a combustion chamber having its walls exposed to the air within said receptacle, a main burner within said combustion chamber, means for supplying said burner with a combustible mixture of air and exhaust gases from the engine so that said combustion chamber will be heated while the engine is operating, a pilot burner for the main burner located within said combustion chamber so as to heat the last mentioned chamber while the engine is not operating, means within said receptacle for creating a circulation of air through the vehicle, and means for diverting heated air to the atmosphere.

5. In a heater for a vehicle equipped with an internal combustion engine, a burner, means for supplying said burner with a combustible mixture of air and exhaust gases from said engine, an enclosure surrounding said burner and provided with exhaust means for delivering products of combustion to the atmosphere, a receptacle heated by a wall of said enclosure, a duct connecting one end of said receptacle with the rear of the vehicle body, a duct connecting the opposite end of the receptacle with the front of the vehicle, and means for circulating the air from the rear of the body through said receptacle into the front of the body.

6. In a heater for a vehicle equipped with an internal combustion engine, a combustion chamber, a refractory heat absorber therein, a burner located in the lower part of said combustion chamber, means for supplying said burner with a combustible mixture of air and exhaust gases from said engine, so as to heat said refractory heat absorber while the engine is operating, a pilot burner for the first mentioned burner also located within said combustion chamber, so as to heat said refractory heat absorber while the engine is not operating, an air receptacle communicating with the vehicle and heated by said combustion chamber and provided with an extension duct also communicating with said vehicle, an exhaust flue for the combustion chamber extending through said duct, and means for circulating air from the vehicle body through said receptacle.

7. In a heater for a vehicle equipped with an internal combustion engine, a combustion chamber, an air receptacle heated by said combustion chamber, said air receptacle having inlet and outlet means connecting it with the body of the vehicle at two positions and also having means connecting it with the atmosphere, a burner within said combustion chamber, means for supplying said burner with a combustible mixture of air and exhaust gases from said engine, so as to heat said combustion chamber, a blower for circulating the air within said vehicle body through said air receptacle, and a damper
for directing said air into the atmosphere or returning it to said body.

8. The combination with a vehicle equipped with an internal combustion engine, of a conduit disposed longitudinally under the vehicle and communicating with the interior of the vehicle at one end, a heating chamber at the other end of the conduit also communicating with the interior of the vehicle, a heater for said heating chamber, means within said heater for reburning exhaust gases from said engine so as to heat the same, an exhaust pipe extending from said heater and delivering the products of combustion through the conduit to the atmosphere, and means for forcing an air current through said conduit around said exhaust pipe and into the vehicle body.

9. The combination with a vehicle equipped with an internal combustion engine, of a heater chamber, means within said chamber for reburning exhaust gases from said engine, said means communicating with the exhaust pipe of the engine, an air heating chamber enclosing a portion of said heater chamber, means for creating an air current through said air heating chamber so that the air will be heated as it passes over said heater chamber, and means for directing said air current into the vehicle body or into the atmosphere.

Signed at Albany, county of Albany, State of New York, this 2nd day of February, 1926.

LEE P. HYNES.