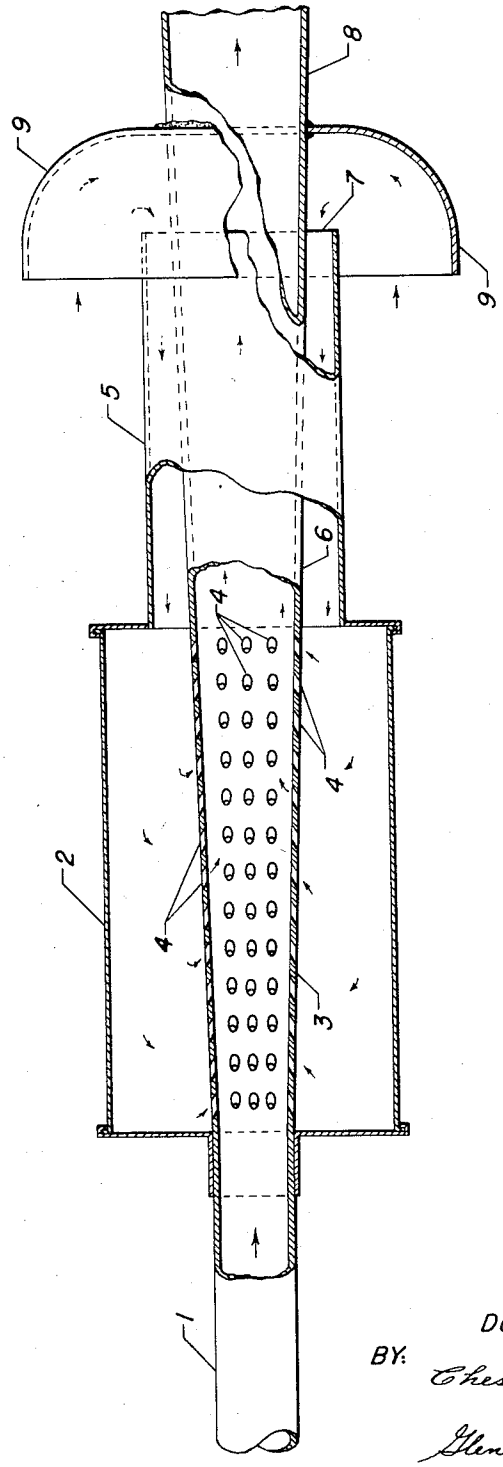
July 14, 1959 D. J. BERGMAN 2,894,598

EXHAUST BURNING MUFFLER

Filed Nov. 14, 1955



INVENTOR:
Donald J. Bergman

BY:
Chester J. Giuliani
ATTORNEY:
Glen R. Grunewald
AGENT:

United States Patent Office

2,894,598

Patented July 14, 1959

2,894,598

EXHAUST BURNING MUFFLER

Donald J. Bergman, Kenilworth, Ill., assignor, by mesne assignments, to Universal Oil Products Company, Des Plaines, Ill., a corporation of Delaware

Application November 14, 1955, Serial No. 546,471

4 Claims. (Cl. 181—43)

This invention relates to a muffler for an internal combustion engine and in particular to a combination muffler and exhaust gas burner.

The exhaust gas from internal combustion engines, due to incomplete combustion, contains unburned or partly oxidized fuel. The exhaust gas is discharged into the atmosphere and, as is well recognized, results in toxic and sometimes foul smelling fumes in the area. In congested metropolitan areas the high concentration of exhaust fumes in the air causes an annoying and sometimes dangerous condition. While not the sole cause, exhaust fumes from automobiles at least contribute in large measure to the smog conditions which are a problem in many metropolitan areas. It is an object of this invention to provide a muffler assembly which adequately dampens the pulsating stream of exhaust gas to cause quiet engine operation, and at the same time, provides a means for burning most of the combustibles in the exhaust gas to eliminate or at least greatly diminish the ill effects heretofore mentioned.

It is an embodiment of this invention to provide an exhaust burning muffler assembly which comprises in combination a heat exchange chamber, a muffling chamber and an exhaust gas conduit, said conduit passing through said muffling chamber and then through said heat exchange chamber, said heat exchange chamber openly communicating with the atmosphere and with said muffling chamber and said muffling chamber openly communicating with the interior of said conduit through perforations in the wall of said conduit.

By employing the muffler assembly of this invention, hot air is mixed with the exhaust gas to provide a gas stream at ignition temperature containing oxidizable material and oxygen. As a result of such a mixture, the combustible gas in the exhaust oxidizes to produce heat while forming carbon dioxide and water, which compounder are neither obnoxious nor dangerous.

The muffler of this invention may be better described with reference to the accompanying drawing which illustrates one embodiment of this invention with various optional modifications and is intended to be illustrative of the general concept of this invention rather than limiting to this particular embodiment.

The drawing shows a partial sectional view of the assembly which is comprised of exhaust-carrying conduit 1, heat exchange chamber 5 and muffling chamber 2 as essential elements thereof. Exhaust gas from an internal combustion engine passes through conduit 1 in the direction of tailpipe 8. The exhaust gas in conduit 1 in a typical internal combustion engine contains carbon dioxide, carbon monoxide, water vapor, nitrogen, hydrocarbon material and partially oxidized hydrocarbon material. Due to the operation of an internal combustion engine, the exhaust gas in conduit 1 is pulsating and, if discharged directly to the atmosphere, would produce a loud noise as well as contaminate the atmosphere with the compounds contained therein. By passing the exhaust gas into mixing conduit 3 contained within muffling

chamber 2, the pulsations are dampened by expanding through the perforations during the high pressure portion of the pulsation and drawing gas back into the conduit from chamber 2 during the low pressure portion. Since chamber 2 is openly communicating with the atmosphere through chamber 5, as will be hereinafter described, and since conduit 3 is openly communicating with the atmosphere through tailpipe section 8; at static conditions the pressure in chamber 2 and in conduit 3 are equal. When, however, exhaust gas passing through conduit 3 is at high velocity, a venturi effect is produced which will tend to draw the relatively static gas within chamber 2 into the interior of conduit 3. Therefore, even though the pulsating gas stream in conduit 3 may produce flow through perforations 4 in both directions, the overall result is that preheated air from the interior of chamber 2 passes into the interior of conduit 3 through perforations 4.

As hereinbefore stated, muffling chamber 2 openly communicates with the atmosphere through chamber 5. Opening 7 at the end of chamber 5 is the point at which air is at least at atmospheric pressure and temperature passes into chamber 5 and while in transit through chamber 5, this air is in indirect heat exchange with the exhaust gas within conduit 6. Within conduit 6, the exhaust gas passes at high temperature, due both to the operation of the engine and the combustion being effected, which in turn is due to the blending of air with the exhaust gas in conduit 3. As a result, the air passing from chamber 5 into chamber 2, is considerably preheated so that when blended with exhaust gas, the mixture will be at ignition temperature and burning will be effected.

In the embodiment of this drawing, air scoop member 9 is attached to the tailpipe section and positioned in relation to opening 7 of chamber 5 so that when this device is used on a moving automobile it will produce a high pressure zone at opening 7 of chamber 5. Although this modification is not essential, it will facilitate the flow of air into muffling chamber 2 and conseqeuntly into the interior of conduit 3. The assembly of this invention is self adjusting since, when the engine operates at higher speed and more exhaust gas is produced, the air scoop functions better and the higher velocity exhaust gas stream magnifies the venturi effect to draw greater quantities of air into conduit 3. Another nonessential but desirable modification of this invention is shown in the drawing and comprises the angular drilling of perforations 4. It is preferred that the air blending with the exhaust gas is introduced into the exhaust gas stream in the direction of the exhaust gas flow so that the flow of exhaust gas is not retarded with a resultant build-up of back pressure in the manifold. The invention, however, is operative when perforations 4 are radial rather than angular. Still another desirable, but not essential, modification of this invention consists of tapering any or all of conduits 3, 6 and 8 so that they may be gradually expanded laterally towards the discharge portion of the assembly. This modification is desirable to cut down the friction drop in the assembly due to the increasing volume of gas passing through the conduit, which in turn is due to the introduction of air and the expanding volume caused by combustion. Still another modification, which is not here shown, may consist of disposing within chamber 5 a means for improving the heat transfer from the wall of conduit 6 to the air stream passing through the annular space. Heat transfer may be improved by corrugating conduit 6 or attaching longitudinal fins to it to increase the heat transfer surface.

Many other modifications of this invention are possible. In operation, for example, with an ordinary auto-

mobile, burning may not begin until the engine is warmed up. This condition if it exists for only a short time is not too serious, however, it can be eliminated by the use of a spark plug or other ignition-promoting device within conduit 6. Various parts of the assembly herein shown may also be insulated to prevent cooling if it is found that the ignition temperature is not readily reached within conduit 3. Conduit 3 may also be lined with ceramic material to reduce the temperature effects on the metal.

From the foregoing, it may be seen that the apparatus of this invention provides a means for muffling the exhaust from an automobile or other internal combustion engine and at the same time providing for the oxidation of the noxious and undesirable components of exhaust gas.

I claim as my invention:

1. An exhaust burning muffler assembly comprising a heat exchange chamber open to the atmosphere at one end thereof, a muffling chamber having one end thereof connected to the other end of the heat exchange chamber, a closure for the opposite end of said muffling chamber, an exhaust gas conduit extending longitudinally through said chambers and through said closure and spaced from the walls of said chambers, the portion of said conduit within the muffling chamber being perforated throughout its length in the last-named chamber and the portion thereof in the heat exchange chamber being imperforate, said conduit having a tailpipe section extending beyond the open end of the heat exchange chamber and an inlet section extending beyond said opposite end of the muffling chamber, and means mounted on said tailpipe section for diverting air into said open end of the heat exchange chamber to flow through the latter into said muffling chamber.

2. The assembly of claim 1 further characterized in that said means comprises an air scoop attached to said tailpipe section and having its side walls overlapping the open end of the heat exchange chamber.

3. The apparatus of claim 1 further characterized in that said exhaust gas conduit decreases in cross-section from said one end to said opposite end of said muffling chamber.

4. The apparatus of claim 1 further characterized in that said exhaust gas conduit decreases in cross-section from said one end to said other end of said heat exchange chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

1,835,053	Huby	Dec. 8, 1931
1,934,567	Fogas	Nov. 3, 1933
2,038,567	Ittner	Apr. 28, 1936
2,065,681	Fogas	Dec. 29, 1936