

Aug. 13, 1968

L. W. MILOS

3,396,535

ENGINE EXHAUST SYSTEM

Filed June 16, 1966

FIG. 1

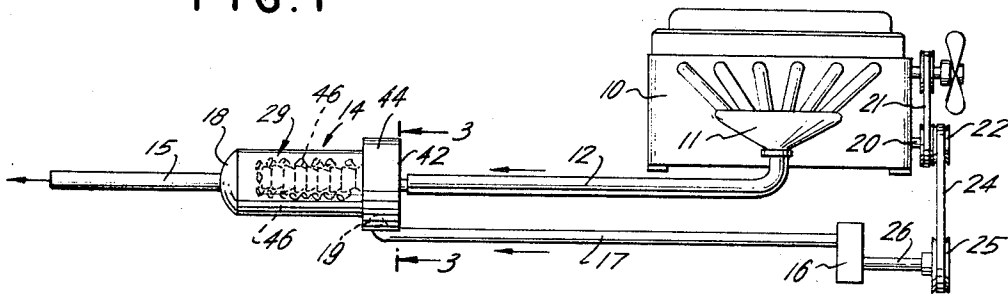


FIG. 2

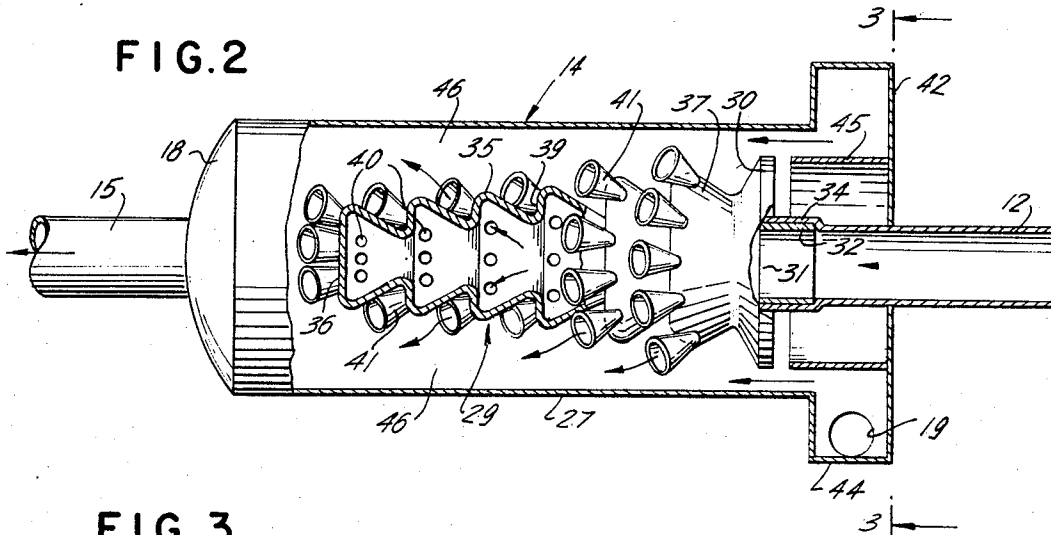
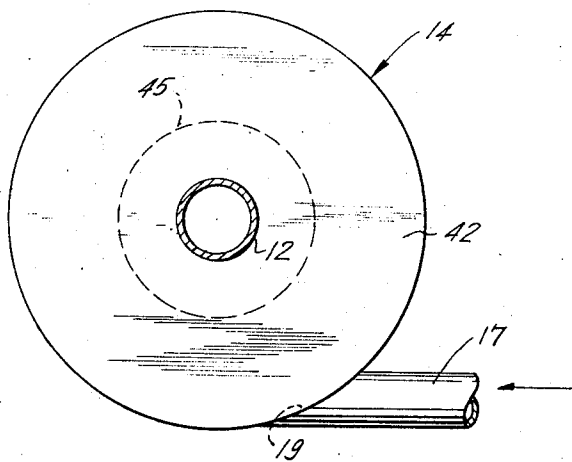


FIG. 3



BY

INVENTOR.
LOUIS W. MILOS

Alfred W. Nibbel
ATTORNEY

1

3,396,535
ENGINE EXHAUST SYSTEM
Louis W. Milos, 152 Mahar Ave.,
Clifton, N.J. 07011
Filed June 16, 1966, Ser. No. 558,063
7 Claims. (Cl. 60—30)

ABSTRACT OF THE DISCLOSURE

An exhaust system for an internal combustion engine, such system eliminating combustible gases from the exhaust gases by oxidizing and/or burning them, such system also substantially deadening or muffling the sound of the exhaust. The system includes an elongated shell or housing with an elongated sleeve disposed coaxially therewithin, the sleeve having a plurality of openings through its sidewall and within the chamber, outwardly expanding funnel-shaped extension tubes projecting outwardly and rearwardly from the sleeve around each opening. Air is introduced into the entrance end of the housing so as to flow longitudinally thereof and to mix with the exhaust gases which travel outwardly through said funnel-shaped extension tubes, the air being supplied in stoichiometric amounts so that the combustible gases and vapors in the exhaust are completely burned within the housing. Preferably such combustion air is supplied by a blower which is driven by and in timed relationship with the engine.

The problem of the increasing pollution of the earth's atmosphere has long been recognized. The Federal Government has now adopted a measure by which the Secretary of the Department of Health, Education and Welfare will establish standards for the control of automobile and diesel truck emissions in an effort to cut down on automobile air pollution. The system of the present invention provides a simple and effective solution to the problem; it may be applied to internal combustion engines of all kinds, whether spark ignited or diesel, and whether four- or two-stroke cycle. The latter type of engine, although not so widely used as the four-stroke cycle engine for automotive use, is employed in great numbers for scooters, motorcycles, lawn mowers, outboard motors, and the like. The untreated exhaust from two-stroke cycle engines is particularly objectionable, since its fuel ordinarily is a mixture of gasoline and lubricating oil, and a portion of unburned fuel escapes from the exhaust along with the combustion gases.

In accordance with the invention, the exhaust gases issuing from an internal combustion engine are fed into an exhaust gas treating device having a shell or housing with a chamber therewithin. Such treating device, which may also function substantially to deaden or muffle the sound of the exhaust, is provided with conduit means in the form of an elongated sleeve mounted generally centrally within the chamber and spaced from the sidewall thereof, the exhaust gases being introduced into a first, entrance end of the sleeve. The sleeve has a plurality of openings through its sidewall and within the chamber, such openings being distributed over the surface of the sleeve and providing for the progressive escape of exhaust gases therethrough into the annular space within the chamber as such gases travel through the sleeve.

The housing has closure means on the first, entrance end thereof, through which the exhaust gases enter the sleeve, and closure means on the second, discharge end of the housing. There is provided means to introduce air into the entrance end of the housing so that such air flows generally longitudinally of the housing. Because of the elevated temperature of the exhaust gases and of the

2

housing by the combustion, to be described, therewithin, the gases, upon flowing outwardly through the openings in the sidewall of the sleeve and into the chamber, react with the air thus introduced into the chamber. Preferably air is supplied to the chamber in an amount which is at least sufficient to react with all of the combustible gases and vapors contained in the exhaust gases, so that such gases and vapors are completely burned within the housing. The housing is provided with conduit means to discharge therefrom the products of the reaction of the air introduced into the housing and the exhaust gases introduced into the device.

The invention has among its objects the provision of a simple, economically made and installed device for the elimination of combustible gases and vapors from the exhaust gases of an internal combustion engine.

A further object of the invention is the provision of a device of the character indicated which is rugged and compact, requiring little of any more space than that occupied by a conventional muffler.

Another object of the invention is the provision of a device for eliminating combustible gases and vapors from engine exhaust which also functions as a muffler for the engine.

Yet another object of the invention is the provision of an exhaust gas treating device of the character indicated which may be installed on existing automobiles, boats, stationary engines, etc., either to replace the muffler thereof or in addition to the existing muffler for the engine, or which may be supplied as a part of the original equipment employed with the engine.

Still another object of the invention is to provide an engine exhaust gas treating device of the indicated character which does not add substantially to the back pressure imposed upon such exhaust gas.

The above and further objects and novel features of the invention will more fully appear from the following description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

FIG. 1 is a somewhat schematic view in side elevation of a preferred embodiment of internal combustion engine exhaust system in accordance with the invention;

FIG. 2 is a view partially in longitudinal axial section and partially in side elevation of the exhaust gas combustion chamber means of the system of the present invention; and

FIG. 3 is a view in end elevation of the combustion chamber, the view being taken from the line 3—3 of FIG. 2 looking in the direction of the arrows, the pipe leading the engine exhaust gases into the device being shown in transverse section.

Turning now to the drawings, an internal combustion engine is schematically shown in FIG. 1 where it is designated by the reference character 10. Engine 10 is provided with an exhaust manifold 11 from which engine exhaust gases pass into an exhaust pipe 12. The pipe 12 leads to a first or entrance end of an exhaust gas treating device 14, which in this instance also performs the function of a muffler as well as that of treating the exhaust gases to eliminate combustible gases and vapors therefrom. Treated gas issues from device 14 through a pipe 15 connected to an end closure 18 at the second, delivery end of the device 14. Pipe 15 may be the tail pipe of an automobile.

The engine is provided with an air blower or pump 16 which is driven in synchronism with the engine, by means

to be described, and which thus delivers a volume of air which is substantially proportional to the volume of exhaust gases delivered by the engine. The blower or pump 16 delivers air therefrom through a pipe 17 which leads to a port 19 at the entrance end of the device 14.

The blower or pump 16, in the embodiment shown, is driven from the engine crankshaft 20, from which the engine fan is driven in a conventional manner by a fan belt 21. Mounted on crankshaft 20 is an additional pulley 22, such pulley driving a further belt 24 which is entrained over pulley 22 and a pulley 25 on the driving shaft 26. Other means for driving the blower or pump 16 in synchronism with the engine, such as gears, chains and sprockets, etc., may be employed, and the blower and pump may be driven from or synchronized with any part of the engine which rotates in a fixed time relationship with engine speed.

The device 14 is shown more particularly in FIGS. 2 and 3. As there shown, such device has a generally circular cylindrical housing or shell 27 to the second, delivery end of which the above-mentioned closure member 18 is attached and sealed. Positioned axially within the housing 27 is an exhaust gas distributing member 29 which is an inner shell generally in the form of a transversely corrugated sleeve which gradually decreases in mean diameter from its entrance (right) end to its other (left) end. The member 29 has a right-hand end wall 30 in the form of a radially inwardly projecting flange which is centrally open at 31. The left-hand end of member 29 is closed by a transverse end wall 36. Affixed and sealed to wall 30 at the opening 31 therein is a short pipe or nipple 32 over which an enlarged end portion 34 of exhaust pipe 12 is sealingly telescoped, the pipe 12 passing centrally through and being sealed to a closure member 42 affixed and sealed to the housing 27. Exhaust gases from engine 10 thus pass from the engine, through manifold 11 and pipe 12 into the exhaust gas distributing member 29, and pass through member 29 in a direction from right to left.

As above mentioned, the member 29 is transversely corrugated. Such corrugations 35, which are deep and of annular shape, extending entirely around the member 29, are of generally saw-toothed shape. Each of the thus-formed sections of the member 29 has a frusto-conical peripheral wall 37 which increases in diameter from its smallest, right-hand end to its largest left-hand end, the right-hand end of one section being joined to the left-hand of the section adjoining on the right by a generally radially extending transverse wall 39.

Each of the thus formed sections of the member 29 is provided with a plurality of angular spaced holes 40 through the sidewall thereof adjacent the larger diametered end of the section, such holes 40 being disposed on a circle transverse to the longitudinal axis of the member 29. At each of the holes 40 there is secured and sealed the smaller end of a frusto-conical expansion tube 41 which is inclined radially outwardly toward the left or delivery end of the device 14. The outer ends of the tubes 41 all lie appreciably radially spaced from the inner surface of the housing 27, as shown. The total effective area of the holes 40 through the wall of the member 29 is preferably greater than the area of the nipple 32, so that the device 14 adds little, if anything, to the back pressure imposed upon the exhaust gases which flow through pipe 12.

The right-hand end of the housing 27 is enlarged, as shown at 44, to form an air-receiving bustle, such enlarged end of the housing being covered by the above-mentioned closure member 42. The port 19, to which the air delivering pipe 17 is attached, is disposed generally tangentially of the space within the enlarged end 44 of the housing. The air delivered to the bustle by pipe 17 flows in a vortex around the bustle, and escapes to the left therefrom, as shown by the arrows in FIG. 2. In order to guide such air as a generally uniform sleeve-like stream longi-

tudinally of the space 46 within the housing 27 and around the member 29, an annular port is formed in part by a short sleeve 45 which extends from the closure member 42 within the housing coaxial thereof, the inner end of sleeve 45 at least slightly axially overlapping the right-hand end of the main, smaller diametered portion of the housing. It will be seen that the described annular port is formed between the sleeve 45, which is of somewhat smaller diameter than the main portion of the housing 27, and the right-hand end of such portion of the housing.

As above disclosed, the elevated temperature of the gases entering the device 14, and thus the high temperature of the parts of the device, including the distributor sleeve 29 and the housing 27, are sufficient to produce the burning of the combustible gases and vapors therein, particularly since the device 14 is supplied with only a sufficient amount of air to burn such combustible gases and vapors completely. Because of the elevated temperatures to which the parts of device 14 are subjected, they are desirably made of heat and temperature resistant metals and alloys. To insure that the device is brought to a sufficiently high temperature, the device may be positioned close to the engine manifold, so that the pipe 12 is short and the heat losses therefrom are small. The pipe 12 and the housing 14 may, if desired, be covered with a suitable thickness of insulating material (not shown) such as asbestos or magnesia to prevent undue heat losses therefrom. Also, the air drawn into and discharged from the blower or pump 16 may, if desired, be preheated by being passed through one channel of a two-channel heat exchanger (not shown) in heat exchanging relationship with the engine exhaust gases passing through the other channel of the heat exchanger, such other channel being interposed in the exhaust pipe 12. With such latter arrangement, the pipe 17 may also be suitably insulated.

Although it is ordinarily not necessary, the device may be provided with ignition means (not shown) to initiate the reaction in device 14. Such ignition means may be desirable when the system is employed with engines which are operated in cold climates. Such ignition means may take the form of a glow plug or an intermittently energized spark plug mounted on housing 27, the incandescent element of the glow plug and the gap of the spark plug being positioned, for example, mid-way of the axial length of the housing. Once the burning of the combustible gases in device 14 has started, the ignition means may be turned off, since the reaction is exothermic and self-sustaining. The surfaces of the distributor 29 and the housing 27, once heated, have a catalyzing function in facilitating the oxidizing reaction of air with further combustible gases.

The system illustrated herein functions as follows:

Engine exhaust gases entering the distributor member 29 expand into the first (right) section of such member, a part of such gases passing outwardly through the expansion tubes 41 associated with the larger diametered end of such first section. The annular stream of air which passes to the left between the distributor member 29 and the housing 27 travel rapidly and at low pressure, thus aiding by Venturi action in the passage of exhaust gases outwardly through the expansion tubes. Such exhaust gases then mix thoroughly with the annular stream of air.

In passing axially through the distributor member 29, the remaining exhaust gases are progressively constricted and expanded, thereby muffling the sound of the exhaust. At the larger diametered end of each succeeding section of the distributor member, a portion of the exhaust gases escapes outwardly through the respective expansion tubes 41, to be intimately mixed with the annular air stream, in which the concentration of combustible gases becomes increasingly high. When the gaseous mixture reaches a sufficiently high temperature, intermediate the length of the housing 27, it burns. The combustion gases which pass out the pipe 15 are substantially free from com-

5

bustible gases, because of the substantially stoichiometric volume of air which is supplied to device 14.

Although a limited number of embodiments of the invention have been illustrated in the accompanying drawings and described in the foregoing specification, it is to be especially understood that various changes, such as in the relative dimensions of the parts, materials used, and the like, as well as the suggested manner of use of the apparatus of the invention, may be made therein without departing from the spirit and scope of the invention, as will now be apparent to those skilled in the art.

What is claimed is:

1. A device for eliminating noxious fumes from the exhaust of an internal combustion engine, comprising, a housing having an elongated chamber therewithin, an elongated sleeve mounted generally centrally within the chamber spaced from the sidewall thereof, conduit means for introducing hot engine exhaust gases into a first, entrance end of the sleeve, the sleeve having a plurality of openings through its sidewall distributed over the surface of the sleeve and allowing said exhaust gases to escape into the elongated annular space between the sleeve and the housing, closure means on the first, entrance end of the housing, means to introduce air into the entrance end of the housing so that it flows generally longitudinally of the housing to mix and react with the hot exhaust gases flowing outwardly through the openings in the sidewall of the sleeve, and conduit means to discharge from the housing the products of the reaction of the air introduced into the housing and the exhaust gases issuing from the openings in the shell, closure means on the second, discharge end of the housing, wherein the sleeve tapers in diameter from a first, larger diameter adjacent the entrance end of the housing to a second, smaller diameter adjacent the other end of the housing, the conduit means to discharge the products of the reaction from the chamber being connected to the second end of the housing, the second end of the sleeve being substantially imperforate, whereby at least substantially all of the exhaust gases flow outwardly from the sleeve through the openings in the sidewall of the sleeve, and funnel-shaped members having their smaller diametered ends attached to the sidewall of the sleeve outwardly thereof at the openings therethrough, said funnel-shaped members extending outwardly from the sleeve for distances which are substantial parts of the radial dimension of the annular space between the sleeve and housing.

2. A device according to claim 1, wherein the means to introduce air into the entrance end of the housing comprises means to introduce air under pressure into said housing along an at least generally annular path at the entrance end of the main chamber, whereby air under

6

pressure is fed as an annular stream longitudinally of the chamber between the housing and the sleeve, said annular stream of air intercepting and intimately mixing with the streams of exhaust gas issuing from the openings in the sidewall of the sleeve.

3. A device according to claim 1, wherein the means to introduce air into the entrance end of the housing comprises a blower, and means to drive the blower at variable speeds, whereby to supply sufficient oxygen at all times to the reaction chamber to permit the oxidation of the carbon monoxide in the exhaust gases to carbon dioxide.

4. A device according to claim 3, wherein the means to drive the blower comprises the internal combustion engine with which the exhaust gas treating device is associated, and means drivingly connecting the blower to the engine to rotate the blower in synchronism with the engine.

5. A device according to claim 1, wherein the means to introduce air into the entrance end of the housing comprises a sub-chamber at the entrance end of the chamber, means to introduce air under pressure into said sub-chamber, and an at least generally annular discharge port for the sub-chamber providing communication between the sub-chamber and the entrance end of the main chamber, whereby air under pressure is fed as an annular stream longitudinally of the chamber between the housing and the sleeve, said annular stream of air intercepting and intimately mixing with the streams of exhaust gas issuing from the openings in the sidewall of the sleeve.

6. A device according to claim 5, wherein the means to introduce air into the entrance end of the housing comprises a blower, and means to drive the blower at variable speeds, whereby to supply sufficient oxygen at all times to the reaction chamber to permit the oxidation of the carbon monoxide in the exhaust gases to carbon dioxide.

7. A device according to claim 6, wherein the means to drive the blower comprises the internal combustion engine with which the exhaust gas treating device is associated, and means drivingly connecting the blower to the engine to rotate the blower in synchronism with the engine.

References Cited

UNITED STATES PATENTS

2,024,834	12/1935	Rippe.	
2,667,031	1/1954	Ryder	60—30
2,873,815	2/1959	Swayze.	

FOREIGN PATENTS

619,949	1/1927	France.
---------	--------	---------

RALPH D. BLAKESLEE, *Primary Examiner.*