June 17, 1969 C. C. MILEY 3,449,907

ENGINE SILENCER AND SMOKE ELIMINATION SYSTEM

Filed May 18, 1967

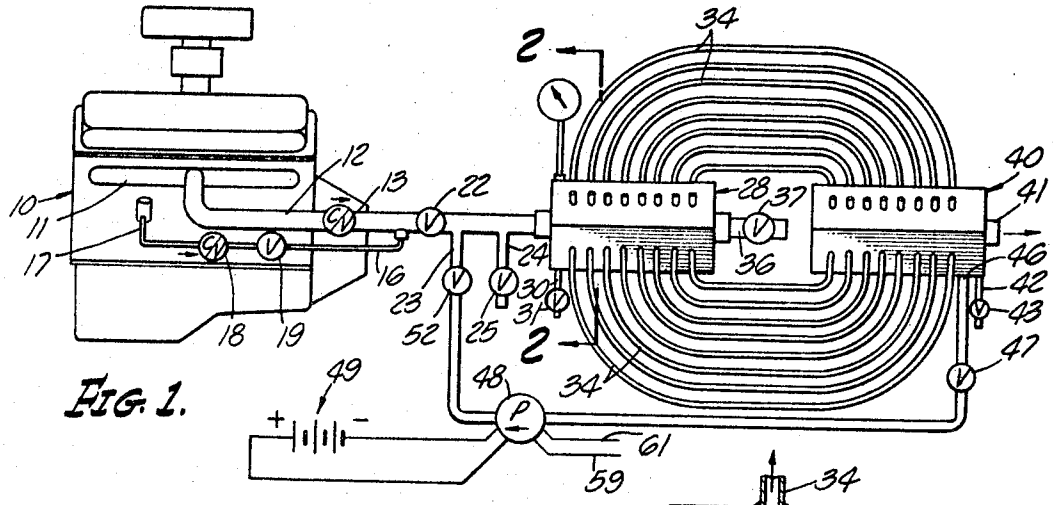

FIG. 1.

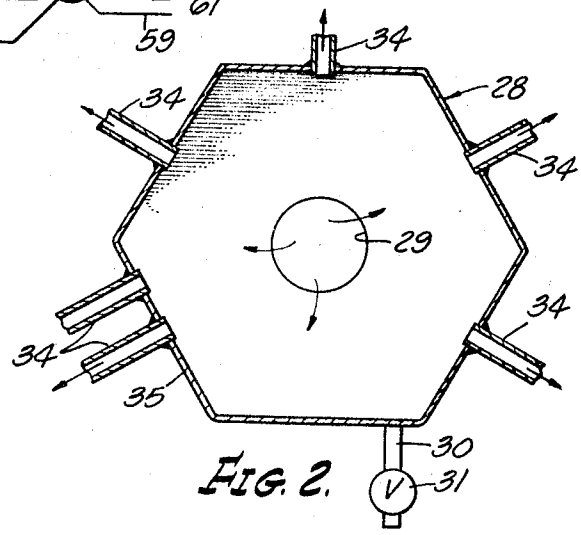

FIG. 2.

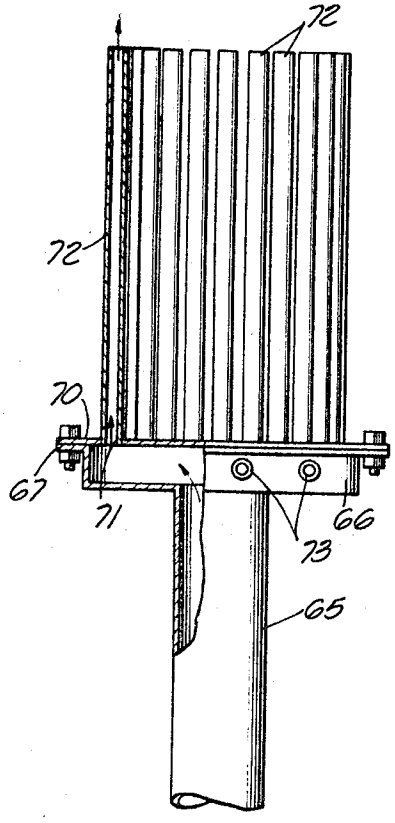

FIG. 3.

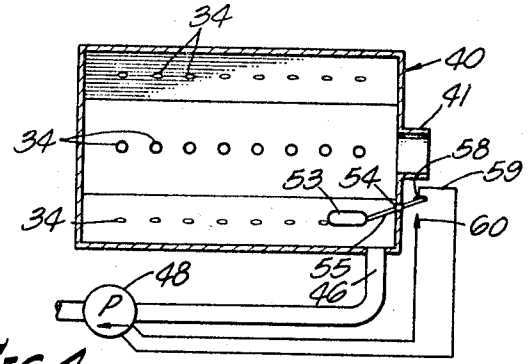

FIG. 4.

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United States Patent Office 3,449,907
Patented June 17, 1969

3,449,907

ENGINE SILENCER AND SMOKE ELIMINATION SYSTEM

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Filed May 18, 1967, Ser. No. 639,458
Int. Cl. F01n 1/12, 3/02
U.S. Cl. 60—31 2 Claims

ABSTRACT OF THE DISCLOSURE

An engine silencer and smoke elimination system being adapted to be connected to a combustion source exhaust and having a plurality of relatively small diameter tubes connected to a manifold, whereby the exhaust is cooled as it passes through the tubes.

BACKGROUND OF THE INVENTION

The invention is for a means and method to eliminate smoke from combustion sources and when used on an internal combustion engine, to provide an engine silencer.

No specific prior art is known, but parts of the prior art devices are internal combustion engine mufflers and smoke stack precipitators. Prior art internal combustion engine mufflers tend to somewhat silence the engines but do nothing substantial to eliminate the smoke from the engines.

SUMMARY OF THE INVENTION

Smoke is eliminated in the present invention by cooling the hot exhaust gases while they flow through a plurality of small tubes. It has been found that by attaching a plurality of small tubes to a pipe connected to an internal combustion engine, from which the muffler had been removed, that the gases were rapidly cooled within the small tubes so that their outer ends were cool to the touch. This arrangement further eliminated the discharge of smoke which had been passing out of the muffler. It was further noted that the exhaust pressure coming out of the individual tubes was hardly discernible. Consistent with the latter, the exhaust noise was almost entirely eliminated.

The invention, when used on compressed gases other than exhaust gases, effectively acts to reduce heat and silence noise.

It is an object of the invention to provide an improved internal combustion engine silencer.

It is another object of the invention to provide an improved smoke eliminator for combustion means.

It is still another object of the invention to provide a means and method for cooling exhaust gases resulting from combustion and for condensing the liquid out of such gases as they are cooled so as to reduce the amount of the gases and solids therein which will otherwise be distributed into the atmosphere.

A further object of my invention is to provide a device of the class described in which crankcase gases are directed into the exhaust manifold or exhaust passages of the engine where temperatures are high and where combustible gases will be burned.

Further objects and advantages of the invention may be brought out in the following part of the specification wherein small details have been described for the competence of disclosure, without intending to limit the scope of the invention which is set forth in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the accompanying drawings, which are for illustrative purposes:

FIG. 1 is a schematic view of an internal combustion engine having the invention attached to the exhaust line therefrom;

FIG. 2 is a cross-sectional view, taken as indicated along the line 2—2 in FIG. 1;

FIG. 3 is a fragmentary view of a smoke stack, having an embodiment of the present invention thereon; and

FIG. 4 is an enlarged fragmentary view, illustrating a portion of a liquid control means for the invention shown in FIG. 1.

In FIG. 1, there is shown an internal combustion engine, generally designated as **10**, having an exhaust manifold **11** to which is connected an exhaust line **12**. In the line **12**, there is a check valve **13** which prohibits flow toward the engine.

Connected to the line **12**, downstream of the check valve, is a line **16** having its other end **17** connected to the engine crankcase at a position above the oil level. In the line **16**, there is a check valve **18** and a stop valve **19**. The line **16** permits the discharge of oil vapor or other gases from the crankcase into the exhaust line **12**. Downstream of the connection with the line **16** there is a stop valve **22** in the exhaust line **12**.

Also connected to the line **12** adjacent the valve **22** is a liquid return line **23** and a drain line **24** having a stop valve **25**.

At the outer end of the line **12**, there is connected a pipe **28** into which the exhaust passes through an opening **29**, shown in FIG. 2. The pipe **28** has a substantially larger cross-sectional area than the pipe **12** and is hexagonal in form for convenience. Through the bottom of the pipe **28**, there is connected a drain line **30** having a stop valve **31**. Secured in each of the sides of the pipe **28**, other than the bottom, are a plurality of relatively small diameter tubes **34**, the tubes being arranged along each face or side, as **35**, in one or more rows extending longitudinally for a substantial portion of the side's length. At the outer end of the pipe **28**, there is connected a smaller diameter line **36**, having a normally closed stop valve **37**.

Each of the tubes **34** is connected at its outer end to a second pipe **40** having the same approximate side and configuration as the pipe **38**. The tubes **34** are connected in corresponding positions to both pipes. At the outer end of the pipe **40** is a discharge line **41**, having an open end large enough so as to not create a back pressure. Extending downwardly from the pipe **40** is a drain line **42** having a normally closed stop valve **43**.

The other end **46** of the liquid return line **23** is connected to the bottom of the pipe **40** to receive liquid collected in the pipe. Downwardly from the end **46** is a stop valve **47** and downstream thereof is an electrically operated pump **48**, having a battery power source **49**. Between the pump and the exhaust line **12**, there is a stop valve **52**. In FIG. 4, there is shown within the pipe **40** a float **53** having a lever arm **55**, pivotally mounted at **54** on a wall of the pipe. At the outer end of the lever arm there is an electrical contact **58** having a lead wire **59** connected to the pump motor. The float **53** is raised a predetermined amount by a liquid level forming in the bottom of the pipe **40** and the electrical contact at **58** is correspondingly lowered to close the circuit with a contact **60** on a lead wire **61** so as to start the operation of the pump to transfer the liquid in the pipe **40** to the exhaust flowing through the line **12** and into the pipe **28**.

In operation, the engine **10**, which may be a gasoline internal combustion engine or a diesel, produces an exhaust through the line **12** and into the pipe **28**. The exhaust enters the small tubes **34** after expansion of the gases in the pipe **28**, and the increased surface made available by the relatively large number of tubes causes

the exhaust gases to cool substantially so that when they enter the pipe **40** they are cool to the touch and a substantial amount of liquid in the gases has been condensed to be collected in the bottom of the pipe. The gas moves outwardly through the discharge line **41** at a very low pressure compared with that that comes out of a muffler tail pipe for the same engine.

When sufficient liquid is formed in the bottom of the pipe **40**, the float raises and closes the circuit at **58**, **60** to start the operation of the pump **48** to deliver the liquid back into the line **12** where the exhaust gases are hot. This liquid serves to further cool the exhaust and to tend to wash out the tubes and pipe as it flows therethrough. However, it has been found that the tubes do not tend to clog or become coated with a substantial amount of exhaust solid residue for at least the first five thousand miles when used on an automobile. It has also been found that where the above arrangement has been used on an old car, burning a substantial amount of oil and which had produced a substantial amount of the smoke through the muffler tail pipe, that no smoke was discharged through the line **41**.

When the line **16** is open to the exhaust line **12**, the gases from the crankcase are free to flow into the exhaust and if they do not flow freely as a result of the suction created by the gases passing the connection of the two lines, a venturi can be installed or a small pump may be used.

If after substantial mileage, there is an excessive coat of carbon solids or other solids formed within the walls of the tubes **34**, they may be flushed out after closing the valve **22** and attaching a hose to line **24**, **30**, **37** or **42** and operating the various stop valves to obtain the desired results. Typical solvents may be used to clean out the tubes.

The first experimental model made of the invention shown in FIG. 1 was comprised of a two inch exhaust line attached to a circular 2¼ inch diameter pipe, 24 inches long. The pipe was closed at its outer end and forty-five tubes, as **34**, were connected into the sides of the pipe wall, the tubes being spaced longitudinally as shown. The tubes were copper for convenience and were approximately two feet long, having an internal diameter of about ¼ of an inch. The outer ends of the tubes were free and had no pipe equivalent to the pipe **40** connected. This arrangement eliminated a smoke discharge from an old car which burned a considerable amount of oil and which had produced a substantial amount of smoke through its tail pipe when the normal muffler was attached. The arrangement substantially eliminated all noise in the exhaust, and to a greater extent than a muffler does. It was found that some liquid was condensed in the tubes and was discharged therefrom. The outer ends of the tubes were cool to the touch even when the engine was idling; that is, when air flow that is normally caused by the movement of the car was not available to blow over them for additional cooling. Cooling of the tubes was such that it was considered that it would not be necessary to use thin-walled tubes having radial fins extending therefrom. However, it is obvious that such tubes would be cooled even more than the ordinary generally cylindrical copper tubes used.

Another embodiment of the invention is shown in FIG. 3. There a smoke stack **65**, adapted to receive combustion gases, has at its outer end an enlarged diameter portion **66** from which extends a circular radially directed flange **67**. Secured to the flange **67** is a flange **70**, having a plurality of openings, as **71**, and in each of which is secured a vertically directed tube **72**. Radially extending through the wall of the enlarged diameter portion **66** are a plurality of flange-covered cleanout openings **73**. Thus, if any residue is deposited in the portion **66**, it may be cleaned therefrom.

The tubes **72** function in the same way as the tubes **34** to cool the exhaust gases and to eliminate the discharge of smoke from the stack **65**. The tubes **72** may be made in a number of pieces for ease of installation and for ease of cleaning, if necessary. The number of tubes required to cool the smoke gases for any particular installation may be determined experimentally.

It is considered that the invention described in the foregoing will substantially reduce the amounts of smoke and solids discharged from auomobile exhaust and from smoke stacks. It is further considered that the formation of liquid by condensation, for example, from a gasoline engine exhaust, should prevent the discharge of a substantial amount of hot vapors into the atmosphere, said vapors containing undesirable air contaminants. If an excessive amount of liquid is produced by condensation in the invention shown in FIG. 1, the liquid can be collected in a separate container attached to the pipe or container **40** and stored therein until filled at which time it may be drained. If the container **40** should become overly filled with the liquid, it would automatically drain through the discharge line **41**.

The invention and its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction and arrangement of the parts of the invention without departing from the spirit and scope thereof or sacrificing its material advantages, the arrangement hereinbefore described being merely by way of example.

I claim:

1. A smoke elimintion system for a combustion means comprising:

(a) conduit means for receiving combustion residue, including a first pipe having one end adapted to be attached to an internal combustion engine exhaust, the other end of the pipe being normally closed;

(b) cooling means connected to said conduit means to permit cooling of said residue and the gases therein, including a plurality of individual tubes connected at one of their ends to said conduit means, and their other ends connected to a second pipe having one end normally closed, said tubes having smaller cross-sectional areas than said conduit means, and said second pipe having a larger cross-sectional area than said tubes; and

(c) discharge means on said cooling means including a reduced discharge opening at the other end of said second pipe, positioned above its lowest part to permit the collection of liquid condensate therein.

2. The invention according to claim **1** including:

(a) a pump connected to said second pipe to pump liquid therefrom to a line connecting exhaust to the first pipe;

(b) means on the second pipe to actuate the pump when the liquid in the second pipe rises to a predetermined level.

References Cited

UNITED STATES PATENTS

1,903,803	4/1933	Barker	60—30
2,037,692	4/1936	Barr	60—30
3,032,968	5/1962	Novak	60—30
3,209,532	10/1965	Morris	60—30
3,313,102	4/1967	Caddell	60—31

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U.S. Cl. X.R.

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