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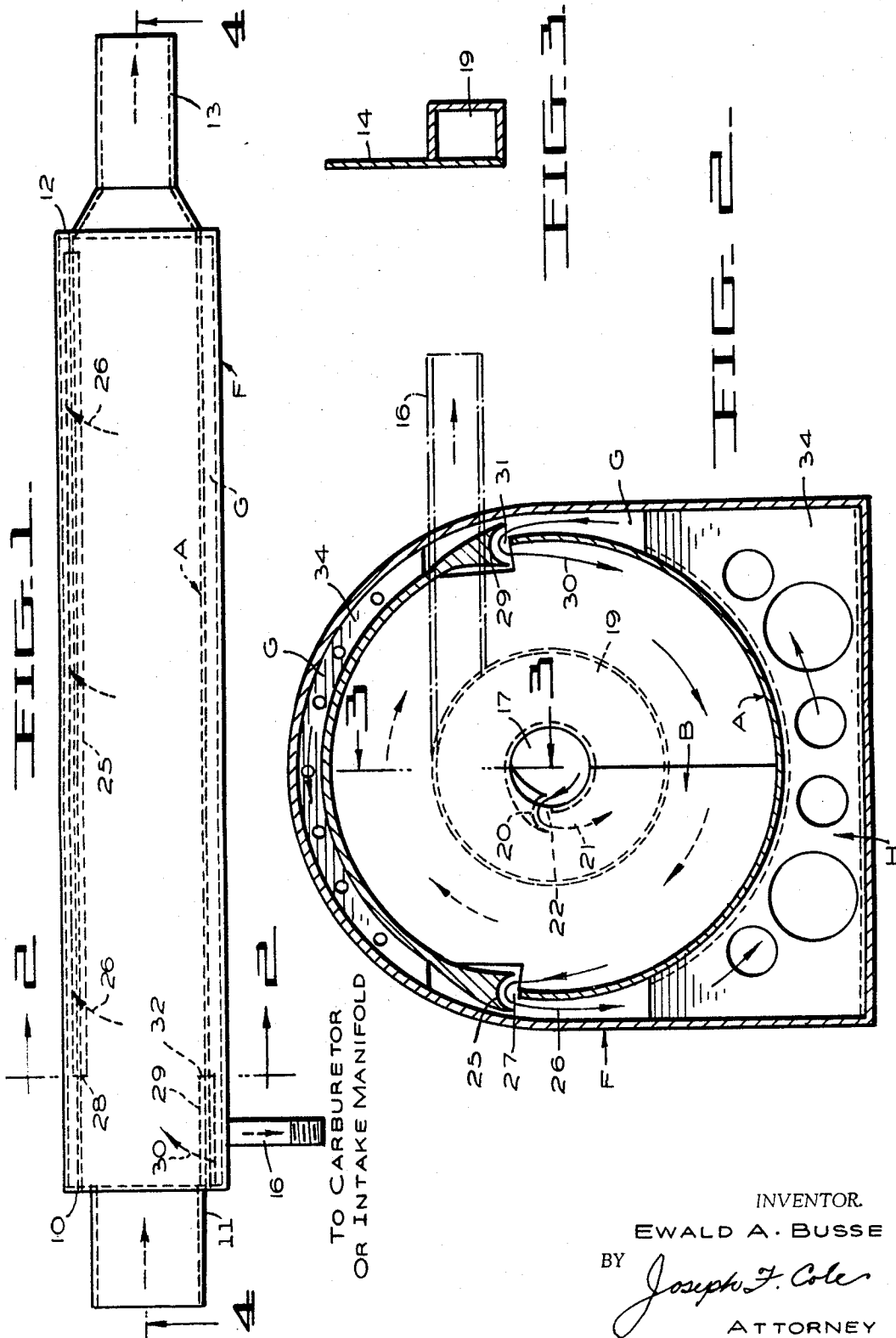
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APPARATUS FOR UTILIZING EXHAUST GASES OF AN INTERNAL
COMBUSTION ENGINE, MUFFLER AND SPARK ARRESTOR

Filed Oct. 13, 1967

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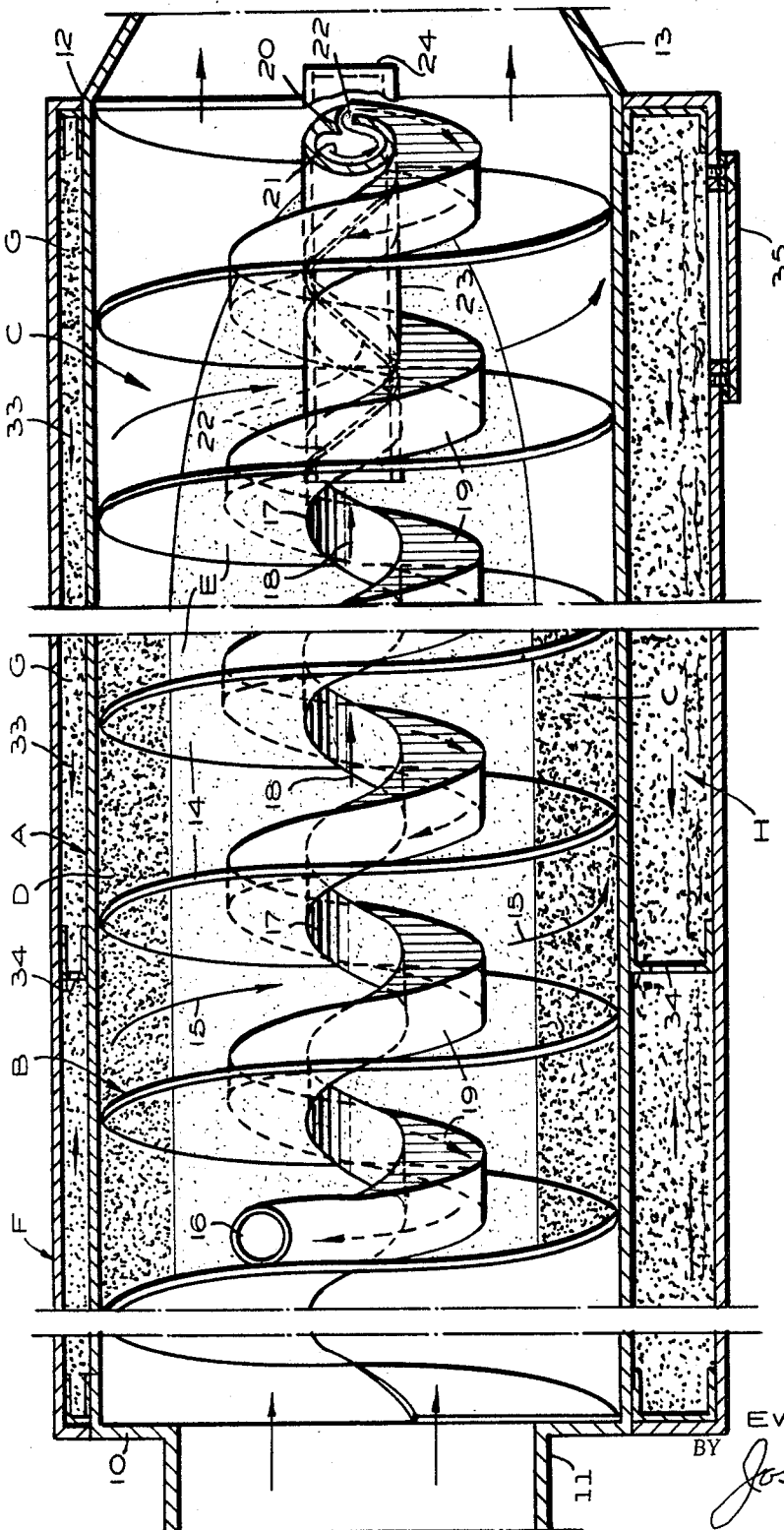


FIG. 4

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**APPARATUS FOR UTILIZING EXHAUST GASES OF
AN INTERNAL COMBUSTION ENGINE, MUFF-
FLER AND SPARK ARRESTOR**

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8 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for utilizing exhaust gases of an internal combustion engine, muffler and spark arrestor having a tubular casing with a helical partition mounted therein so as to form a spiral passageway. An inlet pipe at the front of the casing delivers exhaust gases from an engine to the spiral passageway, and as these gases are whirled through the passageway, the heavier and lighter components thereof are divided into separate streams, and the lighter components of the centrifuged gases are conveyed to a carburetor to augment the engine operating charge, while the heavier components are recycled through the spiral passageway to recover additional lighter components that are delivered to the carburetor. An outer housing is provided to serve as a muffler and to collect ignited fragments contained in the exhaust gases so that they will be extinguished without escaping to the atmosphere.

Summary

It is proposed in this invention to provide an improved apparatus for utilizing exhaust gases of an internal combustion engine by more efficiently separating the heavier expended inert components from the lighter combustible components, and recycling the heavier components so as to recover any additional lighter components therefrom, and to convey substantially all of the lighter components of the centrifuged exhaust gases to the carburetor.

Moreover, it is proposed to provide an outer housing that is provided with a sump on its underside for collecting ignited fragments contained in the exhaust gases so that these fragments will be confined in the sump and will be extinguished without escaping to the atmosphere. This outer housing forms part of the recycling system for the heavier components of the centrifuged exhaust gases, and perforated partitions are provided in a compartment of this housing so as to substantially reduce the noise of the exhaust gases.

Other objects and advantages will appear as the specification proceeds, and the novel features of the invention will be pointed out in the appended claims.

Brief description of the drawings

For a better understanding of the invention, reference should be had to the accompanying drawings, forming part of this specification, in which:

FIG. 1 is a top plan view of my apparatus for utilizing exhaust gases of an internal combustion engine, muffler and spark arrestor;

FIG. 2 is a transverse sectional view taken along the plane 2-2 of FIG. 1;

FIG. 3 is a fragmentary sectional view taken along the plane 3-3 of FIG. 2; and

FIG. 4 is a longitudinal sectional view taken along the plane 4-4 of FIG. 1 on an enlarged scale.

While only the preferred embodiment of the invention has been shown, it should be understood that various changes, or modifications, may be made within the scope

of the appended claims without departing from the spirit thereof.

Description of the preferred embodiment

Referring now to the drawings in detail, it will be noted that a tubular casing A is provided and its front end 10 has an inlet pipe 11 attached thereto, this pipe being connectible to an exhaust pipe of an internal combustion engine so that exhaust gases from the engine will be delivered to the interior of the casing. The latter is further provided at its rear end 12 with an outlet pipe 13 leading to the atmosphere.

As shown in FIGS. 2 and 4, a helical partition B defines a plurality of convolutions 14 mounted in the tubular casing A and coacting therewith to form a spiral passageway C extending longitudinally of the casing, this spiral passageway communicating with the inlet pipe 11 so as to receive a rapid flow of exhaust gases therefrom, whereby heavier and lighter components D and E, respectively, will be separated from one another by centrifugal force into outer and inner streams, respectively, as the exhaust gases whirl along the spiral passageway as indicated by the arrows 15.

The heavier components D of the exhaust gases are combustibly inert water vapor, carbon dioxide and nitrogen, while the lighter components E contain hydrogen, methane and carbon monoxide which may be employed efficiently to augment the engine operating charge. The lighter components E are conveyed by an outlet pipe 16 to a carburetor (not shown), as suggested by the legend "TO CARBURETOR" in FIG. 1. The details of this arrangement will be set forth as the specification continues.

As the specification proceeds, it will be apparent that means are operable for recycling the heavier components D of the centrifuged exhaust gases through the spiral passageway C for recovering additional lighter components E of the exhaust gases that may be mixed therewith, whereby these additional lighter components may be conveyed to the carburetor. The outlet pipe 13 communicates with the spiral passageway C for receiving the purified gases and conveying them to the atmosphere.

For the purpose of withdrawing the lighter components E of the centrifuged exhaust gases, the convolutions 14 of the helical partition B is provided with an axial passageway 17 (see FIGS. 2 and 4) extending therethrough from front to rear thereof, and through which the lighter components E may flow rearwardly, as suggested by the arrows 18. Also, a spiral conduit 19 is carried by the convolutions 14 of the helical partition B and extending from the rear of the latter toward the front end 10 of the tubular casing A.

As illustrated in FIGS. 2 and 4, a substantially axial deflector 20 is mounted adjacent to the rear portion of the helical partition in a position to scoop into and deflect the lighter components E of the centrifuged exhaust gases from the axial passageway 17 into the spiral conduit 19, as suggested by the arrows 21 in FIGS. 2 and 4, these components passing through a slot 22 formed in a fitting 23 that is secured in the rear portion of the axial passageway 17. The rear end 24 of this fitting is closed (see FIG. 4).

The outlet pipe 16 previously mentioned extends from the front end of the spiral conduit 19, and thus the lighter components E of the centrifuged exhaust gases will be delivered to the engine carburetor.

The means for recycling the heavier components D of the centrifuged exhaust gases will now be described. It will be noted that an outer housing F surrounds the tubular casing A and is spaced therefrom to form a compartment G therebetween (see FIGS. 1, 2 and 4). A first lateral deflector 25 is carried by the tubular casing A to extend

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lengthwise thereof in a position to scoop into and deflect the heavier components D outwardly from the spiral passageway C into the compartment G, as suggested by the arrows 26, these heavier components passing through a slot 27 formed in the tubular casing A (see FIG. 2). This slot extends substantially from the rear end 12 of the tubular casing to a point 28 spaced rearwardly from the front 10 of the casing (see FIG. 1).

Moreover, a second lateral deflector 29 is carried by the tubular casing A to extend lengthwise thereof in a position to scoop into and deflect the heavier components D of the centrifuged exhaust gases inwardly from the compartment G and back into the spiral passageway C, as suggested by the arrows 30, these components flowing through a slot 31 formed in the tubular casing A (see FIG. 2). The second lateral deflector 29 extends substantially from the front end 10 of the tubular casing to a point 32, but does not overlap the first lateral deflector 25. As shown in FIG. 1, the first and second lateral deflectors 25 and 29, respectively, are disposed on opposite lateral sides of the tubular casing A.

Thus the heavier components D that enter the compartment G through the slot 27 must return toward the front end 10 of the tubular casing A before passing through the slot 31, as suggested by the arrows 33 in FIG. 4. This will permit heavy particles of the centrifuged exhaust gases to collect in a sump H on the underside of the housing F. Accordingly, ignited fragments contained in the exhaust gases, for instance, carbon, lead oxides and water will be confined in the sump H and will be extinguished without escaping to the atmosphere, and this feature constitutes the spark arrestor of the invention.

Turning now to FIGS. 2 and 4, it will be observed that perforated partitions 34 are provided in the compartment G between the tubular casing A and the outer housing F so as to substantially reduce the noise of the exhaust gases and, therefore, the muffler feature of the invention is provided. These partitions, also, serve to hold the tubular casing A and the outer housing F in spaced relation with respect to one another.

In FIG. 4, a removable inspection plate 35 has been designed which may be periodically taken off to allow the amount of accumulations in the sump H to be determined.

The outlet pipe 16 may be connected to the intake manifold of the engine, if desired, instead of to the carburetor.

I claim:

1. In an apparatus for utilizing exhaust gases of an internal combustion engine, muffler and spark arrestor;

(a) a tubular casing provided at its front end with an inlet pipe connectible to an exhaust pipe of an internal combustion engine, and further being provided at its rear end with an outlet pipe leading to the atmosphere;

(b) a helical partition defining a plurality of convolutions mounted in the tubular casing and coacting therewith to form a spiral passageway extending longitudinally of the casing, this spiral passageway communicating with the inlet pipe so as to receive a rapid flow of exhaust gases therefrom, whereby heavier and lighter components of the exhaust gases will be separated from one another by centrifugal force into outer and inner streams, respectively, as the exhaust gases whirl along the spiral passageway;

(c) means operable for withdrawing the lighter components of the centrifuged exhaust gases, and conveying them to an engine for use as a part of the engine operating charge;

(d) means operable for recycling the heavier components of the centrifuged exhaust gases through the spiral passageway of the helical partition for recovering additional lighter components of the exhaust gases that may be mixed therewith, whereby these additional lighter components may be conveyed to the engine;

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(e) the outlet pipe communicating with the spiral passageway for receiving the purified components of the exhaust gases and conveying them to the atmosphere.

2. The apparatus for utilizing exhaust gases of an internal combustion engine, muffler and spark arrestor, as set forth in claim 1;

(f) and in which the means operable for withdrawing the lighter components of the centrifuged exhaust gases comprises:

(1) the convolutions of the helical partition being provided with an axial passageway extending therethrough from front to rear thereof, and through which the lighter components of the centrifuged exhaust gases may flow rearwardly;

(2) a spiral conduit carried by the convolutions of the helical partition and extending from the rear of the latter toward the front of the tubular casing;

(3) a substantially axial deflector mounted adjacent to the rear portion of the helical partition in a position to scoop into and deflect the lighter components of the centrifuged exhaust gas from the axial passageway into the spiral conduit;

(4) and an outlet pipe extending from the front end portion of the spiral conduit and made to be connected to the engine to deliver the lighter component of the centrifuged exhaust gas thereto.

3. The apparatus for utilizing exhaust gases of an internal combustion engine, muffler and spark arrestor, as set forth in claim 2;

(g) and in which the substantially axial deflector is carried by a fitting that is secured in the rear portion of the axial passageway.

4. The apparatus for utilizing exhaust gases of an internal combustion engine, muffler and spark arrestor, as set forth in claim 1;

(f) and in which the means operable for recycling the heavier components of the centrifuged exhaust gases comprises:

(1) an outer housing surrounding the tubular casing and being spaced therefrom to form a compartment therebetween;

(2) a first lateral deflector carried by the tubular casing to extend along the length thereof in a position to scoop into and deflect the heavier components of the centrifuged exhaust gases outwardly from the spiral passageway of the helical partition into the compartment between the tubular casing and the outer housing;

(3) and a second lateral deflector carried by the tubular casing to extend lengthwise thereof in a position to scoop into and deflect the heavier components of the centrifuged exhaust gases inwardly from the compartment and back into the spiral passageway of the helical partition.

5. The apparatus for utilizing exhaust gases of an internal combustion engine, muffler and spark arrestor, as set forth in claim 4;

(g) and in which the first lateral deflector extends substantially from the rear of the tubular casing to a point spaced rearwardly from the front of that casing;

(h) and the second lateral deflector extends substantially from the front of the tubular casing, but does not overlap the first lateral deflector.

6. The apparatus for utilizing exhaust gases of an internal combustion engine, muffler and spark arrestor, as set forth in claim 5;

(i) and in which the first and second lateral deflectors are disposed on opposite lateral sides of the tubular casing.

7. The apparatus for utilizing exhaust gases of an in-

ternal combustion engine, muffler and spark arrestor, as set forth in claim 4;

(g) and in which the outer housing is provided with a sump on its underside for collecting ignited fragments contained in the exhaust gases so that these fragments will be confined in the sump and will be extinguished without escaping to the atmosphere. 5

8. The apparatus for utilizing exhaust gases of an internal combustion engine, muffler and spark arrestor, as set forth in claim 4;

(g) and in which perforated partitions are provided in the compartment between the tubular casing and the outer housing so as to substantially reduce the noise of the exhaust gases. 10

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