United States Patent [19]

Coop

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[54] **SPARK ARRESTER AND SILENCER**

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[52] **U.S. Cl.** ..... **55/276;** 55/331; 55/414; 55/463; 55/DIG. 20; 181/36 C; 181/55

[51] **Int. Cl.** **B01d 50/00**

[58] **Field of Search** ..... 55/276, 321, 324, 325, 55/328, 331, 332, 414, 418, 422, DIG. 20, DIG. 21, DIG. 30, 463, 482, 484, 419; 181/36 R, 36 B, 36 C, 41, 42, 46, 47 R, 49, 60, 63

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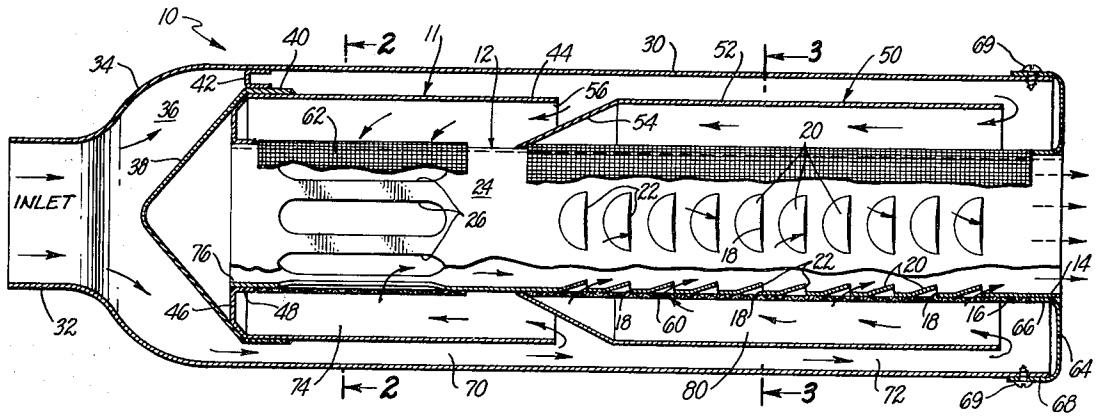
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Attorney, Agent, or Firm—J. Carroll Baisch

[57] **ABSTRACT**

A two-section spark arrester and muffler for an internal combustion engine includes a core which has a tube open at one end for the outlet of gases and provided with longitudinally and annularly spaced openings covered by screens. The opposite end of the tube is closed against entry of gases. Longitudinally spaced cylindrical conduits, each having an open end, are concentrically disposed about the tube and screened openings. The opposite ends of the conduits are connected to the tube and a conical deflector is connected to the end of the conduit covering the openings in the closed end portion of the tube. A shell concentrically disposed about the conduits has an inlet opening adjacent the deflector and is connected to the tube at its open end thereby providing coacting muffler sections for the exhaust gas.

2 Claims, 4 Drawing Figures



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FIG. 1.

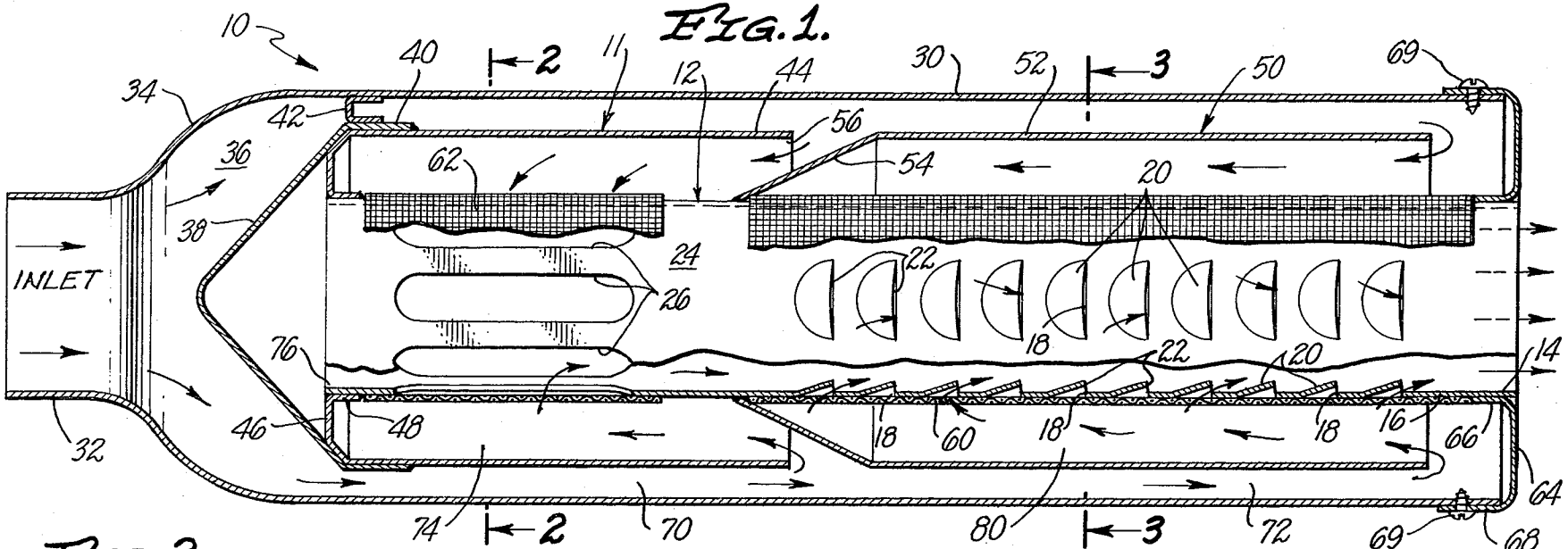


FIG. 2.

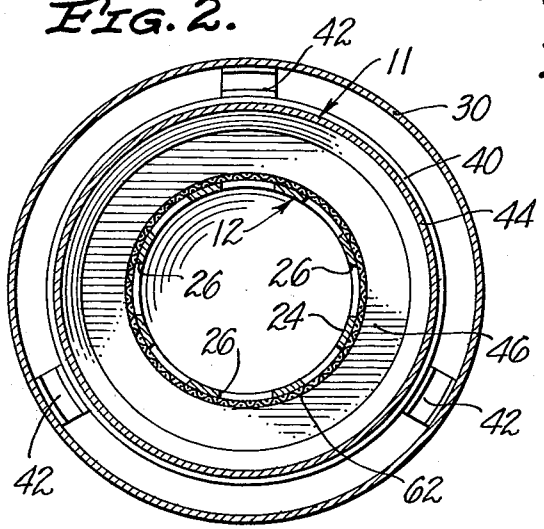


FIG. 3.

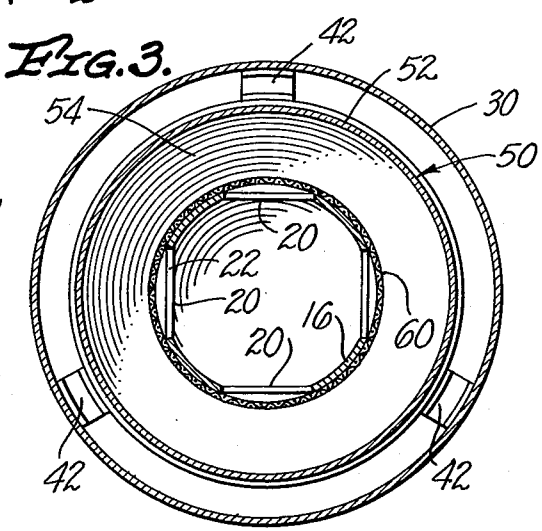
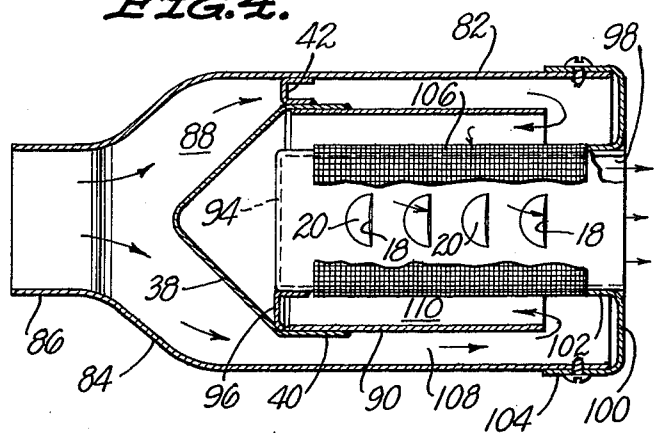


FIG. 4.



SPARK ARRESTER AND SILENCER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to spark arresting and sound muffling devices for internal combustion engines.

2. Description of the Prior Art

Various spark arresting and silencing devices for internal combustion engines and the like are known but for various reasons are not entirely satisfactory.

SUMMARY OF THE INVENTION

A spark arrester and muffler or silencer for internal combustion engines and the like, comprising a tube having an outlet end, the opposite end being closed to the entrance of exhaust gases.

The tube has a plurality of longitudinally spaced openings in rows that are annularly spaced in an outlet end portion of the tube and there are louvers for said openings facing the outlet end. There are also a plurality of annularly spaced elongated openings adjacent the closed end of the tube. Screens with a mesh of 0.020 or less cover those portions of the tube having the louvered openings and the elongated slotted openings respectively, these screens having a snug fit on the tube. There is a shell about the tube which is of greater diameter than the tube throughout most of its length but which tapers at the inlet end to define an inlet chamber and an inlet pipe communicating with said chamber. A cone-shaped deflector is positioned in the inlet chamber with its apex facing the inlet pipe. The diameter of the deflector is smaller than the diameter of the shell thereby leaving arcuate openings at the periphery of the large end of the deflector for the pass of gases into the shell. About the closed end portion of the tube is a cylindrical conduit secured to the large end of the deflector by brazing or the like and having inturned flanges secured to the closed end of the shell by brazing or welding or other suitable means. The conduit is of greater diameter than the tube but of smaller diameter than the interior diameter of the shell and there is a second cylindrical conduit of substantially the same diameter of the first mentioned conduit in alignment therewith and having a frusto-conical part extending toward the slotted part of the tube and sealingly secured thereto so that there is an annular space between the frusto-conical part of the second conduit and the open end of the first mentioned conduit. The opposite end of the second conduit is open and is spaced longitudinally from the end of the shell opposite the inlet end, an annular plate being secured to said end of the shell and the outlet end of the tube to thereby provide a seal between the outlet end of the tube and the adjacent end of the shell. Thus, exhaust gases entering the inlet chamber by way of the inlet pipe are caused by the deflector to enter the annular space between the inlet end of the shell and the cylindrical conduits. A portion of these gases pass into the space between the first mentioned conduit and the closed end of the tube and pass through the screen and into the elongated slots, thence through the tube into the atmosphere by way of the outlet of the tube. The remaining portion of the gases pass around the free end of the second conduit and into the space between the second conduit and the tube, thence through the screen and into the louvered openings to join the gases from the slotted end of the tube and into the atmosphere by way of the exhaust outlet of the tube. The screens capture and pulverise carbon entrained in the gases thereby arresting any sparks that might otherwise pass into the atmosphere and the assembly also serves as a silencer or muffler.

OBJECTS AND ADVANTAGES OF THE INVENTION

It is an object of the present invention to provide a spark arresting and sound muffling device for internal combustion engines and the like, that is effective in capturing carbon and sparks in the exhaust of internal combustion engines.

It is another object of the invention to provide a device of this character having a plurality of air flow paths with means for each of said paths to capture or filter out sparks, carbon particles and the like.

It is still another object of the invention to provide a device of this character that comprises a combination of elements that is highly effective in arresting sparks and silencing or muffling the sound of the exhaust.

A further object of the invention is to provide a device of this character that is relatively simple in construction and effective in operation.

The characteristics and advantages of the invention are further sufficiently referred to in connection with the following detailed description of the accompanying drawings, which represent one embodiment. After considering this example, skilled persons will understand that many variations may be made without departing from the principles disclosed and I contemplate the employment of any structures, arrangements or modes of operation that are properly within the scope of the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 is a longitudinal cross section of a device embodying the present invention;

FIG. 2 is a traverse sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is a traverse sectional view taken on line 3—3 of FIG. 1; and

FIG. 4 is a longitudinal section showing an alternative arrangement.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring more particularly to the drawings, there is shown in FIGS. **1, 2** and **3,** a spark arrester and muffler or silencer, indicated generally at **10.** There is a core, indicated generally at **11** which comprises an elongated tube **12** having an exhuast outlet **14** and a downstream outlet portion **16** having annularly spaced rows of openings **18,** the openings of each row being longitudinally spaced apart. These openings are formed by cutting the tube circumferentially in planes normal to the axis of the tube and pressing or forcing inwardly parts of the tube to form louvers **20** having their free ends **22** at said cuts. Thus, the free ends of the louvers face the outlet of the tube and have a generally arcuate shape at said free ends. With this arrangement, gases entering the openings **18** are directed by the louvers toward the outlet of the tube. Tube **12** has an upstream end portion **24** upstream of the outlet end portion **16** in which there are a plurality of longitudinally extending open-

ings 26 which are annularly spaced apart circumferentially of the tube.

Tube 12 is disposed or encased within a shell 30 of substantially greater interior diameter than the exterior diameter of the tube. Shell 30 has an inlet portion which tapers inwardly at 34 to form an inlet chamber 36. The smaller end of the tapered portion has an inlet pipe 32 adapted to be connected to the engine exhaust pipe. Within the chamber 36 is a cone-shaped deflector 38 with the apex facing the inlet 32. At its base or greater diameter end, there is an annular flange 40 which extends longitudinally. A plurality of generally U-shaped brackets 42 are spot welded or otherwise suitable secured to the flange 40 but not to the interior of the shell 30. With this arrangement, the upper end of the core 11 is properly positioned. Any suitable number of brackets 42 may be provided but three are shown in equally and annularly spaced relationship.

Within the cylindrical space defined by the tube 12 and the shell 30, is a cylindrical conduit 44 having the end adjacent the inlet of the shell turned inwardly to define a wall 46 which has a short flange 48 normal to the axis of the conduit and extending away from the deflector 38. Flange 48 is secured to the adjacent end of the tube 12 by spot welding or the like and wall 46 provides a seal or closure against the passage of gas into the interior of the deflector 38 and tube 12 so that this end of the tube is sealed against the entrance of exhaust gases. This end of the cylindrical conduit 44 is also welded, spot welded, brazed or the like to the flange 40 of the deflector 38, the opposite end of the conduit 44 being open.

In the annular space between the tube and the interior of the shell 30, is a second conduit, indicated generally at 50, which has a cylindrical wall 52 throughout a major portion of its length. The end of the conduit 50 adjacent the outlet of the tube is open, the opposite end having a frusto-conical part 54 which tapers inwardly through the adjacent open end 56 of the conduit 44 and engages the exterior of the tube 12 to which it is secured by welding, brazing or the like.

The outlet end portion 16 of the tube is provided with a screen 60 which snugly engages the exterior of this portion of the tube and covers the openings 18.

The upstream end portion 24 of the tube is similarly covered with a screen 62 which covers the slots 26. The screens may be welded or otherwise suitably secured to the tube and should have a mesh of 0.020 or less.

At the outlet end of the device, there is an annular wall or seal 64 which has flanges 66 and 68, a short outlet end portion of the tube 12 being snugly received in the flange 66 and said flange 66 is welded or otherwise suitably secured thereto. An adjacent end portion of the shell 30 is disposed within the flange 68 and said flange 68 slidingly receives said adjacent end portion of the shell. Screws 69 are received in holes provided therefor in the flange 68 and in aligned tapped holes to thereby releasably secure the core in the shell 30. This arrangement makes assembly and disassembly easy. In assembling the device, the core is slipped into the shell and the screws installed. To disassemble, the screws are removed and the core slipped out of the shell.

The device is adapted to be attached to the discharge end of the exhaust or tail pipe of an internal combustion engine so that exhaust gases therefrom pass through the Inlet 32 of the shell 30 and into the chamber 36, as shown by the arrows therein. Deflector 38 directs these gases into an annular passage 70 between the shell and the cylindrical conduit 44 and into an annular passage 72 between the cylindrical part 52 of the conduit 50 and the shell 30. Some of these gases enter the open end 56 of the conduit 44 and flow through passage 74 defined by the conduit 44 and the adjacent part of the tube. These gases pass through the screen 62 and into the slots or openings 26, then into the interior of the tube and thence to atmosphere by way of the outlet 14 of said tube. It is to be noted that the wall 46 prevents gases in the passage 74 from entering the adjacent end 76 of the tube so that said gases must flow through the screen 62 and into the openings 26.

Gases flowing through passage 72, enter a passage 80 defined by the conduit 50 and the discharge end part of the tube. These gases then flow through the screen 60 and into the openings 18 and are directed toward the outlet 14 of the tube by the louvers 20. The gases flowing through the discharge end part of the tube are joined by the gases flowing through the openings 26 and all of said gases are discharged from the opening 14. Throughout the arrangement shown in FIG. 1, the arrows in the various passages and parts of the tube indicate the flow of the gases.

While a portion of the tube 12 is provided with slots 26, openings such as those at 18 may be used in place of said slots, or the openings may be of other shapes or sizes and may or may not have louvers such as shown at 20 for example. It is also to be understood that openings in the discharge or outlet end portion of the tube, may be used without the louvers.

An alternative arrangement of the device is shown in FIG. 4 and comprises an outer shell 82 which is curved inwardly as at 84 and terminates in an inlet 86 which is adapted to be connected to the discharge end of the tail pipe or exhaust pipe of an internal combustion engine. Within the chamber 88 defined by the part 84 of the shell, there is a deflector 38 having a flange 40 secured to the shell by brackets 42. These parts are the same as corresponding parts in FIGS. 1-3 and hence are given the same reference numerals. A conduit 90 is disposed within the shell 82 and has one end disposed within the flange 40 and secured thereto by welding, brazing or the like. This end of the tube is secured within the conduit 90 by brackets 96 which have parts welded or brazed to the adjacent end of the tube and to adjacent parts of the deflector. The end of the tube opposite the wall 94 is open and comprises the outlet, exhaust or discharge end 98 of said tube. A wall 100 provides a seal between the discharge end of the tube and the adjacent end of the conduit 82, said wall having flanges 102 and 104 welded, brazed or otherwise suitably secured to the respective end portions of the tube 12 and the shell 82.

Tube 92 is provided with openings 18 having louvers 20 as described above in connection with the outlet end portion 16 of the tube 12. A screen 106 is disposed over that portion of the tube having the openings 18, said screen being of the same character as those described in connection with the arrangement of FIGS. 1-3.

In the arrangement of FIG. 4, exhaust gases enter the device by way of the inlet 86 and chamber 88. These gases are directed by the deflector 38 into the annular passage 108 between the shell 82 and the conduit 90. These gases flow around the open free end of the conduit 90 and into a passage 110 between said conduit

and the tube. The gases cannot enter the tube upstream of the outlet thereof because of the wall **94.** Hence, these gases must pass through the screen **106,** through the openings **18** and out the discharge end **98** of the tube. As in the arrangement of FIGS. **1–3,** the louvers direct the gases toward the discharge end of the tube.

In both arrangements shown and described herein, the screens capture and pulverize carbon entrained in the gases thereby arresting any sparks that might otherwise pass into the atmosphere and cause fires. The assembly also serve as a silencer to muffle the noise of the engine to which the device is attached.

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 without departing from the spirit or scope thereof or sacrificing its material advantages, the arrangement hereinbefore described being merely by way of example and I do not wish to be restricted to the specific form shown or uses mentioned except as defined in the accompanying claims.

I claim:

1. A spark arrester and silencer comprising:

a core comprising a tube having an upstream portion and a downstream portion, the tube being open at its downstream end for the outlet of gas, said tube having a plurality of sets of longitudinally spaced openings, said sets being annularly spaced apart, at least one set of said openings being positioned in said upstream portion of said tube, and at least one set of said openings being positioned in said downstream portion of said tube;

means closing the upstream end of said tube against the entrance of gases;

a fine mesh screen disposed about said tube to cover said openings;

a first cylindrical conduit about said upstream portion of said tube, said first conduit having a greater interior diameter than the exterior diameter of said tube and screen, to form a first annular passageway between the upstream portion of said tube and said first conduit, the downstream end of said first conduit being open, and terminating adjacent the downstream portion of said tube;

said means closing the upstream end of said tube further comprises a generally conical deflector connected to the end of the first conduit adjacent said closed end of said tube, the apex of said deflector being adjacent the inlet of the spark arrester and silencer;

a shell in which the core is disposed, said shell having an upstream portion and a downstream portion, the inside diameter of said shell being substantially greater than the outside diameter of said first conduit of the core, to form a second annular passageway between the upstream portion of said shell and said first conduit, said shell extending beyond the open end of the first conduit to substantially the downstream end of said tube;

whereby said upstream portion of said tube, said first conduit, and said upstream portion of said shell coact to define a first upstream muffler section, said first muffler section and said deflector causing gas to flow longitudinally along said second annular passageway, to reverse flow along said first annular passageway, to traverse said screen and openings of said upstream portion of said tube, to flow in the original direction along said tube, and to exit at the downstream end of the said tube;

a second cylindrical conduit positioned about said downstream portion of said tube, said second conduit having a greater interior diameter than the exterior diameter of said tube and screen, to form a third annular passageway between the downstream portion of said tube and said second conduit, the downstream end of said second conduit being open, and terminating at substantially the downstream end of said tube, said second conduit having its upstream end closed by attachment to the exterior of said tube at said upstream portion thereof;

the inside diameter of said shell being substantially greater than the outside diameter of said second conduit, to form a fourth annular passageway between the downstream portion of said shell and said second conduit;

the upstream end of said shell tapering inwardly and terminating in an inlet for gases, the tapered portion of said shell forming a chamber;

means providing a seal between the downstream end of said shell and the downstream end of said tube, said sealing means being spaced from the downstream end of said second conduit;

whereby said downstream portion of said tube, said second conduit, and said downstream portion of said shell coact to define a second downstream muffler section, said second muffler section, said deflector, and said sealing means causing gas to flow longitudinally along said fourth annular passageway, to reverse flow along said third annular passageway, to traverse said screen and openings of said downstream portion of said tube, to flow in the original direction along said tube, to comingle with the gas from said first muffler section, and to exit at said downstream end of said tube;

said first and second muffler sections being similar in structure and function, being longitudinally separated, and being substantially aligned and coaxial.

2. The invention defined by claim **1,** wherein there is a space between the open downstream end of the first mentioned conduit and the adjacent closed upstream end of said second conduit, the upstream end of said second conduit being tapered where it is attached to the exterior of said tube;

whereby said space between said conduits facilitates the flow of gas from said second annular passageway into said first annular passageway of said first muffler section, and whereby the space provided by said sealing means positioned between said downstream ends of said shell and said tube facilitates the flow of gas from said fourth annular passageway into said third annular passageway of said second muffler section.

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