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MUFFLER

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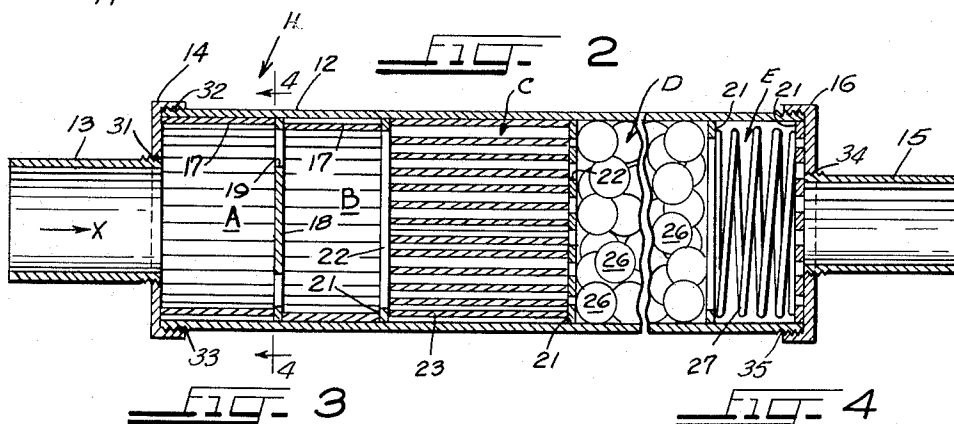
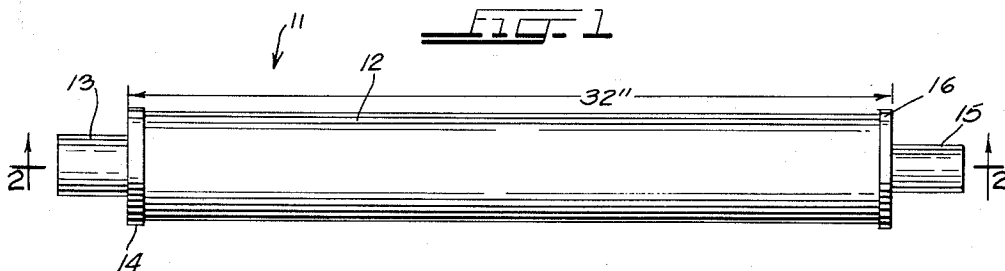


FIG. 3

FIG. 4

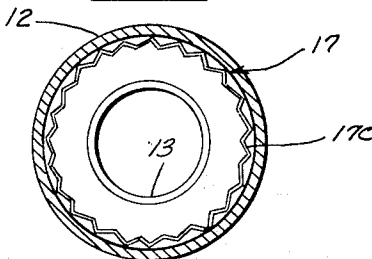
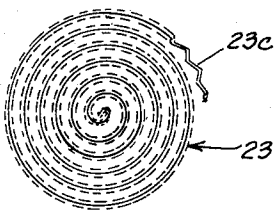
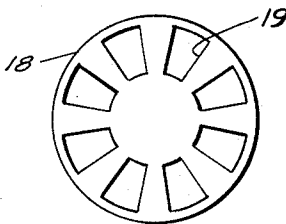
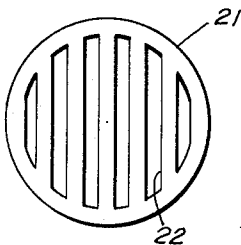


FIG. 5

FIG. 6



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This invention relates to sound muffling apparatus. More particularly, this invention relates to a muffler for use in reducing noise in exhaust gases generated by internal combustion engines.

Heretofore, mufflers of the kind to which this invention relates have generally required rather elaborate internal baffle structures for effective operation. The general practice has been to assemble the baffle structure by welding or similarly mounting the baffles to a casing or housing. By reason of such construction the muffler devices heretofore known and generally adopted in commercial practice have been relatively difficult and expensive to fabricate. Not only have such mufflers been expensive to manufacture but also the welded or similar construction has tended to provide areas where corrosion is likely to begin. Because the exhaust gases from internal combustion engines generally contain some sulphur, the problem of corrosion, caused by the combination of moisture vapor with the sulphur in the exhaust gases in the interior of the muffler, has been a factor in reducing the useful life of the mufflers. Thus, a construction, such as the most commonly utilized welded construction of the prior art mufflers, which in any manner serves to increase such corrosion, is quite undesirable.

Accordingly, it is a primary object of this invention to construct a new and improved muffler which can be fabricated without the necessity of having resort to welds or similar processes.

Another object of this invention is a new and improved muffler which can be quickly and economically constructed from pre-fabricated parts entirely by hand or by the use of simple hand tools.

A muffler constructed in accordance with this invention comprises an elongated tube through which exhaust gases are adapted to be passed in a straight-through or single pass manner. A series of apertured plates are arranged to extend across the inner diameter of the tube and in longitudinally spaced relation to one another so as to define a series of interconnected chambers between the inlet and the outlet ends of the muffler. A coiled strip is preferably disposed in one of the chambers in a manner such that the axis of the coil extends generally parallel to the longitudinal axis of the tube. The coiled strip thereby defines a plurality of relatively narrow arcuate channels through which the exhaust gases must flow. A plurality of ball elements are maintained in random arrangement but compacted relation with one another in another of the chambers as defined by the transversely extending plates. The chamber in which the ball elements are thus contained preferably comprises a major portion of the internal length of the muffler tube and is preferably disposed immediately adjacent and downstream of the chamber in which the coiled strip is disposed. The random arrangement of the ball elements afford multiple flow channels of varied configuration and orientation for further dispersing and damping out noise-producing pulsations in the exhaust gases.

It is yet another object of this invention to construct a novel muffler which includes the foregoing structural features.

It is another feature of this invention that the ball elements may be composed of absorbent material for removing toxic or atmosphere-polluting components

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from the exhaust gases, and such constitutes still another object of this invention.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawing which, by way of illustration, shows a preferred embodiment of the present invention and the principles thereof and what is now considered to be the best mode contemplated for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention.

In the drawings:

FIG. 1 is a plan view of a muffler constructed in accordance with one embodiment of this invention;

FIG. 2 is an enlarged elevation view, in section, taken approximately along the line indicated by the arrows 2-2 in FIG. 1 and partly broken away;

FIG. 3 is an end view of a coiled strip utilized in the muffler illustrated in FIGS. 1 and 2;

FIG. 4 is an end view taken on line 4-4 of FIG. 2 of a spacer element utilized in the muffler illustrated in FIGS. 1 and 2;

FIG. 5 is an end elevation view of one baffle plate which may be utilized in the muffler illustrated in FIGS. 1 and 2; and

FIG. 6 is an end elevation view of another baffle plate utilized in the muffler illustrated in FIGS. 1 and 2.

With reference now to FIGS. 1-6 of the drawings, a muffler constructed in accordance with a preferred embodiment of this invention is indicated generally by the reference numeral 11. The muffler 11 comprises an outer tube or casing 12 through which exhaust gases flow from an inlet conduit 13 to an outlet conduit 15 in the direction of the arrow X. As best shown in FIG. 2, the inlet and outlet conduits 13 and 15 are attached to the tube 12 in a simple but secure manner by respective end caps 14 and 16. Thus, the end cap 14 may include an internally threaded central opening 31 for the reception of the inlet conduit 13 and may also include an internally threaded flange portion 32 which is threaded on a correspondingly threaded end 33 of the tube 12. In like manner, the outlet conduit 15 is threaded within a central opening 34 in the end cap 16, and the end cap is threaded on an end 35 of the tube 12. It should be understood that the use of threaded connections is not essential to the invention; and that any suitable means for assembling the muffler housing and mounting it in an exhaust pipe may be employed.

As illustrated in FIG. 2 the muffler 11 is divided into a series of inner chambers A, B, C, D, and E by means which include baffle plates 18 and 21 extending across the inner diameter of the tube 12 in longitudinally spaced relation to one another. The plate 19 is illustrated separate from the muffler 11 in FIG. 6 and is seen to comprise a series of truncated wedge-shaped apertures 19 which are evenly spaced in an annular array in the baffle plate. The plates 21 are substantially identical to one another and each include a series of slot-shaped and parallel disposed openings 22 for permitting flow therethrough, as illustrated in FIG. 5. In a preferred embodiment of the invention, and as illustrated in FIG. 2, the plates 21 are four in number and are disposed in downstream relation to the plate 18. In the illustrated arrangement, the slots 22 in each plate 21 are disposed perpendicular to the slots in a plate immediately upstream or downstream therefrom. However, the aperture distribution in these baffle plates is not critical, and the plates may be randomly angularly oriented with respect to each other. Moreover, it is not essential that the plates 21 be identical to each other or that they include the specific aperture pa-

tern of FIG. 5, since their sole function is to hold other parts of the muffler structure in position and permit the flow of gas between the muffler sections B, C, D, and E.

The plate 18 is spaced from both the inner surface of the end cap 14 and the immediately downstream baffle plate 21 by a pair of spacer elements 17. As illustrated in FIG. 4, the spacer elements 17 may be formed with one or more corrugations 17C so as to afford offset edges insuring engagement with the transversely extending surfaces of the end cap and baffle plates. While the spacer element 17 has been illustrated in FIG. 4 as continuously corrugated, it will be recognized that the spacer element 17 can effectively serve the function intended with only one or more pairs of corrugations or undulations therein. Also, the spacer elements 17 are preferably somewhat oversized with respect to the inner diameter of the casing 12 so that the natural resilience of the material of which the spacer elements are composed serves to retain the spacer elements in engagement with the inner periphery of the casing.

Coil means, in the form of a coiled metal strip 23, are disposed within the chamber C with the axis of the coil aligned generally parallel to the longitudinal axis of the muffler 11. The coiled strip 23 may be formed without having any corrugations, or may be provided with corrugations 23C at least in some portions thereof, as illustrated in FIG. 3. The ends of the coiled strip 23 abut the facing surfaces of the baffle plates which define the chamber C. With reference to FIG. 3 it is seen that the coiled strip 23 defines a series of generally arcuate channels between the oppositely aligned slotted apertures 22 in the respective upstream and downstream baffle plates 21. Thus, the coiled strip 23 is quite effective in separating noise-producing pulsations in the gases flowing through the muffler 11 into a plurality of separate streams while at the same time presenting little restriction to the flow of gas therethrough. Also, and as will be explained in greater detail hereinbelow, the coiled strip serves as a flame arrester for preventing any flame from being transmitted to the chamber D.

The chamber D, although partly broken away and thereby foreshortened in FIG. 2 to facilitate illustration in a single figure, preferably extends along the major portion of the length of the muffler 11. Multiple channel-producing means in the form of a plurality of individual ball elements 26 are disposed in random arrangement and in a flow-intercepting position within the chamber D. The primary function of the ball elements 26 is to afford a plurality of flow channels of varied configuration and orientation to further break up sound-producing pulsations in the exhaust gases flowing from the chamber C. For this purpose, the particular composition of the material of which the ball elements 26 are composed is not critical. Preferably, however, the ball elements are formed from some relatively light weight material, such as hollow metal spheres, fiber glass or the like. In some instances it may be desirable for the ball elements 26 to serve an additional absorbent function. In such a case the ball elements may be composed of a suitable absorbent material, such as mineral material or charcoal. It is not necessary that the balls 26 be uniform in size or composition; a mixture of balls of varied size made from a variety of materials has been found to be effective in operation in this part of the muffler.

In this latter aspect of the invention it may be noted that the disposition of the coiled strip 23 immediately upstream of the chamber D effectively serves as a flame arrester and heat distributor for transferring heat from the exhaust gases to the outer casing 12, and ultimately to the atmosphere in much the same manner as a screen grid over an open flame. Thus, the coiled strip 23 serves as a flame arrester for preventing any flame from being transmitted to the chamber D.

The ball elements 26 are preferably maintained in compacted relation within the chamber D by biasing

means in the form of a compression spring 27 disposed within the chamber E. The coiled spring 27 is interposed between two baffle plates 21 in the manner illustrated in FIG. 2, although the downstream baffle plate 21, which is seated on the inner surface of the end cap 16, can be omitted if desired. Moreover, a spacer such as one of the spacers 17 may be used instead of the spring 27, if desired, or the final chamber may be eliminated entirely and the ball elements may engage the end of the muffler.

In assembling the muffler 11 the inner structural components may be sequentially inserted through either the inlet or the outlet conduit end of the outer casing 12. Thus, the first spacer element 17 disposed within the chamber A may be inserted first, through the outlet end, to be followed by the plate 18, the second spacer element 17, the baffle plate 21, the coiled strip 23, and the second baffle plate 21 in that order. Subsequently, the ball elements 26 are placed in the chamber D, and the spring 27 and baffle plate 21 are rendered effective to compact the ball elements within the chamber D by threading the end cap 16 on the outlet end of the casing 12.

In the use of the muffler 11 the exhaust gases flow axially through the muffler in the direction of the arrow X. Both of the chambers A and B serve as diffuser chambers while the chamber B, by reason of the varied configuration of the apertures in the plates 18 and 21, additionally functions to break up the noise-producing pulsations in the exhaust gases. As pointed out hereinabove, waves or pulsations in the gases after passing through the chamber B are further broken up as the gases are divided and separated into a plurality of separate streams by the coiled strip 23. Also as pointed out hereinabove, the coiled strip 23 serves as flame arrester and prevents the transfer of excessively high temperatures to the chamber D. In the chamber D, the large number of channels afforded by the ball elements 26 and the varied configuration and orientation of the channels defined by the ball elements are quite effective in dispersing and deflecting any noise-producing pulsations which may be transmitted through the chamber C. Thus, the dispersed and deflected pulsations are damped out, both by cancellation with one another and by contact with the irregular surfaces presented by the ball elements 26. Accordingly, the gases pass from the chamber D in a smooth and quiet flow. In addition to the noise-damping function, and as pointed out hereinabove, the ball elements may also serve an absorbent function for removing impurities or atmosphere-polluting components from the exhaust gases by suitable selection of the material of which the ball elements 26 are composed.

Thus, in accordance with this invention, there is provided a muffler which may be constructed in a simple and economical manner and without the necessity of having to resort to welding or like operations. Furthermore, while the muffler is simply assembled, either by hand or with the use of quite simple tools, from prefabricated parts, the assembled unit is quite effective to silence noise-producing pulsations in the exhaust gases and may additionally serve to remove impurities from the exhaust gases flowing thereto. Furthermore, the simple in-line assembly of the muffler structure renders it readily adaptable to mass production by automatic assembly apparatus.

Hence, while I have illustrated and described a preferred embodiment of my invention, it is to be understood that this is capable of variation and modification.

I claim:

1. A muffler for quieting gases flowing therethrough comprising, a generally tubular outer casing, inlet and outlet conduit means attached to opposite ends of said casing, baffle means defining a plurality of longitudinally aligned chambers within said outer casing and between said inlet and outlet conduit means, coiled strip means disposed within one of said chambers with the axis of said coiled strip means disposed generally parallel to the

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longitudinal axis of said outer casing, said coiled strip means effectively defining a plurality of arcuately shaped passageways within said one chamber, and multiple channel producing means comprising a multiplicity of light-weight hollow ball elements disposed in random arrangement within another of said chambers immediately adjacent said one chamber, said ball elements defining a plurality of channels of varied configuration and orientation for breaking up and dispersing sound-producing pulsations in said exhaust gases.

2. A muffler for quieting gases flowing therethrough comprising, an outer casing, inlet and outlet conduit means attached to opposite ends of said casing, baffle means defining first and second diffuser chambers and third and fourth dampening chambers within said outer casing and between said inlet and outlet conduit means, said baffle means including apertured plates disposed generally perpendicular to the longitudinal axis of said outer casing, coiled strip means disposed within said third chamber with the axis of said coiled strip means disposed generally parallel to the longitudinal axis of said outer casing, said coiled strip means effectively defining a plurality of arcuately shaped passageways within said one chamber and functioning as a heat distributor for arresting the passage of flame through said third chamber, and multiple channel-producing means comprising a multiplicity of light-weight hollow metal ball elements disposed in random arrangement within said fourth chamber immediately adjacent and downstream of said third chamber, said ball elements defining a plurality of channels of varied configuration and orientation for breaking up and dispersing sound-producing pulsations in said exhaust gases, said means further including a resilient biasing member urging said ball elements toward one end of said fourth chamber to maintain said ball elements in compacted relation therein.

3. A muffler for quieting gases flowing therethrough comprising, an outer casing, inlet and outlet conduit means attached to opposite ends of said casing, baffle means defining a plurality of longitudinally aligned chambers within said outer casing and between said inlet and outlet conduit means, coiled strip means disposed within one of said chambers with the axis of said coiled strip means disposed generally parallel to the longitudinal axis of said outer casing, said coiled strip means effectively defining a plurality of arcuately shaped passageways within said one chamber, multiple channel-producing means comprising ball elements disposed in random arrangement within another of said chambers immediately adjacent

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said one chamber, said ball elements defining a plurality of channels of varied configuration and orientation for breaking up and dispersing sound-producing pulsations in said exhaust gases, and biasing means for maintaining said ball elements in compacted relation within the chamber.

4. In a muffler of the kind through which gases flow from an inlet end to an outlet end and wherein the gases are to be quieted, multiple channel-producing means for breaking up and dispersing audible sound-producing pulsations in said exhaust gases including a plurality of hollow metal ball elements disposed in random arrangement, means for containing said ball elements in a flow-intercepting position within the interior of said muffler, and resilient biasing means for holding said ball elements in compacted relation relative to each other.

5. In a muffler of the kind through which gases flow from an inlet end to an outlet end and wherein the gases are to be quieted, a casing, a plurality of baffle members mounted in said casing to define plural chambers therein, at least two of said baffle members being separated by an interposed spacer to define a diffuser chamber, multiple channel-producing means for breaking up and dispersing audible sound-producing pulsations in said exhaust gases including a plurality of ball elements disposed in random arrangement, including two of said baffle members, means for containing said ball elements in a flow-intercepting position within the interior of said muffler downstream from said diffuser chamber, and resilient biasing means for holding said ball elements in compacted relation relative to each other.

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