Dec. 24, 1963 E. A. BEMBINSTER 3,115,209

MUFFLER

Filed May 11, 1960

Fig. 1

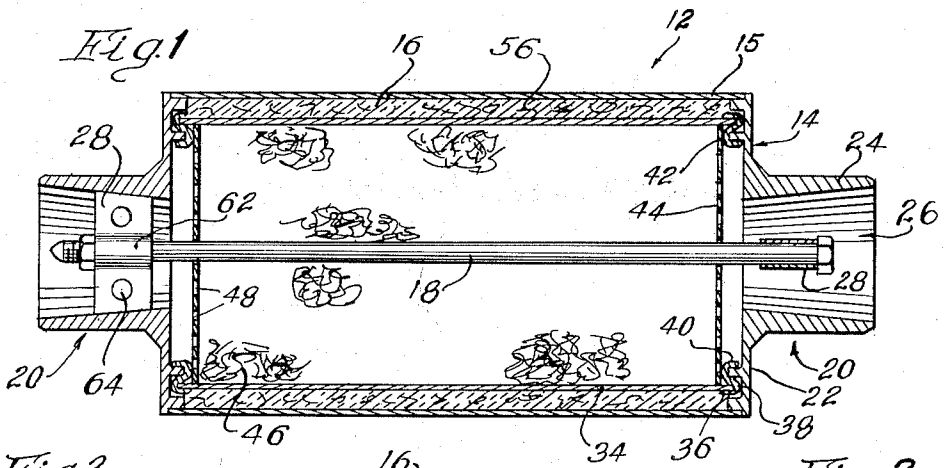


Fig. 3.

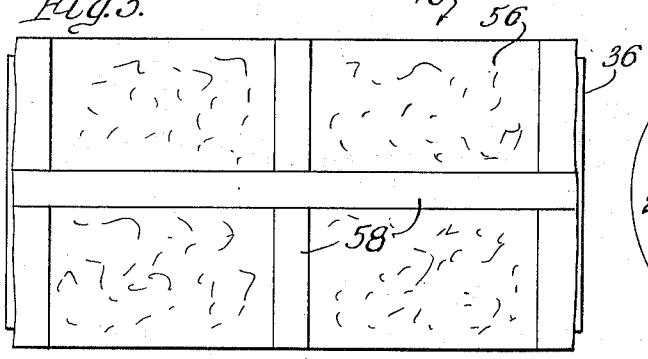


Fig. 2.

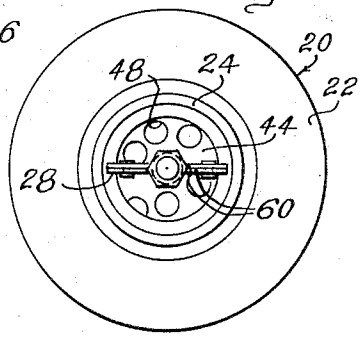


Fig. 4

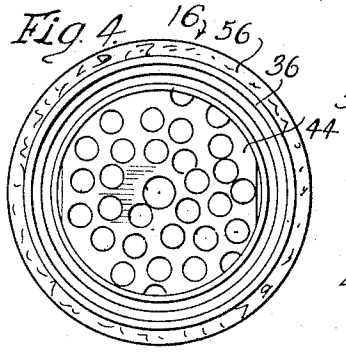


Fig. 5.

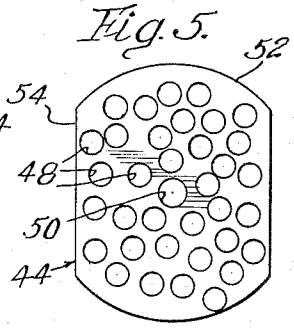


Fig. 6

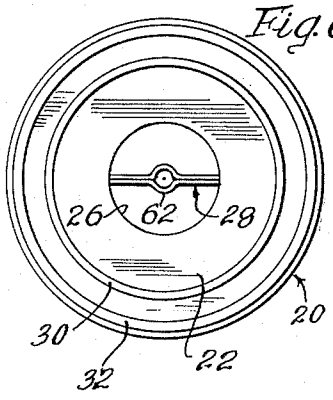
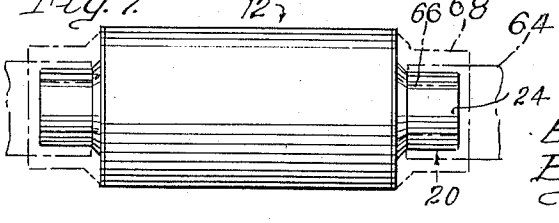


Fig. 7



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MUFFLER

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5 Claims. (Cl. 181—50)

The present invention relates to a muffler for internal combustion engines such as in automobiles.

A main object of the invention is to provide a muffler that, in addition to its muffling function, serves to eliminate or minimize smog-producing substances.

Smog conditions, at least in certain localities, have reached serious proportions, and a main factor, if not the greatest factor, in producing such smog conditions are the products of combustion produced by automobiles.

The gasoline is not perfectly burned in an automobile and many unburned particles are expelled in the exhaust from automobiles, which fill the atmosphere to the detriment of those living in the localities concerned.

Another and broad object of the invention is to provide a muffler which is operative for causing substantially complete combustion of combustible products that are otherwise unburned and expelled from an internal combustion engine such as in an automobile.

Heretofore mufflers generally, if not universally, have been designed for operating cool, with special design for maximum dissipation of heat therefrom. As contrasted therewith, the muffler of the present invention is designed for operating hot, and at such temperatures that combustible products of the combustion in an internal combustion engine that would otherwise be unburned, are substantially completely burned in this muffler, and it is therefore another and broad object of the invention to provide a muffler capable of producing high temperatures therein for burning such combustible products.

Another and specific object of the invention is to provide a muffler having an encasing layer of heat insulation for producing high temperatures therein for burning combustible products expelled from an internal combustion engine.

A further object is to provide a muffler of the general character noted above having a mass of muffling material therein providing large area surface to the gases flowing therethrough, and hence providing highly effective muffling and burning action.

A further and more specific object is to provide a muffler of the character noted in which the muffling means is a mass of shredded material, substantially filling the interior of the muffler housing and providing virtually an infinite number of muffling surfaces, whereby the gases passing through the muffler are heated to extremely high temperatures, for burning materials that otherwise would be unburned.

Another object is to provide a muffler of the foregoing character having novel construction including a cartridge removable and replaceable as a package and thereby facilitating removal and replacement of the muffling material.

A still further object is to provide a muffler of the foregoing character including a housing of rust-proof material whereby to prevent corrosion thereof which may otherwise occur due to the extremely high temperatures encountered.

Still another object is to provide a muffler including removable and replaceable end pieces whereby by utilizing end pieces of different sizes, tail pipes of different sizes can be accommodated by merely utilizing selected end pieces to adapt the muffler to the particular automobile.

Other objects and advantages of the invention will appear from the following detailed description taken in conjunction with the accompanying drawings in which:

FIGURE 1 is an axial sectional view of a muffler made according to the invention;

FIG. 2 is an end view of the muffler of FIGURE 1;

FIG. 3 is an elevational view of the cartridge of the muffler of FIGURE 1, removed from the housing;

FIG. 4 is an end view of the cartridge of FIG. 3;

FIG. 5 is a view of the perforated confining plate used in the cartridge;

FIG. 6 is a view of the inner side of one of the end pieces of the muffler; and

FIG. 7 is an elevational view of the completed muffler, indicating different sizes of end pieces adaptable thereto.

Referring now in detail to the drawings, a muffler made according to the present invention is shown in its entirety in FIGURE 1 which is an axial sectional view through the complete muffler. The muffler 12 includes a housing indicated in its entirety at 14, a cartridge 16 also shown in FIG. 3, and a securing means 18 securing the detachable parts of the housing together and confining the cartridge in the housing.

The housing 14 includes a wall element 15 which preferably is of uniform cylindrical construction, and end pieces 20 which are identical in construction and a description of one will serve for both. The housing, including the cylindrical wall element 15 and the end pieces 20 are of non-corrosive, non-rust material such as aluminum, to withstand the rusting inclinations of the moisture passing through the muffler, and other corroding agents. The aluminum material also is capable of withstanding the relatively higher temperatures encountered in the muffler of the present invention as referred to hereinbelow.

Each end piece 20 includes an annular disc element 22 and a tubular extension 24 defining a passage 26 therethrough. The inner surface of the tubular element 24 is preferably tapered for aiding in securing the parts of the muffler together by a securing means 18 through the medium of anchor elements 28 described hereinbelow. The annular element 22 is provided with an inner rib 30 and an outer rib 32, on its inner surface and extending toward the interior of the muffler in the assembly of the parts, for cooperation in confining the cartridge and the contents thereof in the muffler. The outer rib 32 is spaced inwardly from the marginal edge of the annular element 22 for telescoping into the cylindrical wall element 15 and frictional engagement therewith, the parts being of identical outer diameter to provide a flush exterior cylindrical surface.

The cartridge 16 basically is in the form of a cylinder having ends that are, for the most part, open, but with shoulder areas for use in confining the muffling material therein as described hereinbelow.

The cartridge includes a wall element 34 which is uniformly cylindrical and is made of material capable of withstanding relatively high temperatures and preferably is made of steel with a tin plated coating. At each end of the wall element 34 is a bead construction 36, substantially identical at both ends. This bead construction is similar to that found quite commonly in a paint can construction and is generally S-shaped in cross section. This bead has a portion 38 crimped over the end edge of the wall element 34 and another portion 40 reversely bent and shaped to receive the inner rib 30 of the end piece 20 in the assembly of the muffler, the dimensions of the various parts being such that the portion 38 is received in the annular space between the two ribs 30 and 32. The bead 36 thus forms an annular shoulder surface 42 extending radially inwardly from the wall element 34 for engagement by confining plates 44 described hereinbelow. The beads 36, as will be understood, are permanently secured to the wall element 34. The dimensions of the parts furthermore are such in axial direction

that while the end pieces 20 are butted tightly against the end edges of the outside wall element 15, that also snugly engages the ends of the cartridge 16 to prevent undue movement or rattling of the parts of the muffler.

The cartridge 16 contains a muffling material indicated at 46 for effective muffling and heat-developing properties, this muffling material being in the form of a shredded material such as brass. This shredded metal in itself is a known material. It includes shredded or filamentary elements of such immense number and such irregular shapes that they present an infinite number of surfaces to the gases passing through the muffler, causing a highly effective muffling action. Furthermore, because of their irregular shapes, and their relatively high rigidity, they provide a high void-to-solid ratio, and even when matted or relatively highly compressed, this ratio remains quite high. As an example of this property of the material, a mass of this shredded brass is utilized that in total volume, the solid portions thereof would occupy on the order of 1.3% of the total volume of the interior of the cartridge defining the space in which it is confined. Obviously, I do not wish to be limited to any such exact percentage, and a wide range of ratios is well within the concept of the invention.

This mass of shredded material 46 is confined within the cartridge by the end plates 44 referred to above and shown in FIGS. 4 and 5. These end plates are provided with a plurality of apertures 48 of suitable size and number to enable to gases to readily pass therethrough, but leaving sufficient strength in the plates to withstand the pressures involved. These perforations may be placed at random or in any desired arrangement. A central aperture 50 may be provided of larger size to receive the securing means 18. The plates 44 as will be noted in FIG. 5 are of truncated disc form having circular edges 52 defining a transverse dimension nearly equal to the inner diameter of the cylindrical wall element 34, and parallel straight side edges 54 defining a transverse dimension slightly less than the inner diameter of the bead 40. This shape of the plates enables the plates to be inserted through the opening defined by the beads 40 and after full inseration into the housing of the cartridge, to enable the long dimension portions to engage under the shoulder 42.

As noted above, the muffler of this invention is designed for operating hot so as to eliminate or minimize, through the medium of combustion, undesired but combustible products in the gases passing through the muffler. Accordingly, the cartridge is provided with a layer of heat insulation, this layer being indicated at 56 and forming the outermost element of the cartridge. This insulation 56 is preferably in the form of fiber glass and may be matted or compacted to provide firm construction to retain the muffler housing and cartridge housing, spaced in diametrical directions while still retaining the desired insulating qualities. Preferably this insulation material is applied to the wall element 34 for normal non-removability and may be so confined by suitable means such as strips of adhesive tape 58. The cartridge with the insulation material thereon forms a relatively rigid and unitary construction well adapted for bodily insertion into and removal from the muffler housing.

The anchor elements 28 may be of any suitable construction and preferably are made up of two individual strips 60 fitted flat together and having semi-cylindrical central portions 62 with the concave sides facing each other and secured together by means such as rivets 64. The semi-cylindrical portions 62 define tubular elements for receiving the rod. The rod is provided with a head and a nut for locking against the anchor pieces 28 for securing the parts of the muffler together. These anchor pieces 28 have inclined end surfaces for engaging the tapered inner surfaces of the tubular elements 24 for producing a wedging action with those surfaces, in response to tightening of the rod 13. The flat configuration of the

anchor elements 28 provides a wafer effect for minimizing blocking effect to the passage of gases.

The shredded material 46 provides a relatively high blocking effect to the gases passing through the muffler. This necessarily builds up a relatively high back pressure within the muffler and consequent slower movement of the gases through the muffler. A satsifactory internal pressure has been found to be in the neighborhood of 2 lbs. per square inch, but it will be understood the invention is not limited to this precise pressure. The longer period in which the gases consequently remain in the muffler, and the higher pressures encountered develop higher temperatures, this condition being further enhanced by the presence of the insulation material 56. These higher temperatures which exist in the muffler result in combustion of substantially all of the combustible materials that are discharged in the exhaust of internal combustion engines. A certain quantity of oxygen is contained in these exhaust gases. Therefore these combustible materials are prevented from reaching the atmosphere in unburned condition, and since these materials cause a greate portion of the smog conditions encountered in various localities, this muffler is highly effective for preventing those smog conditions. Furthermore, the higher temperatures encountered vaporize all of the moisture contained in the exhaust gases and this prevents rust to the metal surfaces of the various parts of the muffler. The muffler is effective for producing internal temperatures in the region of 400° F. or 500° F. which I have found to be highly effective for producing the combustion effects referred to. The insulation material 56, while causing the interior of the muffler to run hot, minimizes the transmisison of heat to the outer wall element 15 and this fact, together with the passage of air over the outer surface of the muffler, retains the wall element 15 relatively cool.

The end pieces 20 being detachable from the remainder of the muffler enable replacement of other and substitute end pieces of various sizes and shapes, enabling adaptation of a single muffler to any of various sizes of automobiles or trucks.

In FIG. 7 is shown a muffler in full lines having end pieces 20 of a predetermined size to which are attached tail pieces 64. If desired, these end pieces may be replaced by small end pieces 66, or larger end pieces 68, and since all other parts of the muffler may remain the same, a single muffler may be easily adapted to any of various sizes of automobiles or trucks.

In the event that the interior of the muffler should seriously deteriorate over a period of time due to the relatively high temperatures involved, the construction enables quick and easy replacement of the cartridge 16. By removing one or both of the end pieces, the cartridge may be removed and a new and complete cartridge inserted in replacement thereof. Replacing the end pieces and locking the parts together requires only a relatively short period of time.

While I have herein shown a preferred embodiment of the invention, it will be understood that changes may be made therein within the scope of the appended claims.

I claim:

1. A muffler of the character disclosed comprising a housing of rust-proof material including a tubular wall element and end members removably secured thereto, said end members having openings for passage therethrough of gases passing through the housing, and a self-contained, unitary cartridge removably contained in said housing including a tubular rigid member having open ends, a mass of shredded material in said tubular member presenting an infinite number of surfaces for muffling gases passing through the muffler, perforated end plates in said tubular member confining the mass of material therein, and a tubular layer of high heat insulation material encircling said tubular member, said cartridge being insertable into and removable from said tubular wall ele-

ment of the housing, and the muffler also including securing means passing, through the cartridge and thus the interior of the housing, and passing at least partially into the openings in the end members, engaging the end members for removably securing the end members and tubular wall element together in a rigid assembly forming the housing and confining the cartridge therein.

2. The muffler set out in claim 1 in which the tubular member of the cartridge has a radially inturned bead at each end forming an annular shoulder, and each perforated end plate has relatively long and short mutually transverse dimensions, the shorter dimension enabling the end plate to be passed through the bead, and the longer dimension enabling end portions of the end plate to engage said annular shoulder when the end plate is disposed generally perpendicular to the axis of the cartridge.

3. A muffler of the character disclosed comprising a housing of rust-proof material including a tubular wall element and end members removably secured thereto, said end members having openings for passage therethrough of gases passing through the housing, and a self-contained cartridge in said housing including a tubular rigid member having open ends, a mass of shredded material in said tubular member presenting an infinite number of surfaces for muffling gases passing through the muffler, perforated end plates in said tubular member confining the mass of material therein, and a tubular layer of high heat insulation material encircling said tubular member, said cartridge being insertable into and removable from said tubular wall element of the housing, and the muffler also including securing means passing through the cartridge and thus the interior of the housing, and passing at least partially into the openings in the end members, engaging the end members for removably securing the end members and tubular wall element together in a rigid assembly forming the housing and confining the cartridge therein, said end means having tubular extensions forming said openings therein, the inner surface of said tubular extensions being tapered inwardly, and the securing means including a rod extending through the muffler and anchoring members wedged in said tubular extensions through which the rod projects, and removable securing means on the ends of said rod outwardly of said anchoring members.

4. A muffler for silencing and completing combustion of gaseous waste products expelled from an internal combustion engine comprising a rustproof housing including a tubular wall element and end members detachably secured thereto, said end members each being perforate to admit and discharge the gaseous waste products expelled from said internal combustion engine, a tubular elongated cartridge located within said housing and slidably insertable thereinto and removable therefrom through which said gases pass, a tubular sleeve of heat-resistant insulating material surrounding said cartridge and disposed between said cartridge and said tubular wall element of said housing for maintaining elevated temperatures within said cartridge, means engageable with said end members extending through said housing longitudinally of said cartridge and insertable through said cartridge for removably securing the end members of said housing to said tubular wall element of said housing and for locating said cartridge within said housing, said elongated removable cartridge including a tubular cartridge wall element, muffling means within said tubular cartridge wall element including a mass of shredded material presenting substantially an infinite number of surfaces for muffling and burning gases passing through the cartridge, and means at the ends of the tubular cartridge wall element for retaining said muffling means therewithin and for admitting and discharging gases introduced into said muffler, whereby the combustible portions of gaseous wastes expelled from an internal combustion engine with which said muffler is associated are burned and muffled simultaneously.

5. The combination of claim 4 wherein the tubular sleeve of heat-resistant insulating material is connected to the elongated cartridge and is removable from and insertable into the housing with said cartridge.

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