March 21, 1939. C. HOLLERITH 2,151,470

MUFFLER

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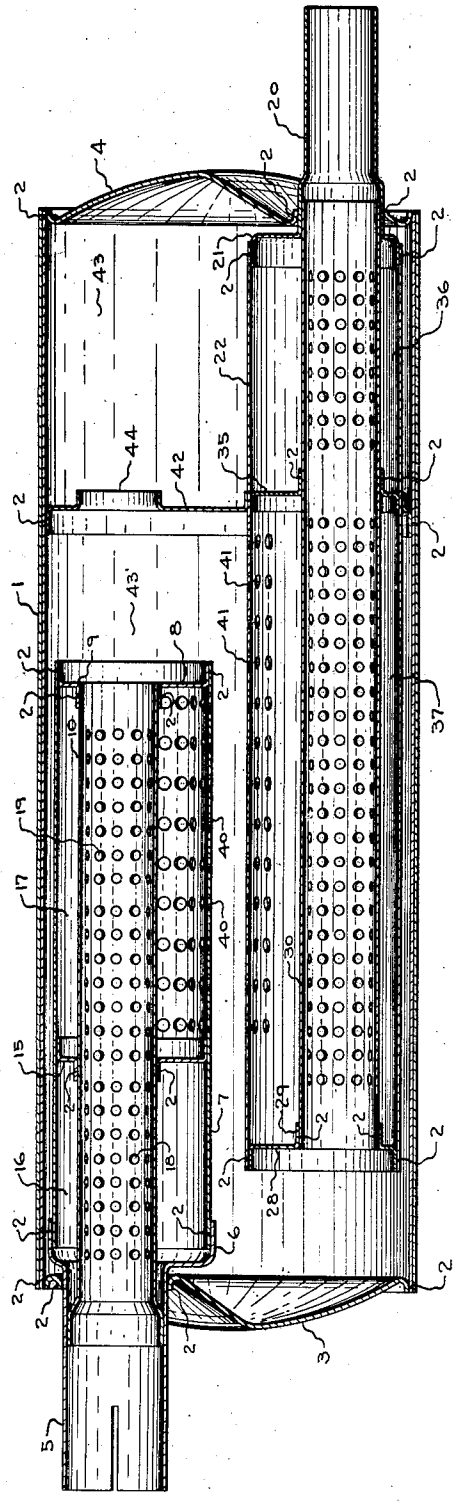


Fig. 1

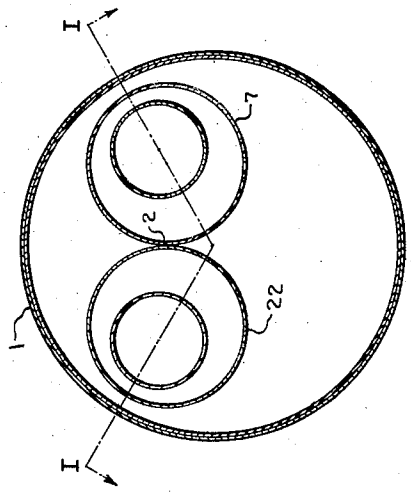


Fig. 2

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MUFFLER

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17 Claims. (Cl. 181—54)

This invention relates to apparatus for attenuating sound waves and more particularly to mufflers for the exhaust gases of internal combustion engines of vehicles.

Such apparatus as heretofore constructed has been of a design insertable into the exhaust conduit with the weight of the muffler construction supported from the sections on the exhaust pipe entirely from the heads of the outer shell of the muffler. In other words the interior construction of the muffler possessing the sound wave attenuating characteristics was in no sense a continuation of the exhaust conduit with reference to distribution of the stresses set up within the muffler itself and the weight of the muffler construction.

The apparatus of the present invention has for its object to bring into effect a redistribution of the stresses set up within the muffler due to heat and resulting expansion and due to the weight of the muffler construction when compared with prior practices and results in removal for the most part of such stresses from the shell of the exterior construction of the muffler.

Another object is to provide a muffler construction of the type described which may be easily assembled and in which the inner construction of the muffler becomes more of a part of the exhaust conduit and thus a more suitable arrangement for use in connection with internal combustion engines having resilient or floating mountings.

A further object resides in novel muffler construction possessing satisfactory sound wave attenuating characteristics and in addition embodying the above mentioned structural advantages.

Other objects including improvements in construction for permitting expansion and for eliminating "shell" noises will be more fully treated hereinafter.

These and other objects will be apparent from the following description when taken with the accompanying drawing in which,

Fig. 1 is a section on the line I—I of Fig. 2, and

Fig. 2 is a vertical section through approximately the center of the muffler.

Referring particularly to the drawing reference character 1 indicates a shell which is preferably of double wall construction as would be produced by telescoping two sheet metal tubes or rolling a sheet metal strip into a double layer coil. Within the shell 1 is disposed sound attenuating structure built up from sheet metal sections which are spot welded together at points indicated by the reference character 2. In each end of the shell 1 are heads 3 and 4 each having a suitable opening for the reception of the inlet and outlet connectors 5 and 6. The head 3 of the shell 1 is welded to the connector 5 to locate the position of the shell with reference to the interior muffler structure upon which the shell is supported. At its inner end the connector 5 is provided with a belled end 6. A tube 7 is connected at one end to the belled end 6 and has the other end partially sealed by a bushing plate 8. The bushing plate 8 has an eccentrically disposed reduced opening surrounded by an axially extending flange 9 to which is connected a tube 10. It will be observed from Fig. 1 that the tube 10 is of somewhat less diameter than the inlet connector 5 and has its end adjacent the inlet connector 5 belled into sliding engagement therewith. Also it will be observed that the tube 10 extends axially within the tube 7 but eccentrically with respect to the longitudinal axis thereof. A baffle plate 15 is secured to the tube 10 somewhat nearer the belled end 6 than the bushing plate 8 of the tube 7 and defines with the tube 7 resonating chambers 16 and 17. Communication is established between the interior of the tube 10 and the resonating chamber 16 by a plurality of perforations 18 and between the interior of the tube 10 and the resonating chamber 17 by a plurality of perforations 19. The resonating chamber 16 is somewhat smaller than the resonating chamber 17 and is for attenuating relatively high frequency tones. The baffle plate 15 is in sliding contact with the tube 7 so that any unequal expansion between the tube 7 and the tube 10 will be compensated for, not only by the sliding fit of the baffle plate 15 but also by the sliding fit of the belled end of the tube 10 with the inlet connector 5. The head 4 is secured to the interior muffler structure in the manner of the head 3 just described. An outlet connector 20 to which is attached the head 4 has a belled end 21 disposed within the shell 1. Connected to the belled end 21 is a tube 22 projecting into the shell 1 and into overlapping and contacting relation with the tube 7. A bushing plate 23 is secured in the inner end of the tube 22 and has therein an eccentrically disposed opening defined by an axially extending flange 29. A tube 30 extending throughout the length of the shell 22 is secured at one end to the flange 29 and is slidably disposed at the other end within the outlet connector 20. A baffle plate 35 is fixed to the tube 30 and extends radially into contacting and sliding engagement with the tube 22, forming with the tube 22 resonating chambers 36 and 37. The resonating chamber 36 near the outlet end is materially smaller than the resonating chamber 37 and is for the purpose of the attenuating high frequency tones. Communication between the tube 30 and the resonating chamber 36 is established by a plurality of perforations 38 and between the tube 30 and the chamber 37 by a plurality of perforations 39.

As shown particularly in Fig. 2, the tubes 7 and 22 throughout their overlapping length are in contact with each other and are spot welded together. Also, it will be observed from Fig. 2 that the tubes 7 and 22 are disposed eccentrically with respect to or to one side of the shell 1.

This arrangement may be varied to bring the outlet and the inlet connectors in any desired position depending upon the exhaust conduit locations. The tube 7 is provided with a plurality of perforations 40 in the portion thereof defining the resonating chamber 17, and the tube 22 is provided with a plurality of perforations 31 in the portion thereof defining the resonating chamber 37. The perforations 40 and 41 establish communication between the resonating chambers 17 and 37.

A baffle plate 42 disposed transversely in the shell 1 is secured to the shell 1 establishing a resonating chamber 43 at the outlet end of the shell 1. An opening 44 in the baffle plate 42 generally opposite the opened end of the tube 10 establishes communication between the resonating chamber 43 and the remainder of the interior of the shell 1 which constitutes a chamber 43'. The ends of the tubes 10 and 30 open into the chamber 43' and the major portion of the exhaust gases flow through these tubes. After leaving the end of the tube 10, the gases will flow to the left in the chamber 43' to enter the open end of the tube 30. Undoubtedly a portion of the gases will be short circuited between the tubes 10 and 30 through holes 40 and 41 defined in the tubes 7 and 22. Acoustically considered, the chamber 43' constitutes a resonator chamber of considerable capacity which is in series with the chamber 43 as well as the chambers 17 and 37. From this it will be understood that the structural departure presented by the present invention lends itself very well to the present accepted theory of effective acoustical circuits. In order to permit the passage of the tube 22 through the baffle plate 42 the baffle plate 42 is provided with an opening in which the shell 22 is slidably disposed. The sliding connection between the baffle plate 42 and the tube 22 permits relative movement if there be unequal expansion of the shell 1 and the shell 22. Also the sliding connections between the tube 30 and the outlet connector 20, and baffle plate 35 and the tube 22 permit a relative movement if there be unequal expansion between the tube 22 and the tube 30.

The present construction effects a substantial departure from heretofore known mufflers in that the structural arrangement of the interior of the muffler becomes in reality a section of the exhaust conduit in which it is inserted and is supported from the exhaust conduit in lieu of being supported through the shell as has been the practice. That is to say, in the illustrated form of the invention the tubes 7 and 22 which are rigidly united in their overlapping relation, together with the connectors 5 and 20, constitute an integral structure which becomes a part of the exhaust conduit in which it is inserted. The shell 1 with its headers 3 and 4 and baffle 42 are in effect hung from this integral interior structure of the muffler.

In production the tubes 7 and 22 with their associated connectors 5 and 20 are assembled and united into a unitary structure and then inserted into the shell 1 and through the baffle 42. The fabrication of the muffler construction is then completed by placing the heads 3 and 4 in position and welding the same to the shell 1 and the connectors 5 and 20. By having the integral interior structure slidably in the baffle 42 as well as having the tubes 10 and 30 anchored only at one point and slidably supported throughout the remainder of their lengths, stresses and distortion from expansion are materially lessened. Moreover, by redistributing the stresses formerly carried for the most part by the shell and especially the heads thereof, the period of serviceability of the shell is materially lengthened. The advantages the present construction offers in connection with the use of mufflers for internal combustion engines yieldingly supported so as to yield to the engine torque will be apparent to those skilled in the art.

Having thus described my invention what I desire to secure by Letters Patent and claim is:

1. In a muffler construction adapted to be inserted in an exhaust conduit of an internal combustion engine, a relatively rigid interior muffling construction defined by spaced nested tubes constituting resonator chambers and having inlet and outlet connectors rigidly supported therefrom, and an outer shell laterally spaced from and enclosing said interior muffling construction and attached to and supported from said connectors, said interior construction with respect to said outer shell having at least the major portion thereof suspended from one end of said outer shell.

2. A muffler of the retroverted gas flow type comprising a pair of interior muffling structures having nested inner and outer tubes in spaced relation to form acoustical chambers disposed in overlapping relation with said outer tubes integrally united with each other, said inner tubes defining central straight through passages in said muffling structures, inlet and outlet connectors rigidly connected to said muffling structure and constituting continuations of said central straight through passages, an outer shell housing said muffling structures and supported therefrom, through which said connectors project, the inner ends of said overlapping muffling sections opening directly into the interior of said shell, the interior of said shell functioning as a conduit for conducting exhaust gases between the overlapped inner ends of said muffling structures, said outer shell being laterally spaced from said interior structures.

3. In a muffler construction of the type disclosed, a pair of interior muffling structures comprising perforated straight through central conduits, means embracing said conduits defining resonator chambers, the exterior surface of said muffling structures being disposed side by side in direct contact and being integrally connected to each other, inlet and outlet connectors constituting continuations of said central conduits, and an exterior shell housing said muffling construction and embracing sections of said connectors projecting outwardly through said shell, said exterior shell being laterally spaced from said interior structures, said interior structures being suspended with respect to said exterior shell.

4. In a muffler construction, a plurality of nested tubes collectively defining a gas conduit and a resonator chamber, means acoustically connecting said conduit and chamber, means spaced longitudinally of said tubes for positioning the same in spaced relation, certain of said last means integrally connecting said tubes, certain other of said last means having sliding engagement with at least one of said tubes whereby relative axial movement between said tubes due to expansion is permitted.

5. In a muffler construction, an elongated shell, headers having openings therein disposed at opposite ends of said shell for enclosing the same, inlet and outlet connectors having enlarged inner ends positioned in said openings of said heads,

a pair of tubes integrally connected to the enlarged ends of said connectors disposed longitudinally with the interior of said shell in juxtaposition with the exterior surfaces of each other integrally connected, tubes supported in spaced relation within said first tubes and communicating with said connectors to provide straight through gas conduit sections, the spacing of said tubes defining resonator chambers embracing said gas conduits, and means acoutically connecting said conduits with each other and with said chambers.

6. In a muffler construction, a pair of straight through conduit sections, acoustic wave attenuating structure embracing said sections defining high frequency filter chambers, an outer shell housing said sections and structure, inlet and outlet conduits associated with said shell and communicating with said conduit sections, said high frequency filter chambers being disposed adjacent said inlet and outlet conduits, said high frequency filter chambers being freely suspended throughout the major portion of their lengths from said outer shell, and means defining resonator chambers of substantially greater volume than said high frequency chambers acoustically connected with said conduit sections intermediate said high frequency chambers.

7. In a muffler construction, an outer shell of double wall metal to metal construction, means defining an inlet and an outlet for the exhaust gases, and means defining high frequency filter chambers acoustically connected with said inlet and outlet disposed directly adjacent thereto within said shell.

8. In a muffler construction of the type described, an outer shell, an inlet conduit, a perforated elongated tube axially aligned with said inlet and positioned within said shell, the inner end of said perforated tube opening directly into the interior of said shell, a baffle within said shell dividing the interior thereof into a plurality of resonator chambers directly acoustically connected, an outlet associated with said shell, a perforated conduit aligned with said outlet and having its inner end opening directly into the interior of said shell, the inner ends of said perforated conduits opening into the same resonator chamber defined within said shell and communicating with each other therethrough, and tubes embracing said perforated conduit section and defining therewith resonator chambers.

9. A muffler construction of the type described comprising inlet and outlet connectors, interior muffling structures with which said connectors coact, said interior muffing structures being in overlapped relation and welded to each other to form a rigid construction and a shell laterally spaced from and embracing said interior muffling structures, said interior structures being suspended with respect to said exterior shell.

10. A muffler to be inserted in the exhaust conduit of an automobile characterized by the fact that the outer shell is materially relieved of supporting and operating stresses, comprising inner shells operatively connected together, connectors for the muffler to manifold and tail pipe sections of the exhaust conduit having enlarged head portions rigidly attached at the ends of said inner shells to form therewith a structural unit within and through the outer shell, and an outer shell embracing said inner shells and through which said connectors extend, said outer shell being supported from said structural unit.

11. A muffler as set forth in claim 10 in which said inner shells are in direct contact with each other.

12. A muffler comprising an inner shell, a gas conduit located within said inner shell and spaced therefrom to form an acoustical chamber, said conduit and inner shell being eccentrically disposed to one another, means acoustically connecting the interior or said conduit and the interior of said inner shell, an outer shell embracing said inner shell and a connector extending through said outer shell and in axial alignment with said gas conduit.

13. A muffler comprising a pair of inner shells rigidly secured to each other to form an interior structural unit, gas conduits located within said inner shells and spaced therefrom to provide acoustical chambers, connectors in axial alignment to said gas conduits and having enlarged head portions rigidly connecting said connectors to end portions of said inner shells, and an outer casing embracing said inner shells.

14. A muffler of a modified straight through type, comprising an outer casing, a pair of inner shells of substantially less length than said outer casing with portions thereof in overlapping and direct contact with each other, one of said inner shells being shorter than the other, means rigidly connecting said inner shells to form an interior structural unit for the outer shell of the muffler and an outer shell embracing said inner shells, said inner shells being cantilevered with respect to said outer casing.

15. A muffler comprising an inlet connector having an enlarged head, an inner shell, said head being rigidly connected with said shell, an outlet connector having an enlarged head, a second inner shell rigidly connected with said second head, means rigidly connecting said shells, and an outer shell enclosing said inner shells and through which said connectors pass.

16. A muffler to be inserted in an exhaust conduit of automobiles and characterized by the fact that it is materially relieved of supporting and operating stresses, comprising a structural unit located within and extending through the outer shell including inlet and outlet connectors, inner shells to which said connectors are integrally and rigidly attached, said inner shells being in juxtaposition and integrally and directly attached to each other, and an outer shell embracing but laterally spaced from said inner shell, said inner shells being substantially suspended from said outer shell, whereby the supporting and operating structures are directly carried through the walls of said connectors and inner shells.

17. In a muffler construction of the type disclosed, a pair of interior muffling structures comprising perforated straight through central conduits, means embracing said conduits defining resonator chambers, the exterior surface of said muffling structures being disposed side by side in direct contact and being integrally connected to each other, inlet and outlet connectors constituting continuations of said central conduits, and an exterior shell housing said muffling construction and embracing sections of said connectors projecting outwardly through said shell, said exterior shell being laterally spaced from said interior structures, one of said interior structures being cantilevered with respect to said exterior shell, from one of said connectors.

CHARLES HOLLERITH.

4.

CERTIFICATE OF CORRECTION.

Patent No. 2,151,470. March 21, 1939.

CHARLES HOLLERITH.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 3, claim 5, for "with" read within; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of May, A. D. 1939.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.