

March 15, 1938.

Q. G. NOBLITT ET AL

2,111,537

MUFFLER

Filed Jan. 7, 1935

3 Sheets-Sheet 1

Fig. 1.

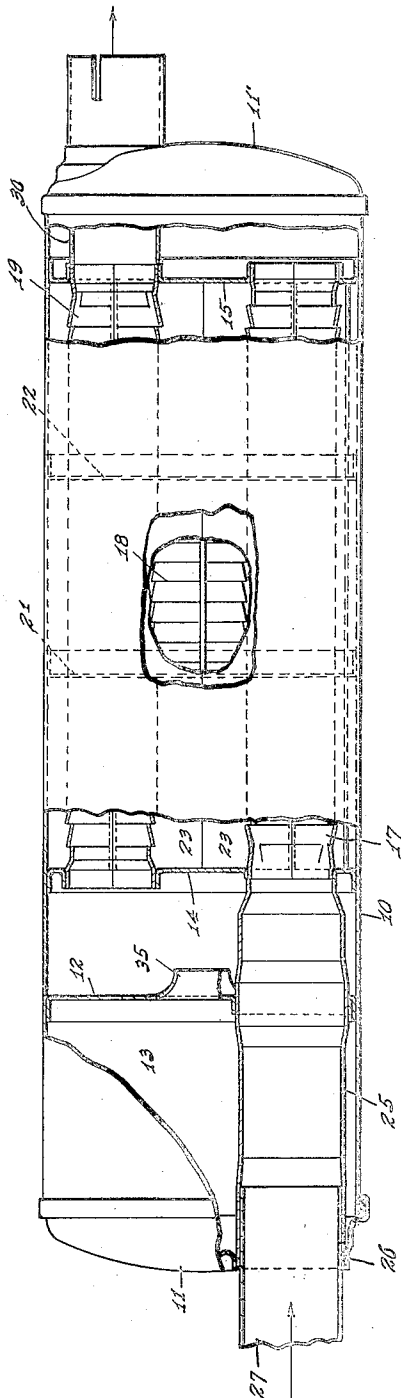


Fig. 3.

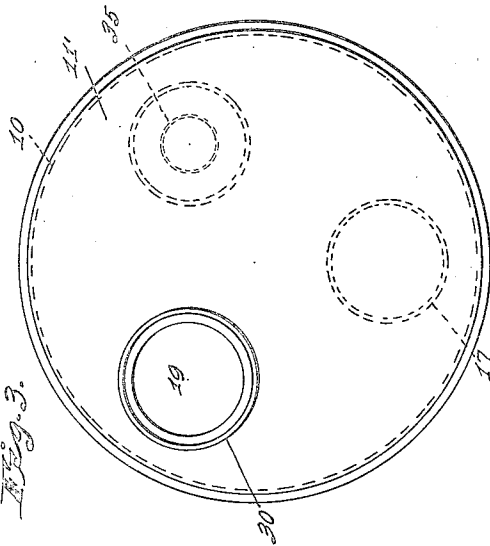
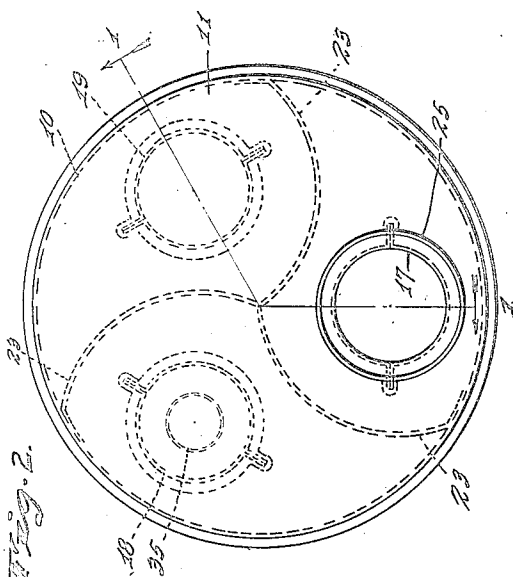


Fig. 2.



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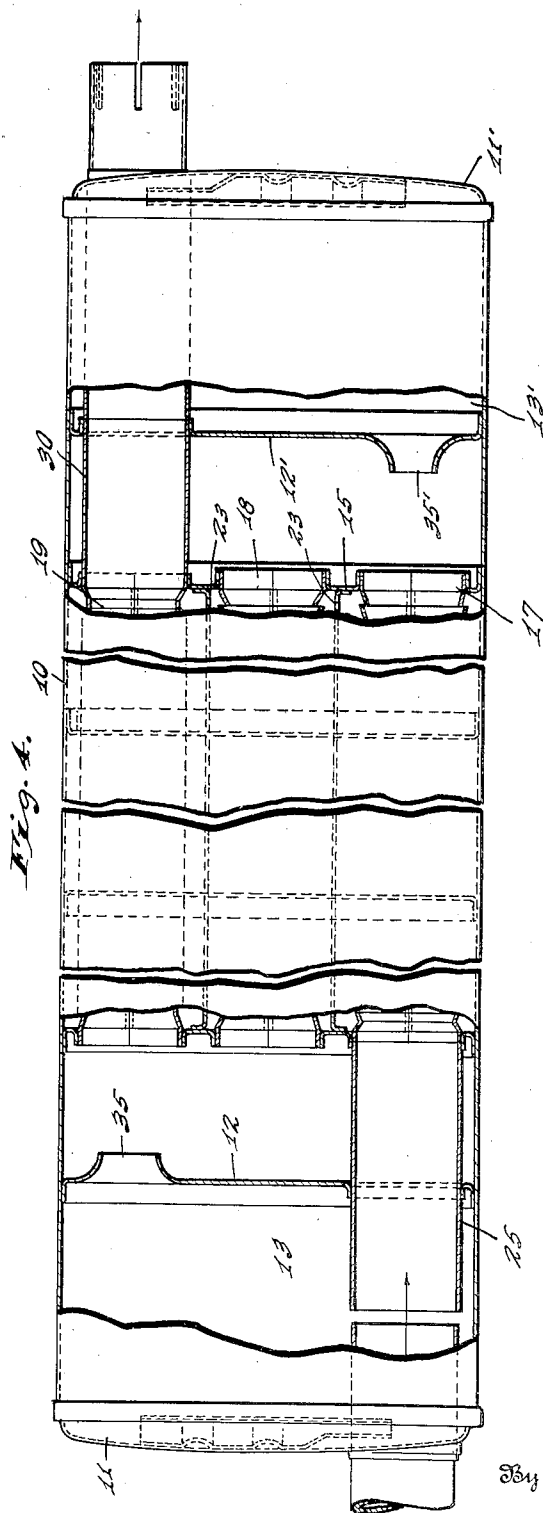
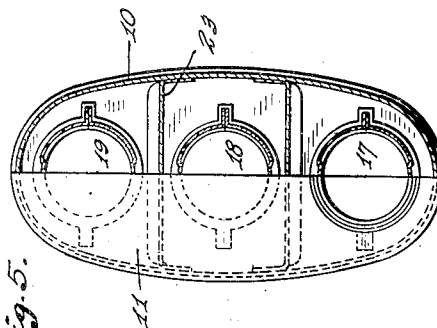
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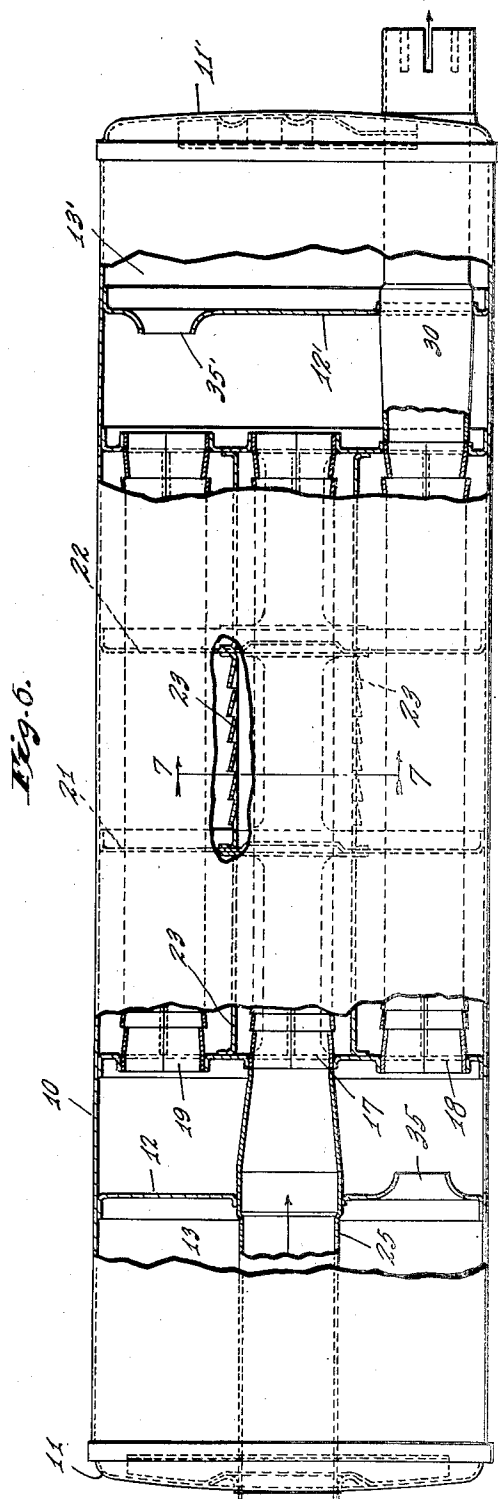
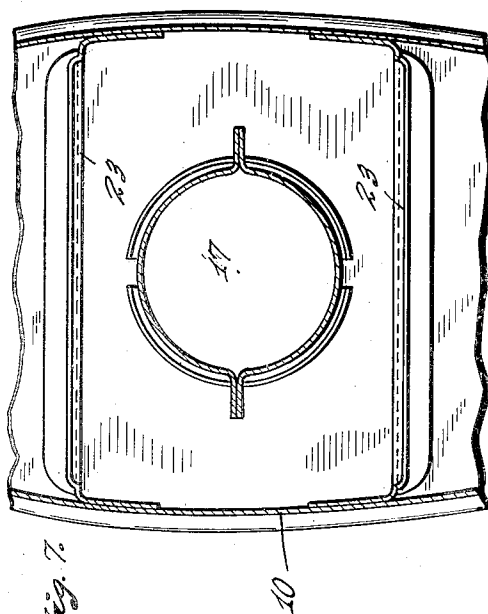
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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MUFFLER

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Application January 7, 1935, Serial No. 632

7 Claims. (Cl. 181—54)

This invention relates to devices for silencing noises accompanying gas flow and particularly to mufflers for silencing the exhaust of internal combustion engines.

5 It frequently happens that mufflers otherwise satisfactory will be resonant to sound-vibrations of a particular frequency and that, while the muffler will in general provide adequate silencing, objectionable noises of rather definite pitch are
10 produced at certain engine speeds. To overcome this, resort has been had to the use of resonating chambers which, as has been known for many years, have the capability of absorbing sounds of characteristic frequencies from a sound field.

15 Our invention is primarily concerned with mufflers of the so-called "reverse-flow" type in which the gases to be silenced are passed back and forth successively through a set of longitudinally co-extensive silencing tubes, and it is our
20 object to incorporate an effective resonating chamber in such a muffler and to produce an assembly which will be compact and which can be simply and economically manufactured.

In carrying out our invention we provide for
25 the muffler an outer casing within which are disposed the longitudinally co-extensive silencing tubes, such tubes being interconnected by passages formed between transverse partitions located within the casing at the ends of the tubes.
30 The resonating chamber is located at one side of one of these partitions, preferably at one end of the muffler, and communicates with the adjacent passage by means of an opening in the partition separating them. If the resonating chamber is
35 located at one end of the muffler there may extend through it a pipe for supplying the gases to the first silencing tube or for conveying such gases from the last silencing tube.

The accompanying drawings illustrate our invention: Fig. 1 is a side elevation of a muffler of
40 circular cross-section with portions thereof broken away and shown in section on the line 1—1 of Fig. 2; Figs. 2 and 3 are front and rear end elevations respectively of the muffler of Fig. 1;
45 Fig. 4 is a top plan view of a muffler of generally oval cross-section provided with resonating chambers at both ends, parts of the muffler being broken away to illustrate details of interior construction; Fig. 5 is an end elevation of the muffler
50 of Fig. 4 with parts thereof broken away and shown in transverse cross-section; Fig. 6 is a top plan view of another muffler of oval cross-section showing a different arrangement of silencing tubes and somewhat different internal construc-

tion; and Fig. 7 is a fragmental transverse section on the line 7—7 of Fig. 6.

The muffler shown in Fig. 1 comprises a cylindrical shell 10 of circular cross-section closed at its inlet end by a head 11 and at its discharge
5 end by a head 11'. Within the casing 10 and near one end thereof, here shown as the inlet end, we dispose a transverse partition 12 cooperating with the adjacent end-head of the muffler to form a resonating chamber 13. Spaced inwardly from
10 the head 11' and the resonating-chamber partition 12 are main transverse partitions 14 and 15 between which extend three silencing tubes 17, 18, and 19 through which the exhaust gases of an
15 internal combustion engine successively flow.

At a multiplicity of points along its length, each of the tubes 17, 18, and 19 is provided with openings of relatively small cross-section which afford
communication between the interior of the tube and the space around it. Conveniently, each tube
20 is formed of a pair of complementary sheet-metal stampings generally semi-circular in cross-section and provided along their longitudinal edges with flanges which are secured together, as by
25 welding. We find it advisable to so arrange the tubes that some of the louvers slope outwardly in the general direction of gas-flow while others slope inwardly. As indicated in Fig. 1, the louvers
30 of the tubes 17 and 18 slope outwardly in the general direction of gas-flow through the tubes, while the louvers of the tube 19 slope inwardly.

The space between the two main transverse partitions 14 and 15 may be divided into compartments by auxiliary transverse partitions 21
35 and 22, and each of such compartments may be further divided into chambers by longitudinally extending partitions 23 disposed between the tubes 17, 18, and 19, as indicated in Fig. 2.

The head 11 at the inlet end of the muffler is provided with an opening to permit the admission
40 of the gases to be silenced, such opening communicating with the first silencing tube 17 through a nipple 25 which extends longitudinally through the resonating chamber 13 and continues across the space between the partitions 12
45 and 14. Conveniently, the head 11 is provided with an annular flange 26 for the reception of the front end of the nipple 25, such nipple having an internal diameter enabling it to receive the
50 exhaust pipe 27 leading from the engine.

The exhaust gases passing from the last silencing tube 19 are conveyed through a nipple 30
55 which extends across the space between the partition 15 and head 11' and projects beyond the

head 11' where it is adapted for attachment to a suitable tail-pipe (not shown).

At its rear end, the first silencing tube 17 discharges into the transverse passage provided between the partition 15 and head 11'. This same passage communicates with the rear end of the intermediate tube 18, the front end of such intermediate tube and the front end of the last tube 19 communicating with the passage between the partitions 12 and 14. Gases supplied to the muffler, therefore, flow through the nipple 25 and tube 17 into the transverse passage at the rear end of the muffler. From this passage the gases flow through the tube 18 into the passage between the partitions 12 and 14 and thence through the tube 19 and nipple 30. As the gases pass through the tubes 17, 18, and 19, gases in high pressure zones escape outwardly through the openings in the tubes into the chambers surrounding them and then return through such openings when a zone of low-pressure gases passes.

The partition 12 is provided with an opening affording communication between the resonating chamber 13 and the passage located between the partitions 12 and 14. The resonating characteristics of the resonating chamber 13 are improved if the passage through which it communicates with the space between the partitions 12 and 14 has an appreciable longitudinal extent, and to provide such a passage, we may displace the metal of the partition 12 to form a bell-mouthed opening 35.

We find that the location of the opening 35 in the cross-sectional plane of the muffler is of some importance, and we prefer to locate it in alignment with one of the tubes 18 and 19 which communicate with the space between the partitions 12 and 14. In the drawings, the opening 35 is shown as in alignment with the tube 18 where the gases emerging from such tube will impinge upon it. We find this arrangement to have a slight advantage when the muffler otherwise has a tendency to resonate upon acceleration of the associated engine. If the muffler otherwise has a tendency to resonate upon deceleration of the engine, some advantage attaches to locating the opening 35 in line with the tube 19.

The resonating chamber 13 may be proportioned to absorb sound of any desired frequency from the sound field within the muffler. In practice, it is proportioned to absorb the objectionable sound which would be produced under resonating conditions in the absence of a resonating chamber.

The muffler illustrated in Figs. 4 and 5 is generally similar to that shown in Figs. 1, 2, and 3 except that its casing 10 is of oval conformation rather than circular and is provided with resonating chambers 13 and 13' at both ends instead of only at one end, the resonating chamber at the rear end of the muffler being defined by the rear head 11' and by a transverse partition 12' spaced axially inwardly therefrom. The two resonating chambers 13 and 13' may be made to be resonant to different frequencies and it is thus possible, through the use of two resonating chambers, to absorb objectionable sounds of two different pitches.

In the muffler shown in Figs. 4 and 5, the opening 35' of the resonating chamber 13' at the rear end of the muffler is shown as located in alignment with the first silencing tube 17 so that the gases discharged from such tube will impinge

upon the opening. This location of the opening 35', as pointed out above, is preferred when the particular sound which the resonating chamber 13' is to absorb occurs upon acceleration of the engine. On the other hand, the opening 35 of the resonating chamber 13 is located opposite the last silencing tube 19, which arrangement is preferred when the noise that the chamber 13 is to absorb occurs upon deceleration of the engine.

With an oval muffler, it is possible to exercise some selection in disposing the inlet and outlet openings which are to communicate respectively with the exhaust pipe and the tail pipe to suit the particular automobile in which the muffler is to be used. Thus, the intermediate silencing tube 18 may be located centrally of the casing, as is shown in Figs. 4 and 5, or at one side of the casing, as indicated in Figs. 6 and 7. If the intermediate tube 18 is located at one side of the casing, the first tube 17 may be located either centrally or at the other side, the former arrangement being illustrated in Figs. 6 and 7.

Other differences between the muffler of Figs. 4 and 5 and the muffler of Figs. 6 and 7 include the disposition in the muffler of Figs. 6 and 7, of the opening 35' in line with the intermediate silencing tube 18 and the provision of louvers in some of the longitudinal partitions 23. These louvers permit a small amount of the gases to by-pass portions of the silencing tubes. In the specific arrangement indicated, the louvers in the partition 23 are provided only between the transverse partitions 21 and 22. We find this arrangement to be of advantage in decreasing back pressure produced by the muffler.

We claim as our invention:—

1. In a muffler for silencing flowing gases, an elongated casing, two gas-conveying longitudinal silencing tubes located in said casing and having longitudinally co-extensive portions, said muffler being provided with a transverse passage interconnecting adjacent ends of said two silencing tubes, and a resonating chamber communicating with said transverse passage at a point opposite and in substantial alignment with that one of said silencing tubes which conveys gases from said transverse passage.

2. In a muffler for silencing flowing gases; an elongated casing provided with end closures, a transverse wall disposed within said casing and near one end thereof and co-operating with the adjacent end closure to form a resonating chamber, two longitudinally spaced transverse partitions disposed inwardly from said wall and from the opposite end-closure to define transverse gas passages, three gas-conveying longitudinal silencing tubes disposed in the space between said partitions and forming with said transverse passages a tortuous passage, conduits for supplying gases to one end of one of said tubes and for conveying gases from the opposite end of another tube, said transverse wall being provided with an opening affording communication between said resonating chamber and the adjacent transverse gas passage.

3. In a muffler for silencing flowing gases, an elongated casing, two gas-conveying longitudinal silencing tubes located in said casing and having longitudinally co-extensive portions, said muffler being provided with a transverse passage interconnecting adjacent ends of said two silencing tubes, a pair of longitudinally spaced main transverse partitions disposed within said casing and defining a chamber through which the longitudi-

nally co-extensive portions of said tubes pass, one or more auxiliary partitions dividing the chamber between said main partitions into sub-chambers, a longitudinal partition disposed within said chamber between said tubes, each of said silencing tubes being provided at a multiplicity of points along its length with restricted openings, and said longitudinal partition within one of said sub-chambers being provided with a longitudinal series of restricted gas-passing openings.

4. A muffler for silencing flowing gases, comprising a casing, a partition dividing the interior of said casing into two compartments, said muffler being provided with a gas passage having two sections disposed respectively in such compartments and through which at least a portion of the gases successively pass, said passage-sections being generally parallel and so arranged that the gases pass through them in opposite directions, the walls of each of said passage sections being provided at a multiplicity of points along its length with restricted openings, and said partition being provided with a longitudinal series of restricted openings.

5. A muffler for silencing flowing gases, comprising a casing, a partition dividing the interior of said casing into two compartments, said muffler being provided with a gas passage having two sec-

tions disposed respectively in such compartments and through which sections at least a portion of the gases successively pass, the wall of each of said passage sections being provided at a multiplicity of points along its length with restricted openings, and said partition being provided with a longitudinal series of restricted openings.

6. A muffler as set forth in claim 5 with the addition that the openings in the wall of said passage-sections are relatively long and narrow and extend generally circumferentially of the wall of the passage-section.

7. In a muffler for silencing flowing gases, an elongated casing having end closures, a transverse wall disposed within said casing near one end and defining in co-operation with one end closure a resonating chamber, and means located within said casing between the other end closure and said wall for defining a tortuous gas-passage including portions with perforated walls and, intermediate such portions with perforated walls, a transverse passage-portion defined in part by said transverse wall, said transverse wall being provided with an open throat providing communication between said resonating chamber and said transverse passage-portion.

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