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MUFFLER WITH TUNED SIDE BRANCH SILENCING CHAMBERS

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Fig. 1.

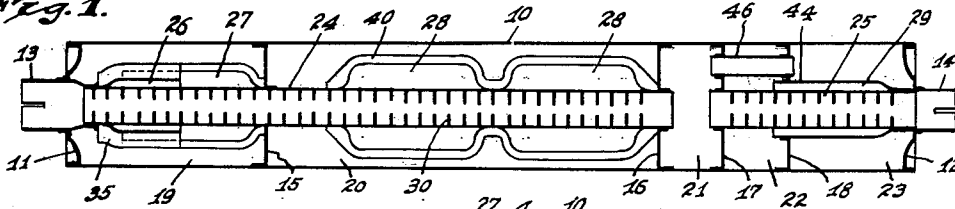


Fig. 2.

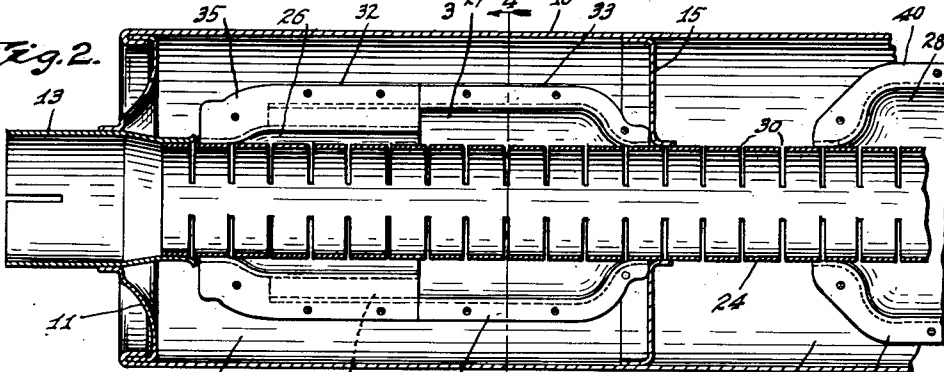


Fig. 3.

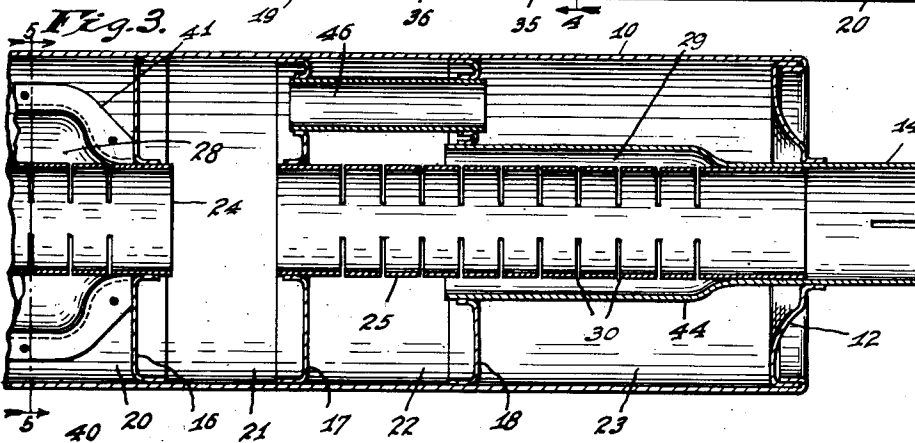


Fig. 4.

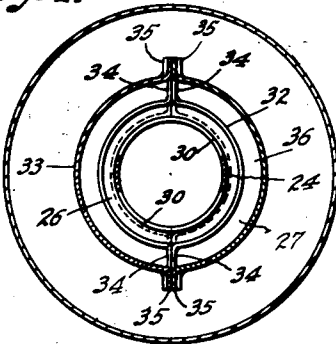
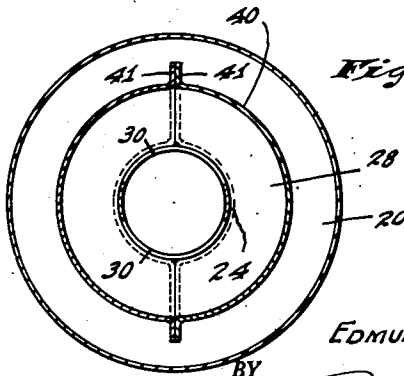


Fig. 5.



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## UNITED STATES PATENT OFFICE

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MUFFLER WITH TUNED SIDE BRANCH  
SILENCING CHAMBERSEdmund Ludlow, Columbus, Ind., assignor to  
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3 Claims. (Cl. 181—48)

1

This invention relates to mufflers or silencers capable of attenuating sounds in a moving stream of gases, such as the gases flowing to or from an internal combustion engine. More specifically, the invention relates to that type of silencer in which tuned side silencing chambers are incorporated for the suppression of sounds of more or less definite frequency.

It is the object of this invention to simplify the construction of and to reduce the cost of silencers embodying side silencing chambers.

In carrying out the invention in its preferred form, I employ a casing or shell through which there extends a gas-conveying passage, usually unobstructed, which is provided in its side wall with a plurality of openings providing communication between the interior of the tube and side silencing chambers within the shell. Relatively large side silencing chambers may be provided by equipping the shell with longitudinally spaced, transverse partitions serving to subdivide the interior of the shell. This invention is especially concerned with the provision of smaller side silencing chambers which, because of their relatively small volume, are desirably of less diameter than the shell. In forming such silencing chambers, I employ generally tubular members formed to surround the gas passage to provide annular chambers. In some instances, it is convenient to form these tubular elements as an assembly of two complementary sheet-metal stampings of generally semi-circular cross-section.

The accompanying drawing illustrates the invention:

Fig. 1 is a longitudinal section, somewhat diagrammatic in character, through a muffler embodying my invention; Figs. 2 and 3 are fragmental sections similar to Fig. 1 but on an enlarged scale; and Figs. 4 and 5 are transverse sections on the lines 4—4 and 5—5 of Figs. 2 and 3, respectively.

The muffler shown in the drawing comprises a cylindrical shell 10 having end heads 11 and 12, the latter being provided respectively with an inlet nipple 13 and an outlet nipple 14. To provide side silencing chambers of relatively large volume, the interior of the shell 10 is sub-divided by transverse partitions 15, 16, 17, and 18, the chambers thus provided being identified in the drawing by the reference numerals 19, 20, 21, 22, and 23. Smaller side silencing chambers are provided, in a manner more fully described hereinafter, by sleeves surrounding a central gas conduit shown as formed in two aligned sections 24

2

and 25. Smaller side silencing chambers so formed are indicated in the drawing by the reference numerals 26, 27, 28, and 29. Communication between the conduit 24—25 and the side chambers is afforded by openings in the wall of such conduit. In the specific construction shown, communication between the conduit and the chamber 21 is provided by spacing apart the adjacent ends of the conduit-sections 24 and 25 within the chamber 21; while the other side chambers communicate with the conduit through a multiplicity of longitudinally distributed openings, conveniently in the form of circumferentially extending slots 30.

Taking up first the construction at the front end of the muffler, the inlet nipple 13 extends through the head 11 into the interior of the shell 10 and receives the front end of the front conduit-section 24. Within the chamber 19, such front conduit-section is surrounded by two pairs of sheet-metal stampings 32 and 33. The two stampings 32, which are conveniently identical, are so shaped that when placed in opposed relation with their plane edge-portions 34 interengaging their center portions will define a cylindrical cavity necked at one end to embrace the conduit 24 closely. Such cavity forms the annular chamber 26 when the stampings 32 are assembled on the conduit. The two stampings 33 have plane edge-portions 35 and are similar to the stampings 32 except that their central cavity-forming portions, which co-operate to provide the annular chamber 27, are of larger diameter so that the two pairs of stampings 32 and 33 can be partially nested together in opposed relation as is clear from Fig. 2.

In the manufacture of the muffler, the two pairs of stampings 32 and 33 are placed on the conduit-section 24 in the proper longitudinal position, the flanges 34 and 35 are secured together, as by spot-welding, and the reduced-diameter portion of each stamping-pair is secured as by welding to the conduit-section 24. The adjacent ends of the two stamping-pairs 32 and 33 overlap each other to provide an annular throat 36 affording communication between the chamber 27 and the silencing chamber 19, the length of such throat equaling the distance by which the two stamping-pairs overlap each other longitudinally.

The silencing chambers 28, of which two are indicated in the drawing, are formed of two opposed sheet-metal stampings 40. The stampings 40 are identical with each other, have co-planar edge portions constituting flanges 41 and central

3

cavity-forming portions which, when the two stampings are assembled on the conduit-section 24, constitute the annular chambers 28. Between the chambers 28 and at the ends of the stampings the cavity formed thereby is of reduced radius to fit against the exterior surface of the conduit-section 24. The two stampings 40 are assembled about the conduit-section 24 in proper longitudinal position, the flanges 41 are secured together, as by spot-welding, and the reduced-diameter portions are secured as by welding to the conduit-section 24.

It will be clear from the drawing that the stampings 40, which are located within the silencing chamber 20, have a longitudinal extent considerably less than that of the silencing chamber 20 and that they extend forwardly from the partition 16 to a point spaced rearwardly from the partition 15. As a result, the slots 30 in the conduit-section 24 between the partition 15 and the front end of the stampings 40 are left uncovered and provide communication between the interior of the conduit-section 24 and the silencing chamber 20.

At the rear end of the muffler, the chamber 29 is provided by the inner end of a cylindrical sleeve 44 which, rearwardly from the chamber 29, is reduced in diameter to embrace and be secured to the rear conduit-section 25. Desirably, the sleeve 44 is an enlarged integral inward continuation of the outlet nipple 14. At its extreme front end, the sleeve 44 extends through the rearmost partition 13 so that the chamber 29 communicates with the silencing chamber 22.

In the particular muffler shown, the silencing chambers 21 and 23 communicate with each other through a tube 46 extending through the partitions 17 and 18.

In using the muffler herein illustrated and described, the inlet nipple 13 is connected to the exhaust conduit extending from an internal combustion engine, and the exhaust gases flow rearwardly from the inlet nipple through the conduit 24—25 to the outlet nipple 14, which is customarily connected to a suitable form of tail pipe. As a result of the sound waves present in the gas stream flowing through the conduit 24—25 alternating regions of high and low pressure exist in such gas stream. At regions of high pressure, gas is displaced outwardly from the conduit 24—25 through the slots 30 into one or another of the side chambers, such gas being returned to the conduit 24—25 as regions of low pressure pass the openings of such chambers. Such alternating outward and inward displacement of gas through the openings in the wall of the conduit 24—25 attenuates the sound waves in the gas stream. It is well known that a silencing chamber of the type described can be proportioned to suppress or attenuate sounds of more or less definite frequency, the frequency suppressed depending upon the volume of the chamber and the dimensions of the throat through which the chamber communicates with the gas passage 24—25. It is also known that silencing chambers can be compounded by connecting one to another to produce a definite attenuating effect on the sound waves within the gas stream.

In the muffler shown in the drawing, the silencing chambers 20 and 28 are simple silencing chambers each communicating with the conduit 24—25 through slots 30 in the wall of such conduit. The chambers 26 and 27, communicating with the gas passage through those slots 30 lying within their respective axial limits, may be re-

4

garded, for the purposes of this application, as constituting a single silencing chamber compounded with the silencing chamber 19 by reason of their communication with such chamber through the annular throat 36. In similar fashion, the chambers 29 and 22 may be regarded as constituting a single silencing chamber communicating with the gas passage through those slots 30 which lie between the partition 17 and the rear end of the chamber 29. The chambers 21 and 23 constitute compounded chambers communicating with each other through the throat 46 and communicating with the gas passage through the gap between the adjacent ends of the conduit-sections 24 and 25.

My invention simplifies and cheapens the manufacture of silencers embodying relatively small side silencing chambers, and facilitates the compounding of such small silencing chambers with others. In addition, it provides a muffler of more flexible design; since sleeves, such as the sleeve 44 or that formed by the stampings 32, can be employed where desired to increase the number of slots constituting the throat of a side silencing chamber without proportionately increasing the volume of the chamber.

I claim as my invention:

1. In a silencer for attenuating sound waves in a stream of moving gases, a casing having end walls provided with aligned openings, nipples extending through said openings and secured to the respective end walls, conduit means within said casing providing a passage between said nipples and including a section of smaller diameter than said casing and having a multiplicity of longitudinally distributed openings affording communication between the interior of the conduit-section and the space surrounding it, one of said nipples being an integral length of tubing having portions of different diameters separated by an annular shoulder located inwardly of the adjacent end wall, the smaller diameter nipple-portion being located outwardly of the larger diameter portion and closely embracing said conduit-section, and the larger diameter nipple-portion extending axially along said conduit-section and in radially spaced relation thereto to form an annular passage, at least some of said openings in the conduit section lying within the axial extent of the larger diameter nipple-portion, said annular passage being closed at its outer end by said shoulder and being open at its inner end to provide communication between said last mentioned openings and the interior of the casing.

2. A silencer as set forth in claim 1 with the addition of a transverse partition located within the casing adjacent the inner end of the larger diameter nipple-portion, said partition having an opening receiving and supporting said larger diameter nipple-portion.

3. In a silencer for attenuating sound waves in a stream of moving gases, a conduit through which the gas stream flows, a casing of larger diameter than said conduit and surrounding it, partition means sub-dividing into separate silencing chambers the space surrounding the conduit and within the casing, said conduit being provided in its wall with a multiplicity of longitudinally distributed openings affording communication between the interior of the conduit and space surrounding it, and a pair of opposed complementary sheet-metal stampings disposed on opposite sides of said conduit and formed to provide a neck closely embracing and secured to said conduit and a sleeve-like body of larger diameter

5

than said conduit to provide an annular cavity closed at one end by the neck, each of said stampings being provided along its side edges with flanges engaging corresponding flanges on the other stamping, a second pair of metal stampings disposed on opposite sides of said conduit and formed to provide a neck closely embracing and secured to said conduit and a sleeve-like body of larger diameter than said conduit to provide an annular cavity closed at one end by the neck, each of said second stampings being provided along its side edges with flanges, the annular cavity formed by said second stampings being of larger diameter than that formed by the first-named stampings, the two pairs of stampings being arranged in opposed relation on the conduit with the sleeve-like body of the first

6

pair of stampings extending into the cavity formed by the second pair of stampings to provide an annular throat communicating with one of said silencing chambers, the flanges on the stampings overlapping and being secured together.

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## REFERENCES CITED

The following references are of record in the file of this patent:

## UNITED STATES PATENTS

| Number     | Name      | Date          |
|------------|-----------|---------------|
| Re. 21,324 | MacKenzie | Jan. 16, 1940 |
| 2,194,457  | Carey     | Mar. 26, 1940 |
| 2,357,792  | Powers    | Sept. 5, 1944 |