

Feb. 10, 1959

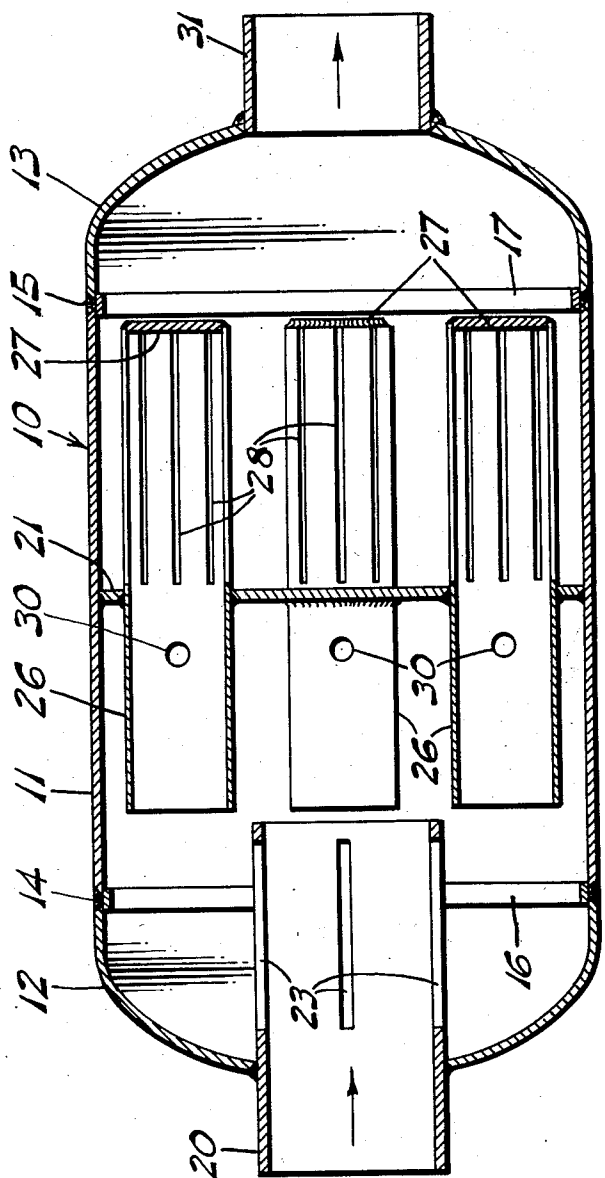
T. TINKER
ACOUSTICAL SILENCER

2,872,998

Filed March 30, 1954

2 Sheets-Sheet 1

FIG. 1.



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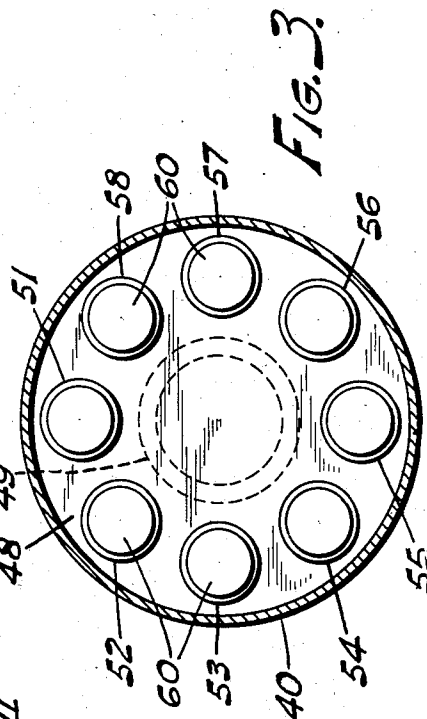
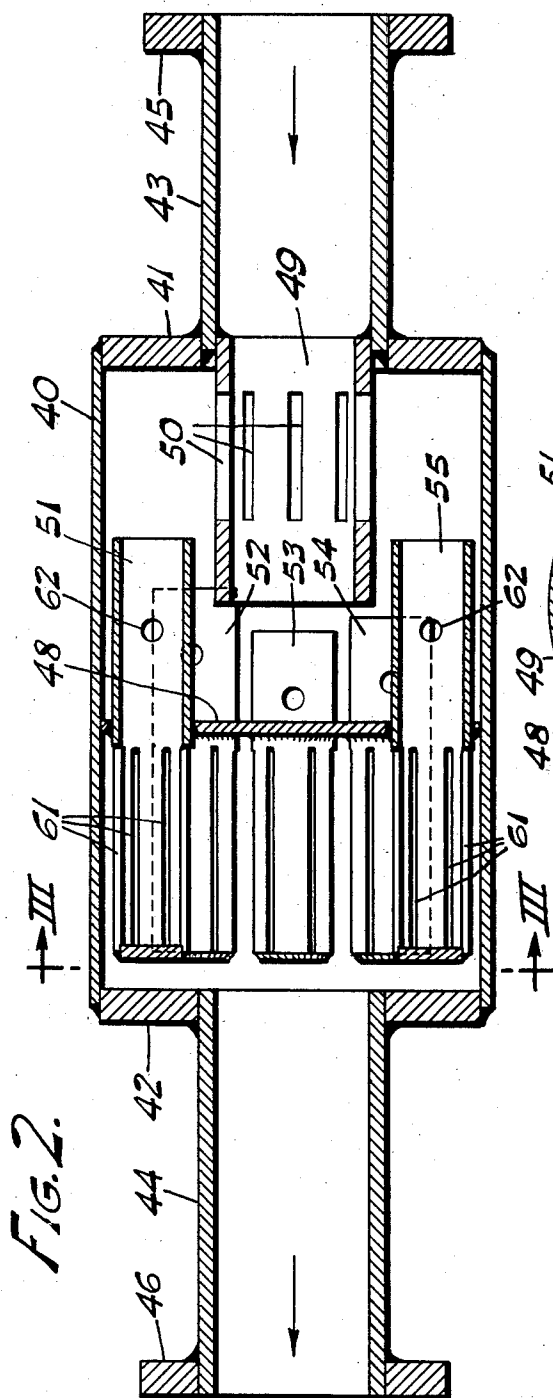
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ACOUSTICAL SILENCER

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8 Claims. (Cl. 181—53)

This invention relates to silencing devices and particularly to devices of this class wherein a pulsating column of a gaseous medium flowing in a conduit is subject to the sound attenuating influence of the device by interposing the latter in the column of pulsating gaseous medium whereby the gas flows through the device and its sound propagating propensities are to a great extent nullified or eliminated.

A well known class of gaseous conduit sound modifying devices comprises a longitudinally elongated cylindrical casing having an intermediate transverse baffle wall which divides the casing into two end-to-end coaxial cylindrical chambers. The pulsating gas is introduced to one end of the cylindrical casing for entry into an inlet chamber and is passed therefrom in a variety of ways to the opposed coaxial chamber which comprises an outlet chamber, from which the gas passes into a continuation of the general conduit.

A common expedient for passing the gases from the inlet chamber to the coaxial outlet chamber is by way of longitudinal tubular members passing through the intermediate baffle wall. Various complex acoustical theories have been advanced and advocated to explain scientifically the acoustical modifying effects of devices of this class and the physical or mathematical principles which are believed to govern such acoustical modifying principles of operation. However, in practice it is believed that there is a rather wide and unexplainable discrepancy between actual performance and that which might be predicted from an application of the foregoing theoretical considerations. In fact, actual performance of an acoustical device of this class seldom follows what might be expected or predicted from purely theoretical considerations.

Accordingly, it is difficult to rationalize or explain from a theoretical standpoint the reasons why a given organization of elements of this class produces a given result. In conceiving the acoustic silencer or silencers forming the subject matter of the present invention, I have found that certain constructions involving the passage of the gases from the inlet to the outlet chambers of acoustical silencers of the type generally described above produced remarkable sound attenuating results in silencers of only a fraction of the size heretofore considered necessary to attain a given silencing result. It may be stated generally that the efficacy of these cylindrical acoustical silencers generally varies with the volumetric size thereof.

In its broadest sense the present invention involves an acoustical silencer having a pair of end-to-end cylindrical chambers and a plurality of tubular members passing through the dividing wall between the chambers, wherein the tubular members have entirely closed ends at their discharge portions whereby the gases flowing from the entry chamber to the discharge chamber through the tubes discharge entirely through radial formations in the tubes. In addition, the present invention provides acoustical silencers wherein the entry ends of these transverse tubes bear a particular relationship

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with respect to each other or with respect to the point at which the incoming air is released into the entry portion of the cylindrical chamber.

Several practical embodiments of the principles of the present invention are shown in the accompanying drawings and described in detail in the following specification. However, it is to be understood that the details and proportions thus shown and described are by way of example only and that the scope of the invention is to be measured by the appended claims and is not limited excepting as defined in the claims.

In the drawings:

Fig. 1 is a general longitudinal cross-sectional view through one form of the acoustical silencer of the present invention;

Fig. 2 is a similar view through a modified form of the acoustical silencer of the present invention; and

Fig. 3 is a transverse cross-sectional view on the line III—III of Fig. 2.

Referring to the embodiment of the invention illustrated in Fig. 1, the numeral 10 designates generally a cylindrical casing consisting of a central tubular cylindrical body member 11 and end walls or head members 12 and 13. In the illustrated instance the end wall members 12 and 13 are butt welded to body member 11 as at 14 and 15, respectively, and circular backing strips 16 and 17 may be arranged at the inner sides of the butt welds to facilitate welding and reinforce the joint.

The left-hand end of the present form of the invention comprises the entry end as viewed in Fig. 1 and an inlet pipe or conduit 20 is fixed coaxially in end member 12, as by welding, in such manner that a substantial portion of inlet pipe 20 extends within the interior of the casing 10. A circular transverse wall 21 is welded within cylindrical member 11 substantially midway thereof to divide casing 10 into approximately equal inlet and outlet chambers.

It will be noted that inlet pipe 20 extends within the inlet chamber of casing 10 to a point approximately half way along the full diameter portion of the inlet chamber. The portion of inlet pipe 20 which extends within the inlet chamber is provided with longitudinal slots 23, in the present instance four in number.

Passage of gas from the inlet to the outlet chamber is by way of a series of tubular members which are welded into transverse wall 21 and extend generally parallel to the axis of the cylindrical casing. In the present instance these tubes are four in number and are designated 26. Each tube 26 begins at approximately the plane of the inner end of the inlet pipe 20 and extends into the outlet chamber of casing 10 a distance which in the present instance is slightly greater than the length of the portion of the tube that is within the inlet chamber. In fact, as shown in Fig. 1 the outlet portions of tubes 26 extend along a major part of the length of the outlet chamber.

The inlet ends of the tubes 26 are open but the outlet ends thereof are closed, in the illustrated instance by means of discs 27 which may be welded to the ends of the tubes 26. The outlet ends of the tubes 26 are thus completely closed and gas passing from the inlet chamber to the outlet chamber of casing 10 through the tubes 26 discharges from those tubes entirely through longitudinal slots formed in the peripheries of the several tubes. These slots are designated 28 in Fig. 1 and in the illustrated instance there are eight slots for each time, the slots running substantially the full length of the portions of the tubes disposed within the outlet chamber.

The inlet portions of the tubes 26 are each provided, in the present instance, with a pair of diametrically opposed perforations 30. Gases entering the tubes 26 through the perforations 30 impinge against the stream of gas flowing axially through each tube 26 in out of

phase relationship to create a turbulence which contributes further to the anti-resonant and sound dissipating effect of the device, in a manner which is known to the art here involved.

The bell shaped end member 13 at the outlet end of casing 10 is provided with an axial outlet pipe 31, and inlet pipe 20 and outlet pipe 31 may both be connected in circuit with a gas conduit by welding or by any suitable coupling means.

In the modified form of the present invention illustrated in Figs. 2 and 3 the basic feature of intermediate transfer tubes having closed outlet ends is generally the same as in the previous embodiment but in the embodiment of Figs. 2 and 3 the inlet ends of these transfer tubes are staggered along the length of the inlet chamber portion of the device in a manner which will presently appear.

Referring particularly to Fig. 2, the modification of the invention there shown comprises a cylindrical casing member 40 having a pair of end head members 41 and 42 at its inlet and outlet ends, respectively. The head members 41 and 42 are provided with inlet and outlet pipes 43 and 44 and, in the present instance, with flanges 45 and 46 for securement to conduits leading to and from the silencer. As in the previous embodiment, the cylindrical space within the casing member 40 is divided substantially medially by a circular transverse wall 48. An inlet tube 49 is fixed in the inlet end of the device and extends along the inlet chamber for a substantial portion of its length. Inlet pipe 49 is provided with a plurality of longitudinal slots in its periphery, the slots being designated 50 in Fig. 2 and, in the present instance, being eight in number.

In the modification of Figs. 2 and 3 the transfer tubes which are fixed in transverse wall 48 are circularly arranged as shown in Fig. 3 and in the present instance are eight in number. As shown in Fig. 3 the eight transfer tubes are numbered consecutively 51 through 58. The tubes 51 through 58 are of varying lengths and as presently arranged the variations in length affect only the disposition of the inlet portions of the tubes, the outlet portions being generally aligned in a common transverse plane.

A pair of diametrically opposed tubes 51 and 55 are of greatest length at the entry end, a second pair of diametrically opposed tubes 52 and 56 are of next greatest length, a third pair of tubes 54 and 58 are shorter than the tubes 52 and 56 and in the present instance terminate at about the plane of the discharge end of inlet tube 49. The fourth pair of diametrically opposed tubes 53 and 57 are shortest in length.

By virtue of the staggered arrangement of the entry ends of the tubes 51 through 58 a number of parallel flow paths of different lengths are provided. This arrangement produces gas flow discharge from the several tubes whose pulsations are out of phase with each other due to their varying lengths of travel between the two chambers. This staggered tube arrangement thus cooperates with the other structural features of the device of Fig. 2 of the present invention and contributes materially to the ultimate silencing efficiency which is the primary aim of the present invention.

The outlet ends of all of the tubes 51 through 58 are closed as by means of discs 60 which may be welded in place as described in connection with the previous embodiment and each of the tubes 51 through 58 is provided with lateral discharge orifices in the form of longitudinal slots in the peripheries of the tubes, the slots being designated 61 and extending throughout the major portions of those parts of the tubes 51 through 58 which extend within the outlet chamber of the casing. In the present instance the slots 61 of each tube are six in number. The entry portions of the tubes 51 through 58 are provided with perforations 62 corresponding in function to the perforations 30 of the tubes 26 of Fig. 1.

What is claimed is:

1. A silencer comprising a pair of adjoining chambers;

an entry tube extending into one of said chambers from the end thereof remote from the other chamber, a plurality of tubular members forming passages between the chambers, said tubular members having their axes offset from the axis of said entry tube and each being disposed partly in each chamber and having an entry portion in said one chamber and a discharge portion in said other chamber, the discharge portion of each tubular member having a closed end and a plurality of lateral discharge passages, said lateral discharge passages providing substantially the entire discharge passage means from said tubular members.

2. A silencer comprising a pair of adjoining chambers, an entry tube extending into one of said chambers from the end thereof remote from the other chamber, a plurality of tubular members forming passages between the chambers, said tubular members having their axes offset from the axis of said entry tube and each being disposed partly in each chamber and having an entry portion in said one chamber and a discharge portion in said other chamber, the discharge portion of each tubular member having a closed end and a plurality of lateral discharge passages, said lateral discharge passages providing substantially the entire discharge passage means from said tubular members, the inner end of said entry tube and the entry ends of said tubular members being disposed generally medially of said one chamber.

3. A silencer comprising a pair of adjoining chambers, a generally central entry tube extending into one of said chambers from the end thereof remote from the other chamber, a plurality of tubular members forming passages between the chambers, said tubular members being circularly arranged about said entry tube with their axes offset from the axis of said entry tube and each being disposed partly in each chamber and having an entry portion in said one chamber and a discharge portion in said other chamber, the discharge portion of each tubular member having a closed end and a plurality of lateral discharge passages, said lateral discharge passages providing substantially the entire discharge passage means from said tubular members.

4. A silencer comprising a pair of adjoining chambers, a generally central entry tube extending into one of said chambers from the end thereof remote from the other chamber, a plurality of tubular members forming passages between the chambers, said tubular members being circularly arranged about said entry tube with their axes offset from the axis of said entry tube and each being disposed partly in each chamber and having an entry portion in said one chamber and a discharge portion in said other chamber, the discharge portion of each tubular member having a closed end and a plurality of lateral discharge passages, said lateral discharge passages providing substantially the entire discharge passage means from said tubular members, the inner end of said entry tube and the entry ends of said tubular members being disposed generally medially of said one chamber.

5. A silencer comprising a pair of adjoining chambers, a generally central entry tube extending into one of said chambers from the end thereof remote from the other chamber, said entry tube having lateral discharge passages into said one chamber, a plurality of tubular members forming passages between the chambers, said tubular members being circularly arranged about said entry tube with their axes offset from the axis of said entry tube and each being disposed partly in each chamber and having an entry portion in said one chamber and a discharge portion in said other chamber, the discharge portion of each tubular member having a closed end and a plurality of lateral discharge passages, said lateral discharge passages providing substantially the entire discharge passage means from said tubular members.

6. A silencer comprising a pair of adjoining chambers, a plurality of tubular members forming passages between

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the chambers, said tubular members each having an entry portion in one chamber and a discharge portion in the other chamber, the entry portion of each tubular member having an open end and the discharge portion of each tubular member having a closed end, the entry ends of the tubular members being staggered along said one chamber, and the discharge portion of each tubular member having a plurality of lateral discharge passages.

7. A silencer comprising a pair of adjoining chambers, a plurality of tubular members forming passages between the chambers, said tubular members each being disposed partly in each chamber and having an entry portion in one chamber and a discharge portion in the other chamber, the entry ends of the tubular members being disposed at various distances along said one chamber, the discharge portion of each tubular member having a closed end and a plurality of lateral discharge passages, said lateral discharge passages providing substantially the entire discharge passage means from said tubular members.

8. A silencer comprising a pair of adjoining chambers, an entry tube extending into one of said chambers at the end thereof remote from the other chamber, a plurality of tubular members forming passages between the chambers, said tubular members each being disposed

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partly in each chamber and having an entry portion in said one chamber and a discharge portion in said other chamber, the entry ends of said tubular members being disposed at various distances along said one chamber with some of said entry ends ahead of and some behind the discharge end of said entry tube, the discharge portion of each tubular member having a closed end and a plurality of lateral discharge passages, said lateral discharge passages providing substantially the entire discharge passage means from said tubular members.

References Cited in the file of this patent

UNITED STATES PATENTS

15	779,024	Buchner et al. -----	Jan. 3, 1905
	2,033,784	Pougher et al. -----	Mar. 10, 1936
	2,166,670	Martin -----	July 18, 1939
	2,205,899	Chipley -----	June 25, 1940
	2,326,613	Bourne -----	Aug. 10, 1943
20	2,416,452	Marx -----	Feb. 25, 1947
	2,624,418	Bourne -----	Jan. 6, 1953

FOREIGN PATENTS

25	514,944	France -----	Nov. 19, 1920
	747,943	Germany -----	Nov. 17, 1944