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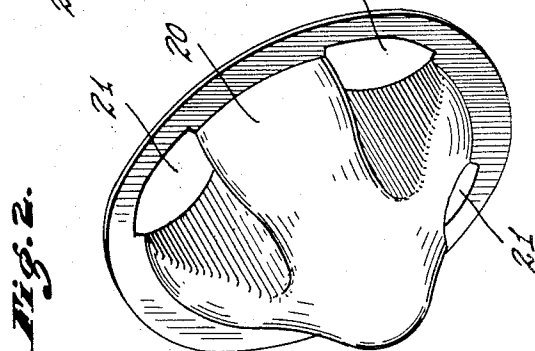
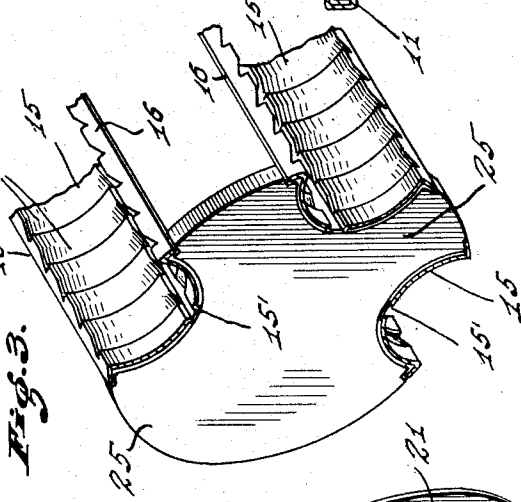
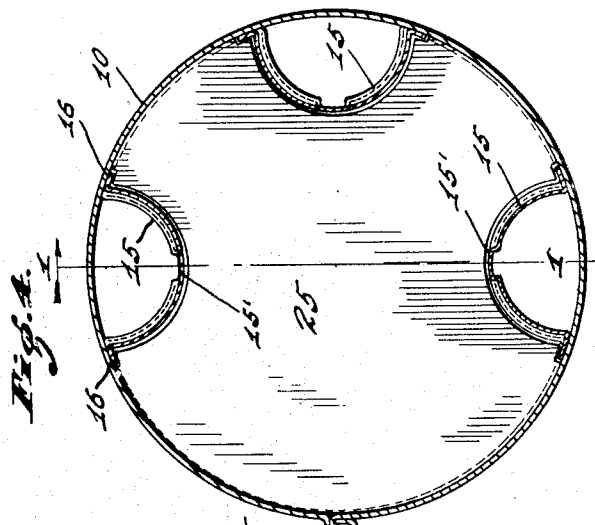
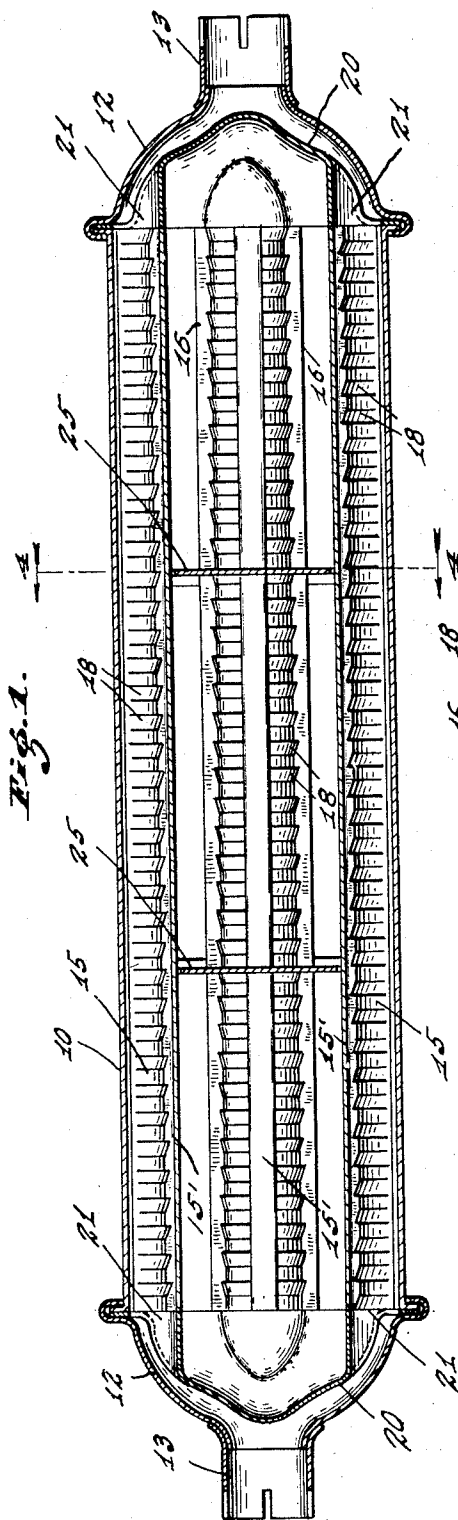
Q. G. NOBLITT ET AL

2,016,254

MUFFLER

Filed Aug. 3, 1931

2 Sheets-Sheet 1



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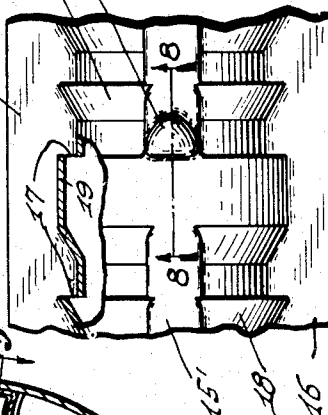
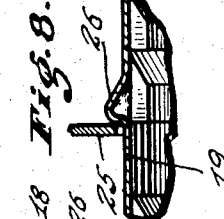
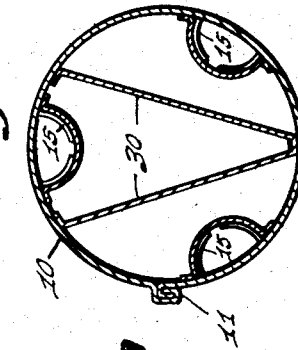
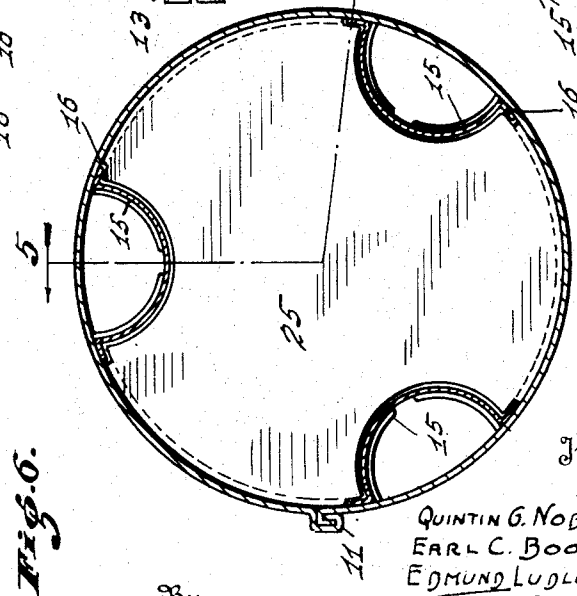
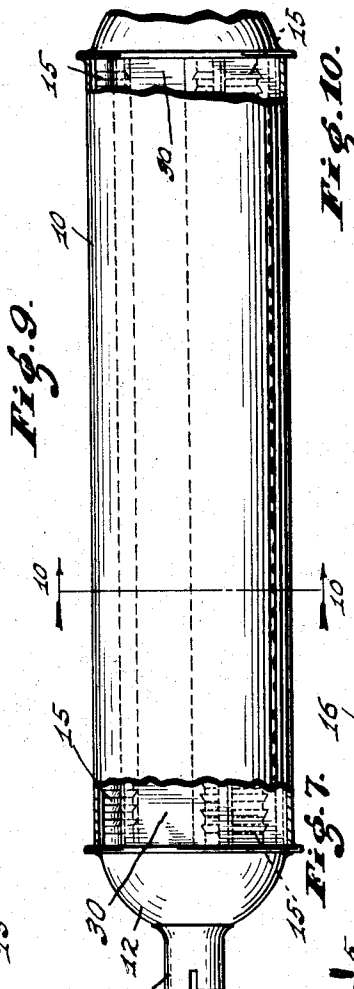
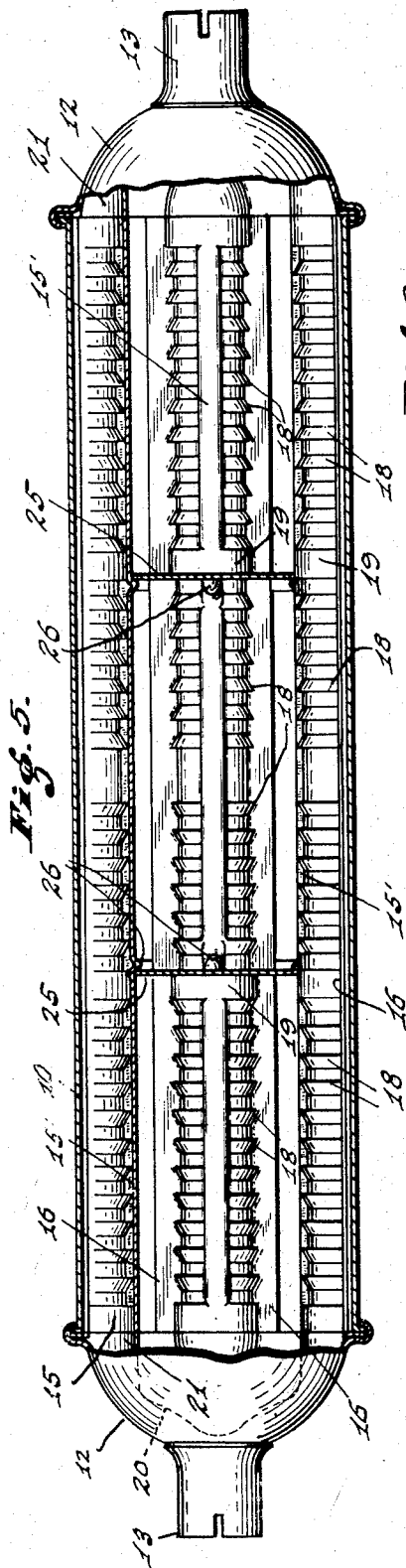
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MUFFLER

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2 Sheets-Sheet 2



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2,016,254

MUFFLER

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Application August 3, 1931, Serial No. 554,723

6 Claims. (Cl. 137—160)

Our invention is concerned with mufflers or silencers for use in silencing the noises made by flowing gases, and particularly with mufflers for use in silencing the exhaust from internal combustion engines. It is the object of our invention to produce a muffler which may be simply and economically constructed, which will be light in weight, which will be compact, and which will adequately silence the noises resulting from gas flow, while creating a back-pressure much smaller than that created by many mufflers in common use.

In carrying out our invention we provide a hollow casing through which there extends a plurality of gas-passages each of which communicates with an inlet opening at one end of the casing and an outlet opening at the other. Conveniently, the gas passages are displaced at angularly spaced points around the inner side of the casing, with the casing wall serving to define a portion of each gas-passage. Each of the gas passages is provided at a plurality of points along its length with openings each affording restricted communication between the interior of such passage and the surrounding space within the casing; and the space within the casing and outside the gas passages is divided into sections by one or more partitions which prevent unobstructed flow of gases from one end of the casing to the other outside the gas passages.

The accompanying drawings illustrate mufflers embodying our invention: Fig. 1 is a longitudinal section through one form of muffler on the line 1—1 of Fig. 4; Fig. 2 is an isometric view of a distributor plate by which the gases are divided among the several gas-passages; Fig. 3 is an isometric view illustrating one of the partitions with fragments of the gas-passages; Fig. 4 is a transverse section on the line 4—4 of Fig. 1; Fig. 5 is a longitudinal section, on the line 5—5 of Fig. 6, showing a modified form of gas-passage; Fig. 6 is a transverse section of the muffler illustrated in Fig. 5; Fig. 7 is a fragmental plan, in partial section, of one of the gas passages; Fig. 8 is a section on the line 8—8 of Fig. 7; and Figs. 9 and 10 are respectively an elevation and a transverse section of a modified form of muffler.

In the muffler shown in the drawings, the casing 10 is of cylindrical shape and is formed of sheet-metal, the edges of which are interlocked to provide a seam 11. At each end of the casing thus formed, there is mounted a head 12 having a central opening, the opening in one head serving as an inlet opening and the opening in the other head serving as an outlet opening. Ferrules 13

may be provided on the heads 12 to facilitate the connection of the muffler to an exhaust pipe and a tail-pipe.

Within the muffler, as previously indicated, we provide a plurality of gas-passages. As is clear from the drawings, we prefer to form these gas passages by means of sheet-metal stampings 15 each of which is generally semicircular in cross-section and is provided along its longitudinal edges with flanges 16 adapted to be secured against the inner face of the casing 10 as by means of spot-welding. At a plurality of points along the length of each of the passages 15, openings 17 are provided for the purpose of affording communication between the interior of the passage and the interior of the casing 10. We prefer to provide these openings by cutting transverse slits through the wall of the passage and by displacing, either inwardly or outwardly the metal at one side of each of such slits to form louvers 18. As shown in the drawings, these slits are disposed in pairs, the two slits of each pair lying in the same transverse plane and being separated by a strengthening rib 15 struck up from the sheet-metal stamping in the formation thereof.

At each end of the casing, and within the adjacent head 12, there is located a distributing plate 20 having near its margin angularly spaced semicircular holes 21 adapted to register respectively with the ends of the passages 15. The central portion of each plate 20 is displaced outwardly to form a projecting boss, the sides of which in alignment with each of the openings 21 are displaced inwardly to form grooves which direct the gases to or from the adjacent openings of the passage 15. The distributing plates close the space within the muffler and outside the gas-passages and insure that substantially all gases entering or leaving the muffler body pass through the gas-passages 15.

Conveniently, each end of the casing 10 is flanged outwardly, the periphery of the adjacent distributing plate 20 lying against such flange and the edge of the head 12 being crimped around the edges of the distributing plate and casing-flange to secure the distributing plate and head in position.

Within the casing, we may provide one or more transverse partitions 25 adapted to divide the interior of the casing into a plurality of chambers. These partitions 25 fit comparatively closely about the passages 15, but it is not essential that they prevent all gas-flow between adjacent chambers.

In operation, one end of the casing is connected to receive exhaust gases from the engine. Such

gases entering the head 12, impinge upon the distributing plate 20 and are directed toward the longitudinal gas-passages 15 through which they flow to the opposite end of the muffler where they are discharged. The gas-passages 15 are preferably unobstructed, and the openings 17 in the walls of the passages 15 permit the gases to flow back and forth between the interior of each passage and the interior of the casing under the influence of local and transient pressure conditions. Each of the partitions 25 tends to insure that gases which pass from the interior of any passage 15 to the interior of the casing return to one or the other of the passages before flowing into the next section of the muffler.

It will be noted that by reason of the manner in which the openings in the walls of the passages 15 are formed the flow of gases through such openings will occur more readily in one direction than in the other. Thus, assuming the general direction of gas flow through the muffler to be from left to right in Fig. 1, gases will flow more readily in an outward than in an inward direction through the openings in the upper and center passages, but will flow more readily inwardly through the openings in the lower passage. This is so because of the inclination of the louvers which are so arranged, as shown, to tend to facilitate outward flow of the gases as they pass to the right in the upper and center tubes but to facilitate inward flow of gases as they pass to the right through and in the vicinity of the lower tube.

As indicated in our co-pending application Serial No. 554,722, filed August 3, 1931, which shows a related muffler and contains claims broadly covering the specific muffler herein described, we have pointed out that advantages result from sloping some of the louvers 18 inwardly and others outwardly. This result may be accomplished in the manner already described—that is, by forming all the louvers on each gas passage with the same slope and disposing one of the passages so that its louvers slope oppositely to those of other passages. In the modification of our invention illustrated in Fig. 5, the same result is accomplished by forming each stamping 15 so that the louvers on one side of its longitudinal center slope in one direction while those on the other side slope in the opposite direction. Preferably, the louvers are arranged to slope outwardly in a direction away from the ends of the passage, whereby gases entering the muffler will be biased outward flow while those near the discharge end of the muffler will be biased toward inward flow, as the result of the direction in which the louvers slope.

Preferably, although not necessarily, each of the stampings 15 is formed, in the vicinity of each of the partitions 25, as indicated in Figs. 7 and 8. That is, one of the louvers 18 adjacent the partition 25 is made of somewhat greater axial length than the other louvers and is formed to provide a cylindrical portion 19 having a diameter approximately equal to that of the opening in the partition 25. Just beyond the cylindrical portion 19 the strengthening ridge 15' is formed with an outward projection 26 which forms a locating abutment for the partition 25 as is clear from Fig. 8.

In the modified form of muffler illustrated in Figs. 9 and 10, the transverse partitions 25 are eliminated and longitudinally extending partitions 30 are provided, such partitions, as is clear from Figure 10, serving to divide the interior of

the casing 10 into three portions each of which contains one of the gas-passages 15.

As pointed out in our co-pending application above referred to, the silencing efficiency of a muffler depends upon a large number of factors external to it. The size and other features of the muffler will depend, to a large extent, therefore, upon the characteristics of the particular engine with which it is to be used; and the most satisfactory method of determining upon the design of a muffler for use with a particular engine is by experiment. The desired design of muffler is of course that which will most economically produce the desired degree of silencing. If the muffler is tested with an engine and is found to produce inadequate silencing, the degree of silencing produced can be increased by increasing the number of the partitions 25. There is a limit, largely determined by considerations of cost, to the number of partitions which can be used in a muffler; and if the desired degree of silencing has not been obtained by increasing the number of partitions to that limit, it may be increased by increasing the size of the muffler.

As a specific example of a muffler for use with a particular engine, we might state that, for the six-cylinder, 205 cubic inch engine of the Studebaker automobile a muffler having a casing-body 20 inches in length and five inches in diameter with three of the gas-passages 15 each one and one-half inches in diameter proved satisfactory. In this muffler, there were two transverse baffles 25, the slots 17 were spaced one-half inch apart, and the louvers were displaced outwardly sufficiently far to make the slots 17 about 0.020 to 0.025 inch in width. While a one-half inch spacing of the slots 17 is generally satisfactory, a closer spacing, of three-eighths or one-quarter of an inch, will increase the silencing efficiency somewhat. The width of the slots is of comparatively slight importance and may be varied considerably without noticeably influencing the silencing action of the muffler. Slots narrower than 0.010 inch, while satisfactory from a silencing standpoint, are apt to become clogged, while the silencing action begins to suffer if the slots are increased in width much beyond 0.040 inch.

To avoid the creation of excessive back pressure, the total cross-sectional area of all the gas-passages 15 should not be materially less than the cross-sectional area of the exhaust pipe through which gases are supplied to the muffler.

It will be noted that in all the mufflers described the gas passages are unobstructed, and the bulk of the gases may therefore flow freely from the inlet opening to the discharge opening of the muffler. Because of this, the back-pressure which the muffler offers to the flow of gases is extremely small compared to that developed by most other mufflers in common use. Because of the simple arrangement of parts, which lends itself to sheet-metal construction, the muffler may be very economically manufactured and is light in weight. Further, I have found that by dividing the exhaust gases and causing them to flow in parallel through several silencing gas-passages, the over-all length of a muffler of given silencing efficiency may be materially reduced.

We claim as our invention:

1. A silencer for gases, comprising a hollow casing having inlet and discharge openings, a plurality of gas passages disposed within said casing and affording communication between said inlet and discharge openings, each of said

passages being formed by a trough-shaped member secured to said casing with its open side adjacent the inner surface of the casing, said members being provided with louvers some of which slope in one direction and others of which slope in the opposite direction.

2. A silencer as set forth in claim 1 with the addition that the louvers on each member all slope in the same direction, at least one of said members being disposed so that its louvers slope in a direction opposite to those of the other member or members.

3. A silencer for gases, comprising a hollow casing having inlet and discharge openings, a plurality of gas passages disposed within said casing and affording communication between said inlet and discharge openings, each of said passages being formed by a trough-shaped member secured to said casing with its open side adjacent the inner surface of the casing, each of said members being provided on both sides of its longitudinal center with louvers sloping outwardly toward the longitudinal center of the member.

4. A silencer for gases, comprising a hollow casing having inlet and discharge openings, a plurality of gas passages disposed within said casing and affording communication between said inlet and discharge openings, each of said passages being formed by a trough-shaped member secured to said casing with its open side adjacent the inner surface of the casing, said trough-shaped members and casing being arranged to provide a chamber within the casing and between the trough-shaped members, each

of said trough-shaped members being provided at a multiplicity of points along its length with openings providing restricted communication between its interior and said chamber, transverse partitions disposed within said casing adjacent the ends of said trough-shaped members and closing the ends of said chambers, and one or more auxiliary transverse partitions extending across said chamber between the ends thereof.

5. A silencer for gases, comprising a hollow casing having inlet and discharge openings, a plurality of gas passages disposed within said casing and affording communication between said inlet and discharge openings, each of said passages being formed by a trough-shaped member secured to said casing with its open side adjacent the inner surface of the casing, said trough-shaped members and casing being arranged to provide a chamber within the casing and between the trough-shaped members, each of said trough-shaped members being provided at a multiplicity of points along its length with openings providing restricted communication between its interior and said chamber, and transverse partitions disposed within said casing adjacent the ends of said trough-shaped members and closing the ends of said chambers.

6. The invention set forth in claim 5 with the addition that said partitions are convex outwardly and are provided in their outer surfaces with grooves communicating with said trough-shaped members.

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