

D. REID.
MUFFLER.

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1,387,614.

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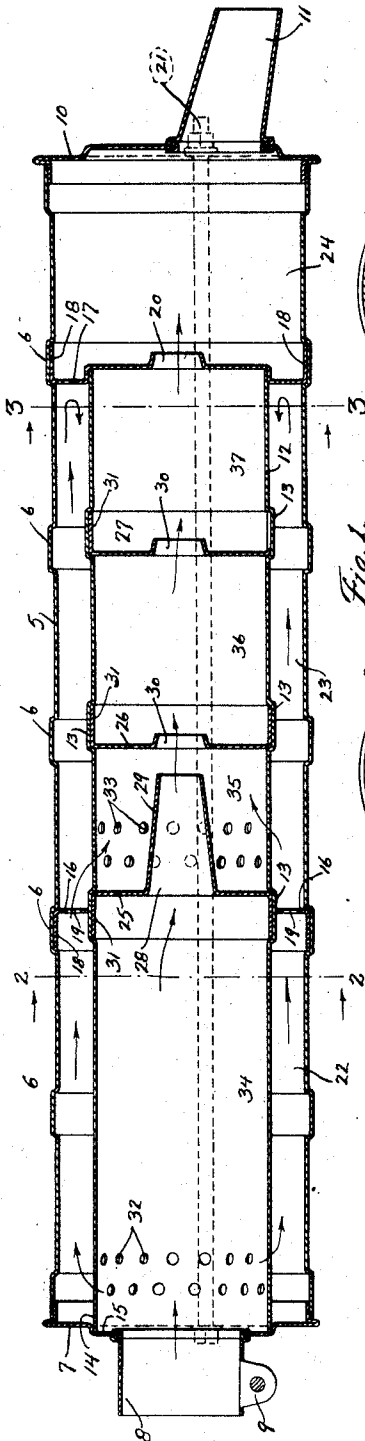


Fig. 1.

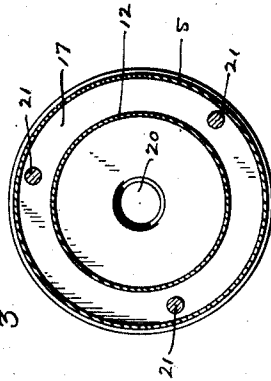


Fig. 2.

Fig. 3.

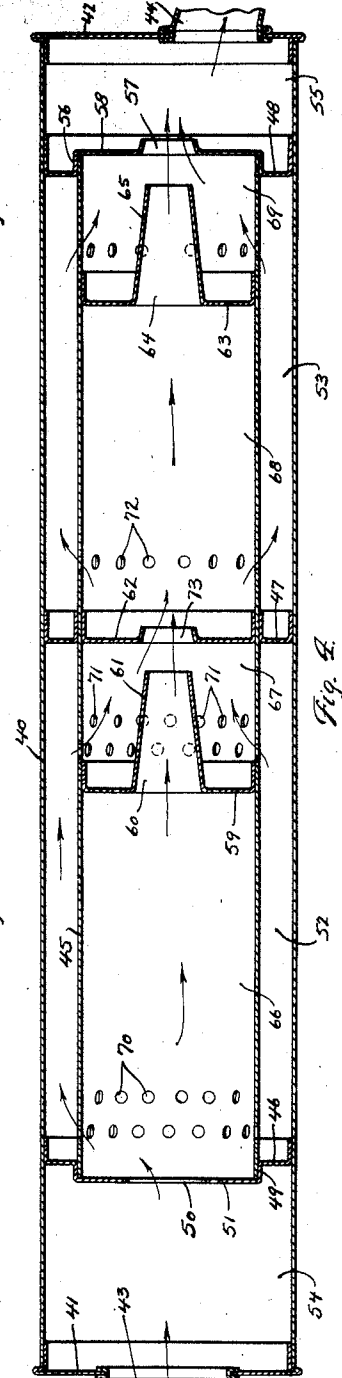


Fig. 4.

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MUFFLER.

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To all whom it may concern:

Be it known that I, DAVID REID, a subject of the King of Great Britain, and resident of the city of Buffalo, county of Erie, and State of New York, have invented certain new and useful Improvements in Mufflers, of which the following is a full, clear, and exact description.

My invention relates generally to mufflers, and more particularly to those types of mufflers which are used to silence the noise of exhaust gases of internal-combustion engines.

It is well known to those skilled in the art, that in mufflers having a single-piece outer casing, the joint of this outer casing is usually of the folded form, generally known as the "stove pipe" joint. This joint, while being the weakest point in the cylinder, is also the most rigid part of the cylinder, because it is formed of four thicknesses of the sheet of material forming the body. When a muffler of this type is fastened to the chassis of an automobile, the weaving action of the chassis causes a weakening of the joint, and, when the muffler bursts from internal pressure it is usually at the center of its length and along the weakened joint.

The principal object of my invention has been to provide a muffler which shall be provided with circumferentially arranged ridges or corrugations in its outer body portion, and with a joint in said body portion which is welded, thus making the body one continuous cylinder.

Another object has been to provide a muffler utilizing the ejector principle, and one so designed that it shall adjust itself to the velocity of the gases passing there-through.

Moreover, my muffler is simple in design; very flexible to the weaving action of the chassis; and cheap to manufacture.

The above objects and advantages have been accomplished by the device shown in the accompanying drawings, which form a part of this application. In the drawings:

Figure 1 is a longitudinal elevation of my muffler.

Fig. 2 is a transverse, sectional elevation of the same, taken on line 2—2 of Fig. 1.

Fig. 3 is a similar view taken on line 3—3 of Fig. 1.

Fig. 4 is a longitudinal, sectional elevation of a modified form of my muffler.

Referring to the drawings, and more par-

ticularly to Figs. 1, 2 and 3 thereof, 5 is the outer cylinder or casing of my muffler, which is preferably provided throughout its length with a plurality of circumferentially arranged corrugations 6. These corrugations are formed in the cylinder in any suitable way, but are preferably rolled therein before the edges of the cylinder are welded together. A head 7, preferably of pressed sheet metal, is provided at the inlet end of the cylinder 5, and in the central aperture thereof is secured an inlet neck 8. The neck 8 is provided with suitable clamping means 9, whereby it may be fastened to the exhaust pipe of an engine. A head 10, also, preferably, of pressed metal, is provided at the opposite end of the cylinder 5, and an outlet spout 11 is secured in an opening formed in this head.

12 is the inner cylinder of my muffler which is, preferably, provided with a plurality of circumferentially arranged corrugations 13. The inner end 14 of this cylinder is supported within a recess 15 formed in the head 7 of the outer cylinder. The central portion of the inner cylinder is supported by means of a plate 16, and the outer end of the cylinder is supported by means of a plate 17. Each of the plates 16 and 17 is provided with a right-angled annular flange 18, which is preferably disposed within one of the corrugations 6 of the outer cylinder. The plate 16 is provided with a plurality of apertures 19 for the passage of the exhaust gases. The plate 17 closes the space between the outer and inner cylinders, and also closes the outer end of the inner cylinder, except for an opening 20 formed near the center of the plate. A plurality of bolts 21 may be passed through the heads 7 and 10 and partitions 16 and 17, whereby the heads of the muffler will be securely held in position. The partitions 16 and 17 divide the outer casing into expansion chambers 22, 23 and 24.

Within the inner cylinder 12 are placed a number of partitions 25, 26 and 27. The partition 25, which is arranged between the center of the inner chamber and the inlet end thereof, is provided with a central opening 28, from which extends an ejector nozzle 29. The partitions 26 and 27 are in spaced relation with each other and the partition 25, and each has a central opening 30 there-through. The material in the partitions 26, 27 and 17, where the central openings are

formed, is tapered rearwardly of the muffler, thus forming a short neck around the openings, as shown in the drawings, thereby preventing secondary sounds. The partitions 5 25, 26 and 27 are each provided with an angular flange 31, and these flanges are preferably disposed within the corrugations 13 of the chamber. By arranging the partitions of my muffler within the corrugations 10 formed in the casings 5 and 12, they are securely held in position and a rigid and durable construction is thereby afforded. In the forward end of the inner cylinder of the muffler is provided a plurality of small aper- 15 tures 32, arranged circumferentially and opening into the expansion chamber 22 of the muffler. A plurality of small circumferentially arranged apertures 33 are also provided near the middle of the inner casing 12. 20 These apertures are arranged between the partitions 25 and 26, and preferably adjacent to the partition 25. The partitions 25, 26 and 27 divide the inner cylinder into expansion chambers 34, 36 and 37, and a suction chamber 35: 25

In the modified form of my invention shown in Fig. 4, I use a plurality of ejector nozzles. In this form 40 is the outer cylinder, having an inlet head 41 and an outlet 30 head 42, provided, respectively, with an inlet neck 43 and a spout 44. 45 is the inner cylinder which is supported preferably by means of the partitions 46, 47 and 48. The portion of these partitions between the inner 35 and outer cylinders is solid, except for apertures provided for the passage of the fastening bolts (not shown). The partition 46, which is arranged some distance from the inlet head 41, is provided with a neck 49 40 which serves to support the forward end of the inner cylinder 45. A comparatively large opening 50 is formed through the center of the wall 51 of the partition 46. The partition 47 is arranged preferably near the 45 middle of the inner cylinder and divides the space between the inner and outer cylinders into expansion chambers 52 and 53. An expansion chamber 54 is provided between the head 41 and partition 46, and an expansion 50 chamber 55 is provided between the partition 48 and the head 42. The partition 48 is provided with a neck 56, in which the outer end of the inner cylinder is disposed. A central opening 57 is provided through the wall 58 55 of the partition 48.

Within the inner cylinder 45, and near its central portion, is secured a partition 59 which is provided with a central opening 60 from which extends an ejector nozzle 61. A 60 partition 62 is also disposed within the inner cylinder and arranged adjacent to the end of the nozzle 61. The partition 62 is provided with a central opening 73. A partition 63, having an opening 64, with an ejector nozzle

65, is also disposed within the inner cylinder 65 and so arranged that the end of the nozzle is adjacent to the opening 57 of the partition 48. The partitions in the inner cylinder, together with partitions 46 and 48 at the ends of the inner cylinder, divide the same into 70 expansion chambers 66 and 68, and into suction chambers 67 and 69. At the forward end of the chamber 66, is provided a plurality of small circumferentially arranged 75 apertures 70. These apertures extend through the wall of the inner cylinder and open into the expansion chamber 52 of the outer cylinder. Immediately behind the partition 59, and connecting chambers 52 and 67, is a plurality of apertures 71, formed 80 through the wall of the inner cylinder. On the rear side of the partition 62 is a plurality of small apertures 72, which are formed through the wall of the inner cylinder and which connect chambers 53 and 68. A simi- 85 lar number of apertures are formed immediately behind the partition 63, whereby chambers 53 and 69 are connected.

Referring to the form of my invention which is shown in Figs. 1 to 3, it will be 90 seen that, as the gases under pressure enter the chamber 34, a portion thereof will pass through the nozzle 29 at high velocity, and that portion which does not go through the 95 nozzle will back up in the chamber 34, and, after filling the same, will pass through the apertures 32 formed at the inner end of the inner cylinder 12 and into the expansion chamber 22 of the outer cylinder. The gas 100 expanding into the chamber 22 will pass through the apertures 19 formed in the partition 16 and enter the expansion chamber 23. The stream of gas leaving the nozzle 29 at high velocity will be projected through 105 the opening 30 of the partition 26 and will create a partial vacuum within the suction chamber 35, thus causing a suction to be produced through the apertures 33 in the inner cylinder. The gases within the expan- 110 sion chambers 22 and 23 will thus be drawn through the apertures 33 and be forced through the aperture 30 in the partition 26 by and with the stream of gas coming from the nozzle 29. The gases will thus pass into 115 the chamber 36, then on through the opening 30 of the partition 27 into the chamber 37, thence through the opening 20 in partition 17 into chamber 24 and thence through outlet spout 11 to the atmosphere. It is a well known fact that if the burned gases 120 from an internal-combustion engine can be cooled before they are exhausted into the atmosphere, they will be substantially relieved of the noise of explosion. By passing the bulk of the gases through the apertures 125 32 and into expansion chambers 22 and 23 they will be brought in contact with a large portion of the outer surface of the muffler

cylinder 5 and will be substantially cooled by contact with this surface, so that by the time they have reached the chamber 24 the temperature of the gases will be so low that when they are finally forced through the spout 11 of the muffler the noise will be greatly reduced.

In the form of my invention shown in Fig. 4 the entering gases expand into the chamber 54, pass through the opening 50 in the partition 46, and enter expansion chamber 66 of the inner cylinder. A portion of the gases at high velocity pass through the ejector nozzle 61 at the end of the chamber 66 and the balance of the gases expand through the opening 70 at the forward end of the chamber 66 and pass into the expansion chamber 52 of the outer cylinder, where they are brought in contact with the outer relatively cold surface of the muffler. The stream of gas passing through the ejector nozzle 61 is projected through the central opening 73 of the partition 62 at a high velocity, thereby creating a partial vacuum within the suction chamber 67. The gases from the chamber 52 are thereby drawn into the chamber 67 through the openings 71 and are then projected, with the gases coming from the nozzle 61, through the opening 73 and into the chamber 68. A portion of the gases will pass, at a much reduced velocity, through the nozzle 65, and the balance of the gases will back up in the chamber 68 and pass into the expansion chamber 53 through the apertures 72. A slight vacuum will be created within the suction chamber 69 by the stream of gas coming from the nozzle 65 and this will cause a suction sufficient to draw the gases from the expansion chamber 53 into the suction chamber 69. The gases from the chamber 69 will be forced through the central opening 57 of the partition 48 and into the expansion chamber 55, whence they pass out of the muffler through the spout 44.

By passing the gases through a number of chambers, a gradual expansion and cooling thereof is thus obtained, and they escape substantially without noise. However, in the ordinary type of muffler now in use, where the openings through the partitions forming such chambers are constant, the muffler will cause back pressure, at high engine speeds, if the openings are of such a size as to effectively muffle the noise at low speeds; and, if the openings are proportioned for high speeds, the muffler will not effectively silence the noise of the exhaust gases when the engine is running at low speeds.

In order to overcome this disadvantage, I provide my muffler with one or more ejector nozzles, which automatically adjusts the muffler to take care of the gases at high or low engine speeds. At high engine speeds

the velocity of the gases passing through the ejector nozzles will be high and will thus create a comparatively high vacuum in the muffler and thus rapidly draw the gases from the expansion chambers. At low engine speeds the suction will be slight, and therefore the gases will be slowly drawn from the expansion chambers. In other words, the gases will be drawn from the expansion chambers at velocities directly proportionate to the speed of the engine.

While I have shown the partitions in my muffler disposed within the corrugations of the cylinders thereof, they may, if desired, be arranged at any convenient position within the cylinders and secured in position by spot welding or other suitable means. Moreover, if desired, the corrugations in the cylinders may be in the form of a spiral instead of the circumferentially arranged ridges shown. If the partitions are to be secured within such a spirally arranged groove, they will, of course, be provided with flanges of a similar spiral pitch. Furthermore, while I have shown the partitions or plates provided with flanges, the corrugations in the cylinders may be made of a width to properly support the plates without flanges. Obviously, these and other modifications of the details herein shown and described may be made without departing from the spirit of my invention or the scope of the appended claims; and I do not, therefore, wish to be limited to the exact embodiment herein shown and described.

Having thus described my invention, what I claim is:

1. A muffler comprising an outer cylinder provided with a plurality of circumferentially arranged corrugations, heads for the outer cylinder, an inner cylinder, a plurality of plates mounted within the corrugations of the outer cylinder for supporting the inner cylinder and for dividing the outer cylinder into a plurality of expansion chambers, and means for dividing the inner cylinder into a plurality of expansion chambers.

2. A muffler comprising an outer cylinder provided with a plurality of circumferentially arranged corrugations, heads for the outer cylinder, an inner cylinder provided with a plurality of circumferentially arranged corrugations, a plurality of plates suitably mounted within the outer cylinder for supporting the inner cylinder and for dividing the outer cylinder into a plurality of expansion chambers, and a plurality of apertured plates for dividing the inner cylinder into a plurality of expansion chambers.

3. A muffler comprising an outer cylinder provided with a plurality of circumferentially arranged corrugations, heads for the

outer cylinder, an inner cylinder provided with a plurality of circumferentially arranged corrugations, and a plurality of plates suitably mounted within the corrugations of the outer cylinder for supporting the inner cylinder and for dividing the outer cylinder into a plurality of expansion chambers.

4. A muffler comprising an outer cylinder provided with a plurality of circumferentially arranged corrugations, heads for the outer cylinder, an inner cylinder provided with a plurality of circumferentially arranged corrugations, and a plurality of plates suitably mounted within the outer cylinder for supporting the inner cylinder and for dividing the outer cylinder into a plurality of expansion chambers, and a plurality of apertured plates for dividing the inner cylinder into a plurality of expansion chambers.

5. A muffler comprising an outer cylinder provided with a plurality of circumferentially arranged corrugations, heads for the outer cylinder, an inner cylinder provided with a plurality of circumferentially arranged corrugations, a plurality of plates suitably mounted within the outer cylinder for supporting the inner cylinder and for dividing the outer cylinder into a plurality of expansion chambers, and an ejector nozzle mounted within the inner cylinder.

6. A muffler comprising an outer cylinder provided with a plurality of circumferentially arranged corrugations, heads for the outer cylinder, an inner cylinder provided with a plurality of circumferentially arranged corrugations, a plurality of plates suitably mounted within the outer cylinder for supporting the inner cylinder and for dividing the outer cylinder into a plurality of expansion chambers, a plurality of plates dividing the inner cylinder into expansion chambers, and an ejector nozzle mounted within the inner cylinder.

7. A muffler comprising inner and outer cylinders, heads for the outer cylinder, a plurality of plates suitably mounted within the outer cylinder for dividing it into a plurality of expansion chambers, means for dividing the inner cylinder into a plurality of expansion chambers and an ejector nozzle mounted within the inner cylinder, the inner cylinder being provided with perforations opening into the outer cylinder and arranged in front of the nozzle, and similar perforations arranged at the rear of the nozzle, whereby slow moving gas is drawn in the desired direction by part of the same gas moving at high velocity.

8. A muffler comprising inner and outer cylinders, heads for the outer cylinder, a plurality of plates suitably mounted within the outer cylinder for dividing it into a plurality of expansion chambers, a plural-

ity of apertured plates dividing the inner cylinder into a plurality of expansion chambers, and an ejector nozzle mounted within the inner cylinder, the inner cylinder being provided with perforations opening into the outer cylinder and arranged in front of the nozzle, and similar perforations arranged at the rear of the nozzle, whereby slow moving gas is drawn into the desired direction by part of the same gas moving at high velocity.

9. A muffler comprising an outer cylinder, heads for the outer cylinder, an inner cylinder, means within the outer cylinder for supporting the inner cylinder in spaced relation to the outer cylinder and for dividing the outer cylinder into a plurality of expansion chambers, a plurality of apertured plates dividing the inner cylinder into a plurality of expansion chambers, and an ejector nozzle mounted within the inner cylinder adjacent to one of said apertured plates and in alinement with the aperture thereof, the inner cylinder being provided with perforations opening into the outer cylinder, whereby slow moving gas is drawn into the desired direction by part of the same gas moving at high velocity.

10. A muffler comprising an outer cylinder, heads for the outer cylinder, an inner cylinder, a plurality of apertured plates within the outer cylinder for supporting the inner cylinder in spaced relation to the outer cylinder and for dividing the outer cylinder into a plurality of expansion chambers, a plurality of apertured plates dividing the inner cylinder into a plurality of expansion chambers, and an ejector nozzle mounted within the inner cylinder adjacent to one of said apertured plates and in alinement with an aperture thereof, the inner cylinder being provided with perforations opening into the outer cylinder, whereby slow moving gas is drawn into the desired direction by part of the same gas moving at high velocity.

11. A muffler comprising an outer cylinder, heads for the outer cylinder, an inner cylinder, means within the outer cylinder for supporting the inner cylinder and for dividing the outer cylinder into a plurality of expansion chambers, and a plurality of spaced apertured plates dividing the inner cylinder into a plurality of expansion chambers, the inner cylinder being provided with perforations opening into the outer cylinder, whereby direct and indirect paths for the gas are provided.

12. A muffler comprising an outer and an inner cylinder, each of substantially uniform diameter throughout its length, heads for the outer cylinder, means within the outer cylinder for supporting the inner cylinder and for dividing the outer cylinder into a plurality of expansion chambers, 130

and a plurality of spaced apertured plates dividing the inner cylinder into a plurality of expansion chambers, the inner cylinder being provided with perforations opening
5 into the outer cylinder, whereby part of the gas is permitted to pass directly through the inner cylinder at high velocity and part of the same gas follows an indirect path through the perforations of the inner cylinder. 10

In testimony whereof, I hereunto sign my name.

DAVID REID.