

Oct. 13, 1925.

1,556,934

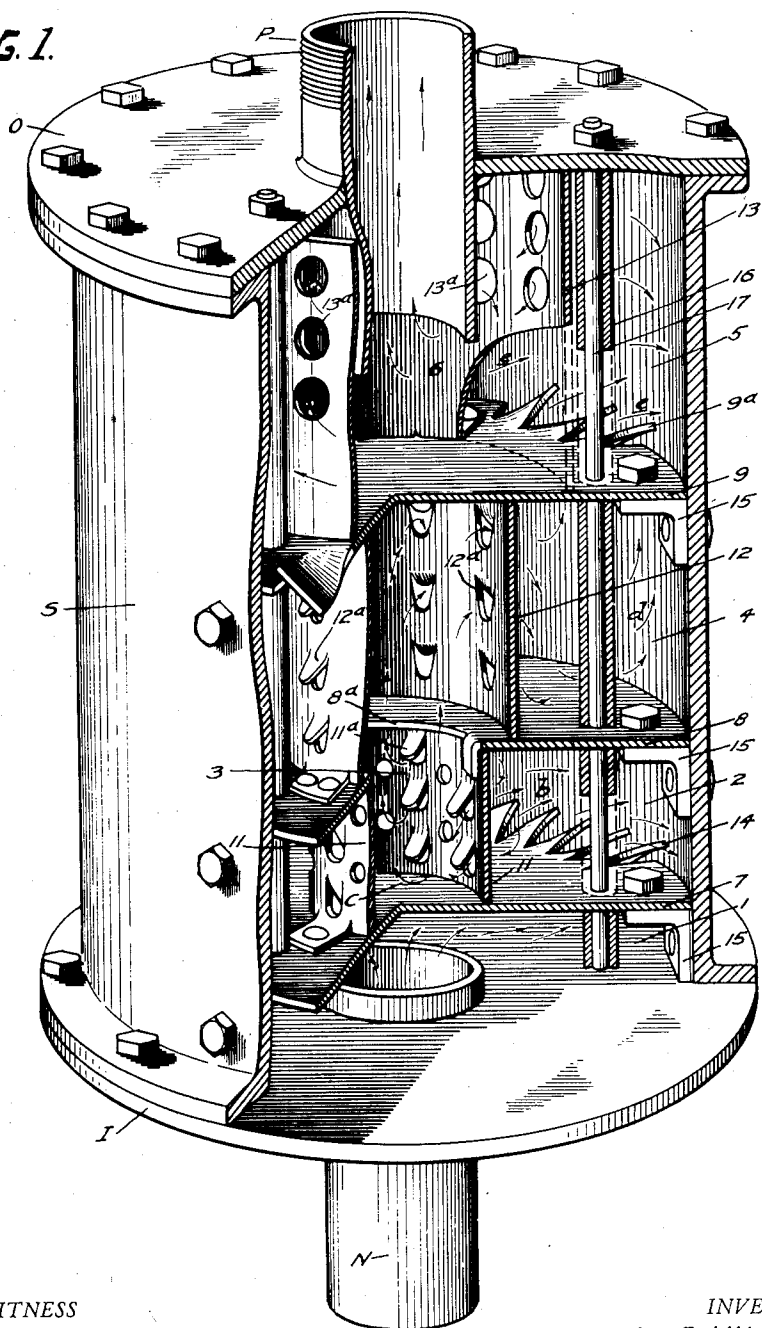
A. A. HILLDRING

MUFFLER OR SILENCER

Filed Feb. 20, 1922

2 Sheets-Sheet 1

FIG. 1.



WITNESS

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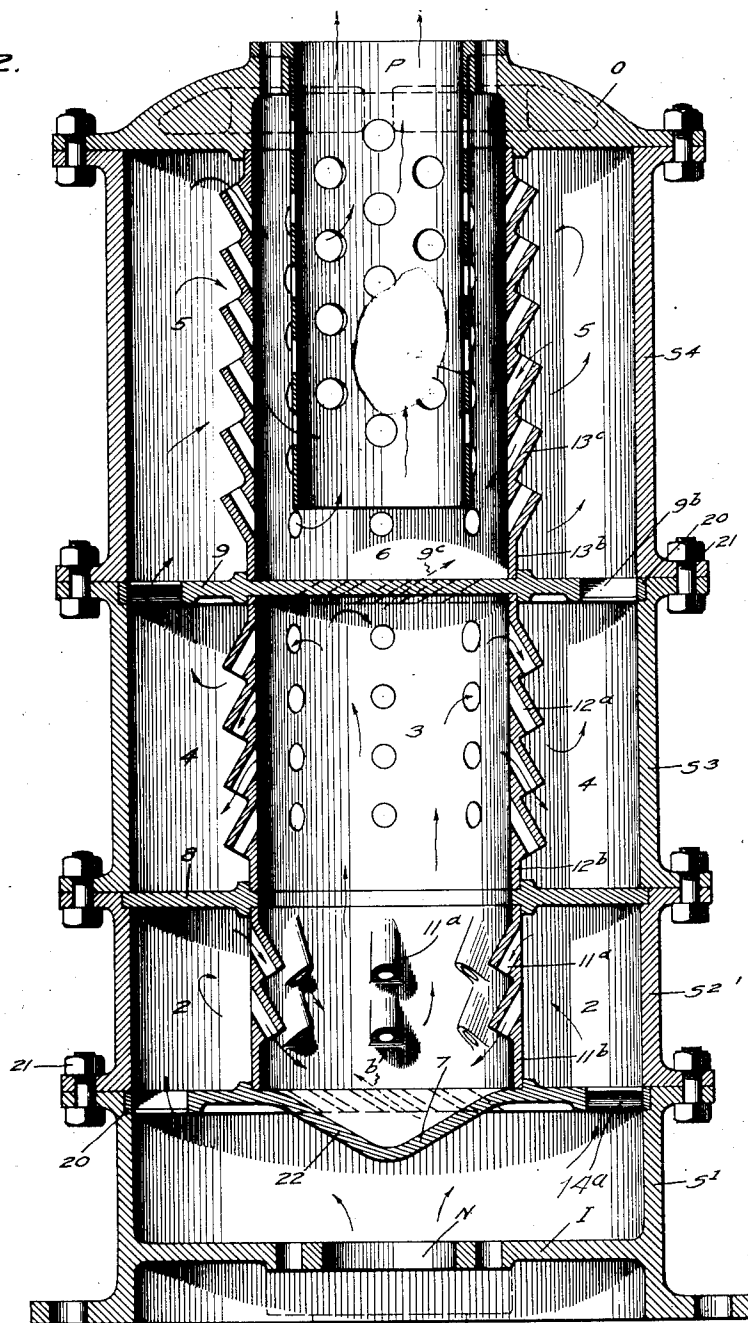
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2 Sheets-Sheet 2

FIG. 2.



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UNITED STATES PATENT OFFICE.

AXEL A. HILLDRING, OF SAN FRANCISCO, CALIFORNIA.

MUFFLER OR SILENCER.

Application filed February 20, 1922. Serial No. 537,699.

To all whom it may concern:

Be it known that I, AXEL A. HILLDRING, a citizen of the United States, and a resident of the city and county of San Francisco, State of California, have invented a new and useful Muffler or Silencer, of which the following is a specification.

This invention relates to means for reducing the noise of the exhausting gases from internal combustion and explosive engines, such means commonly being termed "silencers."

An object of the present invention is to provide a simple, substantial, durable and practicable device for effectually eliminating the exhaust sounds of engines of the combustion and explosion type.

Another object of the invention is to provide a device of this kind which is compact in arrangement and which, within its shell, provides a circuitous path of travel from end to end of the shell and through which path of travel, the gases under pressure are caused to have not only changes of direction at right angles to each other, but also which have a spiral direction of flow. In this connection, an object is to provide a muffler having a series of chambers successively increasing in length from the intake to the discharging end of the muffler and having also a series of chambers successively increasing in diameter from the intake to the discharge end of the chamber. Further, an object is to provide a muffler with an inner series of chambers increasing in diameter and a concentric series of chambers surrounding the inner chambers and which successively increase in length, all with the object of effectively reducing the exhaust sound without restricting or retarding the escaping gases.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be made manifest in the following description of the preferred form of the invention, which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood that it is not intended to limit the invention to the embodiments shown by the said drawings and description, as variations may be adopted within the scope of the invention as set forth in the claims.

Figure 1 is a perspective and longitudinal, sectional view.

A modified form of the invention is shown

in central, longitudinal section in Figure 2.

The muffler of my invention consists broadly of a cylindrical exterior shell having at opposite ends intake and discharge heads and between these and within the shell there is arranged substantially two series of separate chambers, means being provided in certain of the chambers for deflecting the gases so as to impart to them a spiral or rotary movement.

More particularly the muffler has an exterior cylindrical shell S closed at one end by the intake head I, which has a nipple N to be connected to the exhaust pipe or outlet means of an engine. At the opposite end of the shell is the outlet head O, having a discharge pipe P.

In the illustrated embodiment the muffler is provided with six expansion and separate chambers designated in their order in the circuit, as 1, 2, 3, 4, 5 and 6, which are spaced longitudinally and formed by transverse partitions 7, 8 and 9, and by the inner cylinders 11, 12 and 13.

The chamber which is formed between the intake head I and the partition 7, receives the hot gases entering through the nipple N and then passing, as shown by the arrows, outwardly toward the perimeter of the partition which is provided with a series of tongues 14 formed by radially slitting the margin of the partition 7. The tongues 14 are each symmetrically bent upwardly from one side of the partition 7 and are also bent by a twisting action disposing the ends of the blades at an angle with the plane of the partition 7, as is clearly shown in the drawing. The pitch or inclination of the blades 14 obviously may be varied and determined according to the given conditions to which the muffler will be subjected. This formation of blades at the perimeter of the partition 7 produces a series of apertures between the contiguous radial edges of each blade and the gases flow through these apertures and are impelled in a common circular direction, as shown by the arrows b in the chamber 2. As the partition or disc 7 forms one end of the second chamber 2, its opposite end is formed by the disc or partition 8 and this is shown as having a central aperture 8^a which is surrounded by the short section of cylinder 11. This cylinder is apertured as by punching inwardly a multiplicity of tongues 11^a, which are inclined downwardly toward the

partition 7 and therefore form deflecting means directing the gases downwardly toward the partition 7. The flowing gases reverse their direction, as indicated by the arrows *c* and pass upwardly into the upper portion of chamber 3 which is formed within the cylinder 12; this being somewhat larger than the cylinder 11.

The cylinder 12 is apertured as by striking outwardly a number of tongues 12^a of suitable size and arrangement, these being inclined downwardly toward the partition 8 on which the lower end of the drum 12 is arranged. Therefore the moving gases are again reversed in their direction as they pass through the cylinder 12 and are deflected downwardly toward the plate 8, which, in turn, deflects them upwardly, as shown by the arrows *d* in chamber 4, which is the second outer chamber and is, as shown, of considerably greater length than the chamber 2. From the chamber 4, the moving gases pass through apertures provided by upwardly struck and circumferentially twisted tongues 9^a in the margin of the partition 9, which forms the top of the chambers 12 and 14. The twisted tongues or blades 9^a serve to deflect the moving gases, as shown by the arrow *e*, in chamber 5, which, in turn, is longer than the chamber 4 and is closed at one end by the outlet head O. The gases in the chamber 5 flow inwardly through apertures 13^a, provided in the cylinder 13 which is arranged between partition 9 and the outlet head O and this cylinder is also of larger diameter than the cylinder 12. It is obvious that the cylinder 13 may be provided with deflecting tongues, such as 11^a.

The movement of the gases after passage through the cylinder 13 is then again deflected by the inwardly extending end of the discharge pipe P.

It will, therefore, be observed that the high pressure gases entering the first chamber pass with a deflected movement into the second chamber 2, wherein they are given a circulating movement and then pass into the elongated inner chamber 3. The travel of the gases entering the chamber 3 is deflected by the inclined deflectors 11^a in the cylinder 11 and is further swerved by the outwardly inclined tongues 12^a in the cylinder 12. The deflecting effect is again secured by the passage of the gases through the apertures between the deflecting tongues 9^a of the partition 9 and the circulating movement of the gases in the chamber 5 also serves to silence the ultimate discharge.

It is manifest that the structural elements of the improved muffler may be varied as the conditions may demand and the elements may be secured together for convenient assembly and detachment. In the present case the cylindrical shell S is provided on its

surface with a series of angle brackets 15 upon which may be secured the intermediate partitions 7, 8 and 9 and also these may be further secured and braced by spacing sleeves 16 mounted upon respective longitudinal stay bolts or rods 17 passing through the inlet head I and the outlet head O and through the several partitions.

An embodiment of the invention in a different form is illustrated in Fig. 2 in which the shell consists of a plurality of sections S¹, S², S³ and S⁴ respectively increasing in length from one end of the silencer or muffler to the other but being of substantially the same diameter. In this form of the silencer the end section S¹ is provided with an integral end wall I, as distinguished from the separate head I of Fig. 1. The opposite end of the silencer is closed by a suitable head O bolted to the longest shell section S⁴. A feature of this form of silencer is that one or the other of the meeting ends of sections S¹, S², S³ and S⁴ is rebated or counter-sunk, as at 20, sufficiently to form a seat for respective intermediate partitions 7, 8 and 9 extending transversely across the silencer or muffler and therefore being clamped between the meeting edges of the sections when these are bolted together, as by bolts 21. This forms an extremely simple form of assembly for the parts of the silencer.

The marginal portion of the transverse partition 7 is provided with radial apertures 14^a whose parallel walls are inclined all in a common direction, as shown by the arrows *b'*, so that as the gases flow from chamber 1 into the next and outer chamber 2, a spiral motion is imparted to the same.

In this form of the silencer the innermost chambers 3 and 6 are shown as of equal diameter and are formed by sections of cylinders 11^b and 12^b, these forming the chamber 3, and cylinder 13^b which forms, above the transverse partition 9, the chamber 6 and from which leads an exhaust pipe P shown as perforated. The bottom of the chamber 3 of the form of silencer in Fig. 2 is in the form of an inverted cone 22 serving as a deflector for throwing the gases from the inlet N outwardly. The chamber silencer 11^b is provided with inwardly inclined nozzles 11^a forming inlet apertures through which the gases flow inwardly from chamber 2 to chamber 3 and thence into the upper cylinder section 12^b which is provided with outwardly inclined nozzles 12^a forming apertures in the cylinder. The gas flowing through these apertures passes into an outer chamber 4 formed in the shell section S³ and from this outer chamber 4 the gas or gases flow through radial apertures 9^b having inclined lateral walls, so as to impart the circular movement as shown by the dotted arrows 9^c, as the gases enter the lower portion of the

upper and outer chamber 5 above the partition 9.

The inner cylinder 13^b is provided with outwardly inclined nozzles 13^c forming 5 apertures through which the gases flow inwardly into the inner and exhaust chamber 6 which is within the cylinder 13^b. The gases then flow into the discharge pipe P 10 through its lower open end and also through its perforated wall. A simple and economical form of construction shows the partitions 7, 8 and 9, and the inner face of the head O all having countersunk or re- 15 bated seats to receive the contiguous ends of the respective inner cylinders 11^b, 12^b and 13^b. The transverse partition 8 has a central opening for permitting the formation of a common chamber 3 within the cyl- 20 inders 11^b and 12^b, but the partition 9 is closed between the adjacent ends of the cylinder 12^b and the cylinder 13^b to prevent the flow of gas directly from chamber 3 to chamber 6 and therefore causing it to flow outwardly and through the radial and 25 inclined deflecting passageways 9^c. It will be seen, therefore, that each of the shell sections forms with the intermediate partitions outer chambers of increasing length from end to end of the silencer or muffler.

30 It will be seen that the muffler is constructed of very simple and inexpensive parts all of which may be readily assembled and securely fastened and that renewals and changes may be made expeditiously when 35 necessary.

What is claimed is:

1. An exhaust muffler having a series of inner axially arranged chambers and a 40 series of outer chambers providing for a zig-zag flow between the inner and outer chambers, and means in certain of the chambers for producing a circular flow of the gases.

2. An exhaust muffler having a series of 45 inner axially arranged chambers and a series of outer chambers providing for a zig-zag flow between the inner and outer chambers, and means in certain of the chambers for producing a circular flow of 50 the gases; certain of the chambers having means for reversing the flow of gases.

3. An exhaust muffler having a series of

inner axially arranged chambers and a series of outer chambers providing for a zig-zag flow between the inner and outer 55 chambers, and means in certain of the chambers for producing a circular flow of the gases; certain of the chambers having means in their walls for reversing the flow 60 of gases.

4. An exhaust muffler comprising a shell having an inlet head, an outlet head, a set of partitions dividing the shell into separate outer chambers, and means forming 65 separate inner chambers to form a continuous zig-zag path from end to end of the shell; certain of the partitions having marginal means for imparting a circular flow to the moving gases.

5. In an exhaust muffler, a shell, a parti- 70 tion disc dividing the shell into two chambers and a plurality of struck up tongues on the periphery of the disc contacting with the shell, said tongues being twisted symmetrically to form inclined deflectors for 75 imparting a common direction of movement to a flowing fluid.

6. In an exhaust muffler, a casing, a partition disc dividing the casing into two chambers and contiguous twisted tongues 80 formed on the periphery of said disc to cause circular movement of fluid passing between said tongues.

7. An exhaust muffler, comprising a shell 85 having an inlet head and an outlet head, transverse partitions dividing the shell into separate outer chambers, the partitions being disposed so that the chambers are of increasing length in the direction of flow 90 of the exhaust, the alternate partitions being provided on their peripheries with twisted tongues to impart circular movement to the exhaust gases, an intermediate partition being provided with a central 95 aperture, perforated inner casings disposed between the alternate partitions and registering with said aperture and tongues on the inner casing overlying the perforations therein to reverse the direction of flow of 100 the gases.

In testimony whereof, I have hereunto set my hand.

AXEL A. HILLDRING.