The present invention relates to improvements in mufflers, and more particularly to an inexpensively constructed durable silencer for exhaust gases and sound waves.

The muffler or silencer of the present invention is particularly constructed for use in connection with low velocity internal combustion engines, gas engines, air motors and the like. Certain known types of mufflers designed to silence the noise of an engine or motor exhaust embody various conventional types of construction, such as, for example, the inclusion of an outer shell and in some instances intermediate tubular passageways and chambers. Most mufflers embodying such features of construction have at least some of the passageways therein coextensive with the entire length of the muffler, which passageways are interconnected by perforations provided to create a turbulence in the escaping gases and sound waves. Other known mufflers designed especially for use on low velocity engines, such as the type of muffler shown and claimed in my Patent Nos. 2,416,452, dated February 25, 1947, include a casing or shell having a perforated transverse partition disposed between perforated baffles.

It has been definitely established that mufflers including coextensive axial passageways are unsuited for silencing the noises of the exhaust gases from a low velocity engine and that the flow of gases and sound waves along and through a perforated partition and baffles devoid of louvers or other structure designed to prevent free uninterrupted flow of the gases creates high frequency sounds or whistling. Such known types of mufflers are objectionable also from the standpoint of involved and costly assembly.

It is therefore an object of the invention to provide a durable low-cost muffler which is especially suited for silencing the noises of the exhaust gases from low velocity engines, and which is inexpensive to construct and may be installed easily and quickly and embodies a minimum of parts.

Another object is to provide a muffler with a series of compartments of different capacities interconnected through a plurality of lowered perforations.

Another object is to provide a muffler of the character described with one or more domed baffles having openings therein internally lowered so as to afford means to effectively reduce the noises of gases and sound waves passing there-through.

Another object of the invention is to provide a low velocity muffler of a kind which causes the gases and sound waves entering therein to be divided into a multiplicity of turbulent non-directional streams of different values, lengths and velocities so as to absorb and destroy sound waves of all frequencies and provide maximum efficiency in silencing noises.

Another object is to provide a muffler organization embodying novel features of construction.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which by way of illustration show preferred embodiments and the principles thereof. Other embodiments of the invention embodying the same principle may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention or the purview of the appended claims.

In the drawings:

Fig. 1 is a longitudinal central sectional view of a muffler embodying features of the present invention.

Fig. 2 is a longitudinal central sectional view of the muffler embodying other features of the invention.

Fig. 3 is a longitudinal central sectional view of a muffler substantially like those shown in Figs. 1 and 2, but embodying other features of the invention.

Fig. 4 is a longitudinal central sectional view of a muffler having a single baffle therein.

Fig. 5 is a transverse sectional view taken, for convenience, substantially on a line 5—5 of Fig. 4.

Fig. 6 is a longitudinal central sectional view of another form of muffler.

Fig. 7 is a transverse sectional view of a muffler substantially like Fig. 5, but showing a modified form of baffle.

Fig. 8 is an enlarged fragmentary sectional detail view taken substantially on line 8—8 of Fig. 7.

Fig. 9 is a fragmentary sectional detail view, substantially like Fig. 8, but showing a modified form of baffle.

Fig. 10 is a transverse sectional view of a muffler showing another modified form of baffle therewith.

The silencers embodying the features of the present invention and disclosed in the accompanying drawings are formed of sheet material such as sheet steel or metal tubing and are constructed of a plurality of separate parts all joined, as by welding, into an integral self-contained unit having a uniform external appearance.

Referring particularly to the silencer illustrated in Fig. 1, the muffler includes a cylindrical shell generally indicated at 11, preferably formed from two cylindrical end portions 12 and a cylindrical intermediate portion 13. Each of the end portions 12 is fashioned in a substantially cup-like configuration having a cylindrical wall portion 14 and an end wall 15. The end wall is suitably apertured and the aperture is provided with an internally directed annular flange 16. The
flanged aperture in one end portion receives a tubular fitting 17 to adapt the muffler for ready attachment to the exhaust of a motor. The flanged aperture in the other end portion 12 receives a tail fitting 18. The fittings 17 and 18 may be secured in the respective flanged openings by any suitable means, it being preferred however, that the fittings and the flanges 17 and 18 be joined as by welding at 19. The cylindrical wall portion 14 of each of the end portions 12 is provided on its free circumferential edge with an outwardly turned circumferential flange 20, adapted to receive in abutment therewith an annular flange 21 one of which is provided on each end of the intermediate cylindrical wall portion 11. When the unit is assembled the circumferential flanges 20 are suitably rolled over the annular flanges 21 so as to afford a tight joining of the related members and further, to provide external circumferential ribs to reinforce the assembly. Prior to joining the end portions 12 with the intermediate portion, a dome-shaped baffle, generally indicated at 22, is arranged in place between the opposed flanges of the related portions and is secured in such position when the circumferential flange 20 is rolled over in the manner described heretofore for each of the two baffles 22 shown in the embodiment disclosed in Fig. 1 includes a cylindrical wall portion 23 having an end wall 24 closing one end thereof and an external circumferential flange 25 at the other end thereof. The cylindrical wall portion 23 of the baffle is concentric with the wall of the shell 11 and is spaced therefrom in the manner illustrated. A plurality of elongated perforations 26 are provided in the cylindrical baffle wall 23, said perforations extending longitudinally thereof and being spaced apart circumferentially suitable distances so as to dispose the perforations in closely spaced pairs. Upon referring to Fig. 5, (described as taken on Fig. 4 but which also represents the structures of Figs. 1, 2 and 3) it will be noted that each of the perforations 26 is provided with an angularly disposed internal longitudinal flange 27 which has a protrusion on the body of the cylindrical wall and has its ends and one longitudinal edge thereof integral with said wall. It should be quite apparent at this time that the effective opening at each of the perforations 26 is determined by the distance to which the louver 27 is arched inwardly. Consequently it is a simple matter to determine the size of the opening so as to adapt the muffler for use in association with engines having different exhaust velocities.

Referring again to the disclosure in Fig. 1 it will be observed that both of the domed baffles 22 are disposed in a direction that is, the cylindrical body portion 23 of each is disposed towards the outlet end of the muffler. In operation exhaust gases and sound waves entering the shell through the fitting 17 flow into a chamber 28 defined by the cylindrical end portion 12 and the baffle adjacent thereto. The gases and sound waves then pass through the perforations 26 in said baffle outwardly radially in a tangential direction, and because the louvers are arranged in pairs and are opposed one to the other, the gases flowing therethrough are turbulated sufficiently to break up the streams and disrupt the sound waves and frequencies thereof, leaving the lowered perforations 26 the gases flow freely in and about the intermediate chamber 29 defined in part by the intermediate shell portion 13. This chamber has a capacity exceeding the capacity of the chamber 28 and consequently said gases expand sufficiently to further disrupt the sound waves and frequencies which continue their passage through the muffler they pass out of the chamber 29 through the lowered perforations 26 in the next baffle 22 and into an end chamber 31 defined by said baffle and the cup-shaped end portion 12. Inasmuch as the chamber 31 has a capacity considerably less than the capacity of the chamber 29 the gases are compressed or restrained sufficiently to again disturb and disrupt the sound waves and frequencies to thereby eliminate or deaden all noises in the gases passing out of such tubes entering the baffle.

The muffler construction shown in Fig. 2 is substantially like that disclosed in Fig. 1 and like numerals are used to identify corresponding parts. As illustrated, the dome-shaped baffles 22 are disposed in opposed directions so as to provide end chambers 28 and 31 having less capacity than the intermediate chamber 29. The function of a muffler constructed in this manner is substantially like that of a muffler previously described in that the sound waves and gases entering the small chamber 28 flow into the large chamber 29 through the radially disposed perforations 26 in the cylindrical wall 23. Each of the baffles. The expanded gases and sound waves leaving the chamber 29 flow through the lowered perforations 26 in the second baffle 22 and are contracted or compressed upon entering the end chamber 31 from where they pass out through the tail-fitting 18.

The muffler disclosed in Fig. 3 differs from the construction of the mufflers previously described in that dome-shaped baffles 22 are opposed to each other in such manner that relatively large end chambers 25—31 are provided and a restricted intermediate chamber 29 is formed. The operation and function of this muffler is substantially like that of the previously described mufflers in that the gases and sound waves are expanded and restricted during passage, and like numbers are used to identify corresponding parts thereof.

Fig. 4 shows a silencer having but one dome-shaped baffle 22 therein. The baffle 22 is like the baffles employed in the previously described constructions and its circumferential flange 25 is firmly embedded in the reinforcing bead 29 joining the two end portions 12 of the muffler together. This assembly is similar to the dome-shaped baffle 22 with the difference that the intermediate chamber 32 is formed. The operation and function of this muffler is substantially like that shown in Fig. 4 except in this instance the outer shell thereof is fashioned from a shallow cup-shaped end portion 34 joined in a reinforcing bead 30 to a central cup-shaped portion 35. The cup-shaped portion 34 is provided with an inlet fitting 17 which is suitably joined as by welding 30 to an internal flange 16. The other end portion 35 has its end wall 36 provided with a plurality of ports 37 through which sound deadened exhaust gases pass. In other respects this construction functions like the structures previously described, the gases and sound waves passing through the baffles contained the radial louvers and expanding into the exhaust chamber 38.

Figs. 7 and 8 show a modified form of construction for the dome-shaped baffle. As shown, the cylindrical wall 23a of the baffle 22a is pro-
vided with a plurality of circumferentially spaced apart slits to define elongated portions which are struck inwardly from the plane of the cylindrical wall 23x to define louvers joined to said wall at their ends only. Gases and sound waves flowing through the openings 43, provided by striking said louvers inwardly, flow in a circumferential direction and are turbulated in such manner as to break up said sound wave frequencies in the gases flowing therethrough.

Fig. 9 teaches a modified form of construction of a louver substantially like that shown in Figs. 7 and 8. As illustrated, the inwardly struck portion 42a is connected to the cylindrical wall of the dome-shaped baffle at one end only, thus affording a passageway for the gases and sound waves along three of its sides.

The muffler structure illustrated in Fig. 10 differs from that shown in Fig. 5 only in that all of the inwardly struck louvers 35a are disposed in a common direction circumferentially.

It should be understood that although a plurality of differently assembled silencers have been illustrated in the accompanying drawings and described in detail herein, the construction of each is such as to afford progressive expansion or contraction of the exhaust gases as they pass through the muffler and that means is provided in each whereby the direction of flow of said gases is interrupted to such degree as to break up all sound wave frequencies and effectively eliminate and deaden all sounds of the exhaust. It should be understood further that any one of the mufflers disclosed herein may incorporate louvers constructed in accordance with any one of the several teachings herein, and that the invention is not to be limited to the specific form of louver illustrated in each disclosure, and that other modifications of detail structure may be embodied therein without departing from the spirit of the invention or the scope of the appended claims.

I claim:

2. A muffler comprising a cylindrical casing having inlet and outlet openings for exhaust gases, an imperforate partition dividing said casing into compartments, a dome in said partition including a wall portion concentric with the horizontal casing, said dome having an imperforate end wall, and a plurality of circumferentially disposed louvered perforations in said concentric wall portion, said louvered perforations being arranged in pairs and the louvers on each pair being integral with one longitudinal edge of the wall portion and disposed angularly away from each other inwardly to define opposed tangential openings to create a turbulence in the gases passing through the perforations.

3. A muffler comprising a shell having inlet and outlet openings in its ends through which gases and sound waves may pass while entering and leaving said shell, a domed partition in and secured at its base only to said shell including a cylindrical wall portion spaced from the wall of the shell, and louvers in the cylindrical wall in the form of arches formed by deflecting portions of said wall inwardly, said louvers each being connected to said wall at the spaced ends of the arch and along one edge, the free edges of the louvers and the opposed edges of the wall defining an elongated opening through which the gases and sound waves may pass, the size of the opening being determined by the extent to which the louvers are offset from the cylindrical wall.

4. A muffler comprising a shell having inlet and outlet openings in its ends through which gases and sound waves may pass while entering and leaving said shell, a domed partition in said shell including a cylindrical wall spaced from the wall of the shell, circumferentially spaced pairs of louvers in the cylindrical wall in the form of arches formed by deflecting portions of said wall inwardly, each pair of louvers being integral along one longitudinal edge with the cylindrical wall and being disposed angularly away from each other inwardly each to define with a louver of an adjacent pair opposed tangential openings to create a turbulence in the gases and sound waves passing therethrough.

5. A muffler of the type described, in combination, a cylindrical shell having an opening at each end, a partition in said shell dividing the shell into two compartments, said partition including a perforate cylindrical wall spaced from the circumferential wall of said shell, and circumferentially inclined louvers shielding the perforation, said louvers being offset on the inside of said cylindrical wall and being arranged in pairs.

6. A muffler comprising a cylindrical shell closed at its ends and having an inlet opening in one end and an outlet opening in the other end, two oppositely facing substantially cup-shaped baffles, each including a perforate cylindrical portion concentric with the shell arranged in said shell, and a louver overlying the inside face of each perforation and spaced therefrom a predetermined distance to regulate the effective size of the perforations.

7. A muffler having a cylindrical shell including end walls, an inlet fitting in one end wall, and a plurality of ports in the other end wall, a substantially cup-shaped baffle including a perforate cylindrical portion concentric with and arranged in said shell, and louvers on the inside face of said cylindrical wall, one shielding each of the perforations therein.

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