

Aug. 5, 1941.

B. B. CARY ET AL

2,251,880

MUFFLER AND SILENCER CONSTRUCTION

Filed April 24, 1936

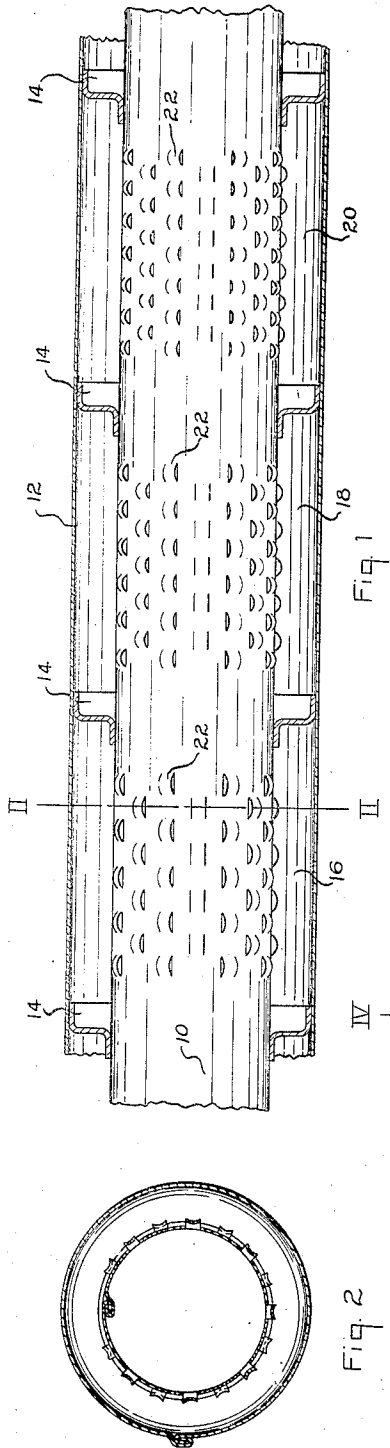


Fig. 1

Fig. 2

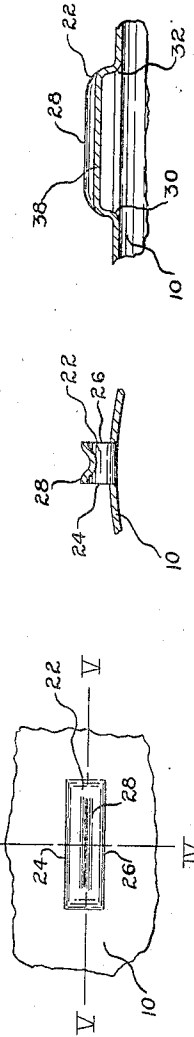


Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

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2,251,830

MUFFLER AND SILENCER CONSTRUCTION

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Application April 24, 1936, Serial No. 76,114

11 Claims. (Cl. 131—48)

The present invention relates to improvements in mufflers for internal combustion engines, intake silencer and similar sound attenuating structure and the method of making the same and constitutes a continuation in part of our copending application Serial No. 58,799, filed January 13, 1936, on which Patent No. 2,070,543 issued February 9, 1937.

In muffler and silencer constructions for attenuating sound waves of gas flow it is the general practice to provide ports or openings in the conduit structure for diverting or breaking up the flow or for bringing the conduit structure into communication with acoustic filter or resonator chambers. For the most part in commercial constructions the conduit structure has been perforated with circular openings although to a limited extent other types of openings have been proposed, but their use has been limited because of cost of production and general absence of any particular advantage over circular openings.

It has been definitely established that the flow of gases along perforated conduit structure, particularly in mufflers and silencers of the acoustic tube type, will create high frequency sounds or "whistling" where wall structure transversely of the gas flow is of a character provided by circular openings or the like.

Thus it becomes the primary object of the present invention to provide a novel perforated wall structure for the conduit structure of mufflers and silencers and method of making the same which may be inexpensively fabricated and does not possess the objections to prior structures.

Another object is to provide an improved perforated conduit section for use in mufflers, silencers and the like, in which no stock is removed by the perforating operation and the strength of the conduit is not materially decreased and may even in some cases be increased.

A further object is to provide an improved perforated conduit section for acoustic tube type mufflers and silencers in which the gas flow is straight through the section and the perforations open into acoustic filter chambers or resonators.

These and other objects and advantages which reside in the specific details of construction will appear from a consideration of the following description of our invention when considered in connection with the appended claims and accompanying drawing, wherein,

Fig. 1 is a side elevational view partly shown in cross-section showing our improved conduit construction,

Fig. 2 is a cross-section taken on line II—II of Fig. 1,

Fig. 3 is an enlarged fragmentary plan view of our improved louver structure,

Fig. 4 is a cross-sectional view taken on line IV—IV of Fig. 3,

Fig. 5 is a cross-sectional view taken on line V—V of Fig. 3,

Fig. 6 is a fragmentary enlargement of the section of our improved conduit structure as shown in Fig. 2, and

Fig. 7 is a view similar to Fig. 6 of a modified construction showing the louvers positioned on the inside of the conduit.

Referring to Fig. 1, a conduit 10 is shown which in connection with its embracing structure may be a complete muffler or it may be only a section of a muffler as disclosed in our copending application above mentioned. While we have shown the conduit 10 encased by a tube 12 defining with partitions 14, acoustic chambers 16, 18 and 20, it is to be understood that our improved conduit structure may be used in mufflers and silencers in which the gas flow passes through the perforated wall of the conduit and traverses other than a straight through course.

Preferably, the conduit 10 is fabricated from flat sheet stock and after being provided with perforations or louvers 22 is then formed into a tube. The construction of the perforations or louvers 22 constitutes the essence of the present invention, being best shown in Figs. 3 to 6 inclusive. As should clearly appear, each louver 22 is formed by piercing the conduit 10 along parallel axially extending lines defining the sides 24 and 26. Accompanying the piercing operation is a drawing operation which produces the arch or baffle 28. Referring to Fig. 5 the arch 28 is shown as a continuation of the wall structure of the conduit 10 with the points of connection between the arch and conduit curved as at 30 and 32 to eliminate any abrupt shoulders transversely disposed to the direction of gas flow. The area of opening in the conduit 10 defined by each louver 22 is dependent upon the length of the arch 28 and its degree of deflection out of the curvilinear surface of the conduit. As shown in Fig. 1 the louvers 22 opening into the chambers 18 and 20 are smaller and more numerous than those opening into the chamber 16. In practice it has been found by regulating the size and number of the louvers 22 that the attenuating characteristics of the acoustic chambers can be regulated. With the arrangement shown in Fig. 1 higher frequency sound waves may be attenuated by the chambers

18 and 20 than by the chamber 16. Moreover, tests appear to indicate that our particular louver construction possesses inherent sound wave attenuating characteristics in addition to its important feature of functioning without creating any sounds produced by the rapid travel of the gases through the conduit 10. We have observed the fact that the attenuating characteristics of our louver construction when used in acoustic type tubes and mufflers and silencers may be varied by regulating the height of the arch. Under some conditions the degree of attenuation has been increased by lowering the height of the arch. As this accordingly reduces the area of opening between the arch and conduit a large number of closely positioned louvers may be required which is possible without objectionable reduction in the strength of the conduit with our louver construction. In Fig. 6 the openings between the conduit 10 and arch 28 upon opposite sides of the latter are designated by reference characters 34 and 36. To strengthen the arch 28 so as to avoid any possibility of the same being crushed inwardly during handling or assembling during the course of manufacture the same may be reinforced with a longitudinally extending rib 38.

We have found that our louver structure may be located on the inside of the conduit as well as on the outside and that the advantages and results accomplished are substantially identical. In Fig. 7 the louvers 38 are shown extending inwardly upon the inside of the tubular conduit 40. The louvers 48 may be identical in construction with the louvers 22, however, as shown the rib has been omitted from the arch for the reason that with the louvers located upon the inside of the conduit there is no need to strengthen the same as they are well protected against any damage due to handling and assembling during the course of manufacture. The construction shown in Fig. 7 has the particular advantage that the partitions 14 for example, may be readily inserted over the conduit with no provision being made to clear the louvers as was disclosed in the aforesaid co-pending application. As will appear from Fig. 5 the outer contour of the arch is curved at the ends so that with the louvers located upon the inside of the conduit no abrupt corners are provided which might create "whistling."

It should be particularly noted that, with the louvers located on the inside or the outside of the conduit section, the opening through the wall of the conduit is defined by structure disposed in a plane parallel to the direction of gas flow. This is one of the structural characteristics of our perforated conduit structure which is considered to materially contribute to the fact that no objectionable high frequency sound waves are experienced when the construction is used in mufflers for internal combustion engines of the straight or semi-straight through type in which the exhaust gases at high velocity pass along the perforated conduit section. It will be appreciated that by perforating the conduit section without the removal of any metal, the wall structure is not weakened and that the total ported area per unit area of conduit may be varied over a greater range than is practically possible in constructions in which conventional forms of perforations such as circular holes and the like are used.

Some of the advantages of our preferred form of the invention may be obtained by providing

openings in the conduit section having leading and trailing edges axially aligned of the section and defined by a curved portion deflected out of the general contour of the wall of the section; the curved portions being disconnected over the central part of the opening. For example, the central portion of the arch 28 may be punched out or the arch defining portion of the section pierced transversely and the opening drawn with curved trailing and leading edges with overlying baffle portions.

We anticipate the broad application of the principles of our invention to mufflers and silencers and other sound attenuating structures in which there is desired that the sound waves or gas flow or both pass through a wall structure into another chamber or defined space. For this reason we desire to broadly claim our louver construction without limitation to associated structure in connection with which its use may be found desirable.

Having described our invention what we claim and desire to protect by Letters Patent is:

1. In muffler constructions and the like, a conduit section forming a passage for exhaust gases, acoustic wave attenuating structure embracing said conduit, louvers defined in the wall of said conduit, said louvers being formed from continuous portions of said wall radially disposed out of the general contour of said wall to provide arches, said wall having openings bridged by said arches, and additional openings defined by said arches and wall upon opposite sides of said arches constituting continuations of said first openings, said arches being axially disposed of said conduit and paralleling the direction of flow of said gases.

2. In muffler constructions and the like of the acoustic tube type, a perforated conduit section defining a free passage for gases along its length, portions of said section along its length being disposed out of the general contour thereof to define arched louvers disposed parallel of the longitudinal axis of said conduit, the radially disposed edges of said conduit and louvers defining passages through said conduit opening tangentially along the outer surface of said conduit on opposite sides of said arched louvers.

3. A section for mufflers and the like forming a conduit for the gases, louvers in the wall of said section in the form of arches formed from deflected portions of said wall, said louvers being connected with said wall only at the spaced ends of the arch, each of said louvers forming with said wall, a pair of openings at each side of the arch which merge into a single opening in said wall shielded by each louver.

4. A muffler having an outer imperforate shell, and an inner conduit for gases and sound waves, said conduit having openings therein through which gases and sound waves may pass, said openings comprising parallel slits extending substantially in the direction of the flow of gases in said muffler and separated entirely from each other by uncut metal, the metal of said conduit between pairs of said slits being offset beyond a surface of said conduit and the size of the openings being determined by the extent to which the metal between said pairs of slits is offset.

5. A shell for a muffler having perforations therein comprising pairs of slits arranged adjacent to each other and having the metal between said slits offset beyond a surface of said shell and integrally connected at both ends with said shell, the size of the perforations being de-

terminated by the extent to which said metal between slits is offset.

6. A shell for a muffler having perforations therein comprising pairs of slits arranged adjacent to each other and entirely separated from each other by uncut metal and having the metal between said slits offset beyond a surface of said shell, the size of the perforations being determined by the extent to which said metal between slits is offset, the offset metal being integrally connected with said shell at opposite ends thereof.

7. A shell for a muffler having perforations therein comprising pairs of slits arranged adjacent to each other and having the metal between said slits offset beyond a surface of said shell to space the sides of said offset metal from the undeformed metal of the shell at a distance to form openings of the desired size, both of the ends of said offset metal being integrally connected with said shell, said slits extending in a direction approximately lengthwise of said shell.

8. A shell for a muffler having perforations therein comprising pairs of slits arranged adjacent to each other and having the metal between said slits stretched in the direction of its length to offset the same with relation to the surface of said shell, both of the ends of said offset metal being integrally connected with said shell and extending crosswise of the length of said shell, said shell having openings at said slits, the

areas of which openings are determined by the extent of said offset.

9. A shell for a muffler having perforations therein comprising pairs of slits arranged adjacent to each other and entirely separated from each other by uncut metal and having the metal between said slits offset outwardly beyond the outer periphery of undeformed portions of said shell, said offset portions forming substantially tangentially directed openings in said shell.

10. A shell for a muffler having perforations therein comprising pairs of slits arranged adjacent to each other and entirely separated from each other by uncut metal and having the metal between said slits offset inwardly beyond the inner surface of said shell, whereby the exterior surface of said shell is free from projections and whereby apertures in said shell are directed approximately tangentially with reference to said shell.

11. A muffler shell having a series of offsets spaced from each other and having portions thereof extending substantially lengthwise of the direction of flow severed from said body portion to form apertures through which sound waves may pass, the opposite ends of said offsets being integrally connected with the body portion of said shell.

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