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COMBINATION TAIL PIPE AND MUFFLER

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This invention relates to a combined muffler and tail pipe for internal combustion engines or the like, and more particularly to a simple and inexpensive device for reducing the exhaust gas noise without materially increasing the back-pressure of the engine.

Present day automobile engine noise silencing systems generally include a pipe which has one end connected to the exhaust manifold of the engine. The pipe is curved downwardly and is attached to a muffler having a comparatively large diameter and length. A tail pipe is usually attached to the muffler to conduct the exhaust gases to the atmosphere. The muffler and tail pipe are disposed below and supported by the chassis frame and because of the construction of the chassis frame which includes cross-frame members longitudinally spaced along the chassis frame and the other vehicle parts such as the drive shaft and rear axle located below the chassis frame, it is oftentimes difficult to position the muffler beneath the chassis frame. In other words, a particular muffler possessing the sound-deadening characteristics needed for efficiently operating a given engine could not be utilized because of the lack of space to mount the same beneath the chassis frame. It is, therefore, the primary objective of the present invention to provide a unitary structure leading from the engine to the atmosphere which can be shaped to conform to the underside of the chassis frame and which will efficiently muffle or deaden the engine exhaust explosions with a minimum of back-pressure without the need of a bulky, cumbersome separate muffler in addition to the tail pipe.

A further object is to provide combined muffler and tail pipe structure comprising a single pipe which may be of any desired length and preformed in irregular shapes to conform to the contour of the underside of the vehicle without impairing the noise silencing efficiency of the structure.

A still further object is the provision of an inexpensive combined muffler and tail pipe structure which includes a single corrugated tube enclosed by a single pipe which are easily assembled together.

The foregoing and other important objects and desirable features inherent in and encompassed by the invention together with many of the purposes and uses thereof will become readily apparent from a reading of the ensuing description in conjunction with the annexed drawings, in which:

Figure 1 is a side elevational view of a motor truck chassis frame equipped with a new and improved combined muffler and tail pipe;

Figure 2 is a plane view of the combined muffler and tail pipe detached from the chassis frame;

Figure 3 is an enlarged detail view, in section, taken substantially along line 3—3 of Figure 2;

Figure 4 is a fragmentary sectional view taken substantially along line 4—4 of Fig. 2; and

Figure 5 is a view similar to Figure 2 showing a modification of the invention.

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Referring to the drawings, wherein like reference characters designate like elements throughout the various views, there is shown a motor truck chassis frame 10 comprising a pair of laterally spaced side sill members 11 (one of which is shown) interconnected by a plurality of longitudinally spaced cross members 12. An internal combustion engine 13 is secured to the forward end of the chassis frame 10 and is provided with an exhaust manifold 14 on one side thereof.

The combined muffler and tail pipe structure, designated generally by numeral 15, extends rearwardly from the exhaust manifold 14 to rear of the chassis frame 10 or other appropriate point where the exhaust gases are expelled to the atmosphere. The combined muffler and tail pipe structure 15 is supported by brackets 16 or other suitable means attached to the side sill members 11.

The combined muffler and tail pipe structure 15 includes a steel pipe 17 which serves as the outer casing for the structure 15. One end of the pipe 17 is flared outwardly, as best shown in Figure 4, to provide a flange 18. A collar 19 which encircles the pipe 17 has an annular surface 20 for engaging the flange 18 and a plurality of spaced apertures 21. Bolts 22 are shown extending through the apertures 21 into aligned threaded recesses formed in the exhaust manifold 14 to tightly clamp one end of the pipe 17 to the manifold.

Inserted within the pipe 17 and having substantially the same length as the pipe is a flexible corrugated tube 23. The ends of the tube 23 are welded to corresponding ends of the pipe 17. As best shown in Figures 3 and 4, the rounded crest portion 24 of each corrugation 25 abuts the interior surface 26 of the pipe 17. It will also be noted that the corrugations 25 are spaced along the entire length of the pipe 17 and lie in planes normal to the axis of the pipe 17 to form a series of successive ring-like expansion pockets or chambers 27, each chamber 27 being defined by the crest portions 24 of adjacent corrugations 25, the valley portion 28 joining the successive crest portions and the interior surface 26 of the pipe 17. A plurality of apertures 29 are formed in the valley portion 28 of each corrugation 25 to provide passages for the flow of the exhaust gases to and from each expansion chamber 27.

In operation, the hot exhaust gases which are emitted by the engine 13 under pressure enter the tube 23 at one end thereof and flow comparatively freely therethrough to the opposite end where they are discharged to the atmosphere. It will be obvious that by constructing the muffler and tail pipe in this manner the back pressure is practically negligible since there are substantially no obstacles in the path of the exhaust gases to impede the flow of the same. While the exhaust gases are flowing through the tube 23 a percentage of the flow is allowed to enter the expansion chambers 27 where the pressure of the gases is decreased suddenly to deaden the explosion noises. Inasmuch as each chamber 27 is separated from the atmosphere by a thin metallic wall section (pipe 17) the exhaust gases which enter the chambers 27 are rapidly cooled to further decrease the pressure of the gases and to lessen the possibility of explosions of the gases in the muffler and tail pipe structure 15 by lowering the temperature of the same. From the foregoing it will be appreciated that the velocity of the exhaust gases flowing through the structure 15 is decreased by continually lowering the pressure of the gases as the flow from one end of the structure to the other to consequently decrease the objectionable exhaust noise of the engine 13.

It will also be clear from the foregoing that the combined muffler and tail pipe structure 15 is not only efficient

in operation but simple and inexpensive to manufacture. In order to construct the structure 15 it is only necessary to insert a length of flexible corrugated tubing having apertures drilled into the valley portion of each corrugation in a straight piece of steel pipe having a predetermined length. The ends of the tube are then welded to respective ends of the pipe and the entire assembly is bent or formed in any desired configuration. Inasmuch as the tube is flexible there is no danger that the forming operation will cause the tube to buckle or break. Furthermore, the various bends and curves formed in the pipe tend to maintain the tube snugly and securely within the pipe. The fact that the structure may be formed in any desired configuration without impairing the operating efficiency of the same is deemed extremely advantageous. Heretofore in certain installations employing a conventional muffler and tail pipe the efficiency of the exhaust system had to be sacrificed to accommodate the equipment in the vehicle because of space limitations. The combined muffler and tail pipe structure 15, once it has been formed and adapted for a particular vehicle, is rigid and will remain rigid and free from rattles or other obnoxious noises during the period of use of the structure and for all practical purposes is a single, unitary structure.

In certain installations it is not necessary to employ a flexible corrugated tube which extends fully from one end of the pipe to the other end. As shown in Figure 5, a corrugated tube 30 of the same construction as tube 23, but having a length less than the outer sheath or pipe 17, has one end secured to a pipe 31 adjacent an attaching collar 32. The pipe 31 and pipe 17 are substantial duplicates in function and construction.

The embodiment of the invention chosen for the purposes of illustration and description herein is that preferred as the result of selective tests based upon the requirements for achieving the objects of the invention and developing the utility thereof in the most desirable manner, due regard being had to existing factors of economy, simplicity of design and construction, production methods and the improvements sought to be effected. It will be appreciated, therefore, that the particular structural and functional aspects emphasized herein are not intended to exclude, but rather to suggest, such other adaptations and modifications of the invention as fall within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A combined muffler and tail pipe assembly for internal combustion engines comprising a single gas-imperious pipe extending from the exhaust manifold of the engine to the area where the exhaust gases are expelled to the atmosphere; a single flexible corrugated tube having substantially the same length as said pipe disposed within and immovable with respect to said pipe, the crest portion of each of the corrugations tightly abutting the interior surface of said pipe to provide a plurality of spaced ring-like pockets, said pockets each being defined by crest portions of successive corrugations, the interior surface of said pipe, and the respective valley portion joining successive corrugations, said valley portions being provided with a plurality of spaced apertures for establishing gas communication between said tube and said pockets.

2. A combined muffler and tail pipe assembly for internal combustion engines comprising a single gas-imperious pipe extending from the exhaust manifold of the engine to the area where the exhaust gases are expelled to the atmosphere; a single conduit having substantially

the same length as said pipe for conducting the exhaust gases from the engine to the atmosphere, said conduit being disposed within and immovable with respect to said pipe, said conduit being formed to partially define a plurality of gas expansion chambers spaced along the length of said pipe, said chambers being interposed between the interior surface of said pipe and the outer surface of said conduit, each of said expansion chambers being in gas communication with the interior of said conduit.

3. A combined muffler and tail pipe assembly for internal combustion engines comprising a single rigid, gas-imperious pipe of uniform diameter throughout its length extending from the exhaust manifold of the engine to the area where the exhaust gases are expelled to the atmosphere; a single flexible conduit disposed within and immovable with respect to said pipe for conducting the exhaust gases from the engine to the atmosphere, said conduit being formed to partially define a plurality of means spaced between said conduit and said pipe for allowing the exhaust gases to expand, said means being disposed along the entire length of said conduit and each means being spaced from an adjacent means a distance less than the diameter of said pipe.

4. The combination as set forth in claim 3, in which said means includes a plurality of ring-like expansion chambers.

5. A combined muffler and tail pipe assembly for directing exhaust gases from an engine to the atmosphere including a rigid, deformable, elongated pipe; said pipe being capable of retaining its deformed shape; a flexible conduit disposed within and immovable with respect to said pipe; said conduit being formed to partially define a plurality of means spaced between said conduit and said pipe for allowing said gases to expand, each of said means being spaced from an adjacent means along the length of said pipe a distance less than the diameter of said pipe.

6. The combination as set forth in claim 5, in which said means includes an expansion chamber interposed between said pipe and conduit.

7. A combined muffler and tail pipe assembly for internal combustion engines comprising a pipe of uniform diameter throughout its length extending from the exhaust manifold for directing exhaust gases to the atmosphere, said pipe being gas-imperious; and structure disposed within said pipe and formed to partially define a plurality of expansion chambers disposed within said pipe and spaced along the length of said pipe, said expansion chambers being fixed with respect to said pipe, each of said expansion chambers being in gas communication with the interior of said pipe and being spaced from an adjacent expansion chamber a distance less than the diameter of said pipe.

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