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MUFFLER

Filed March 9, 1936

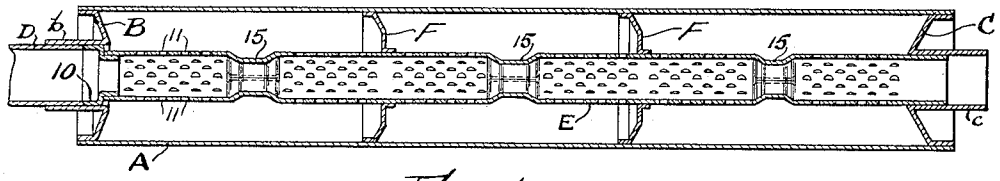



Fig. 1.

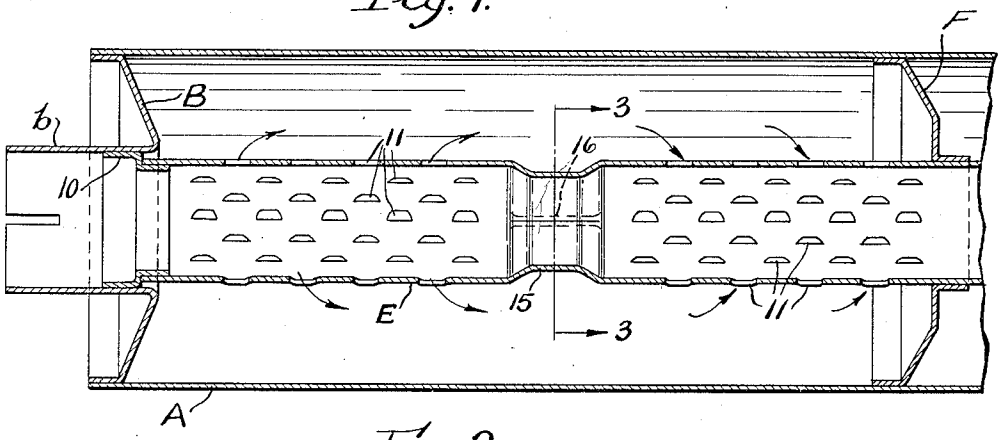



Fig. 2.

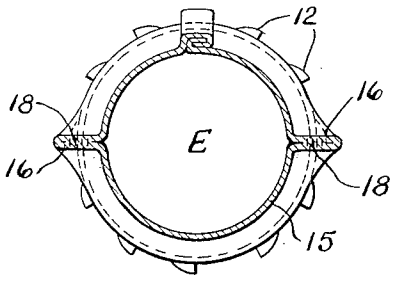



Fig. 3.

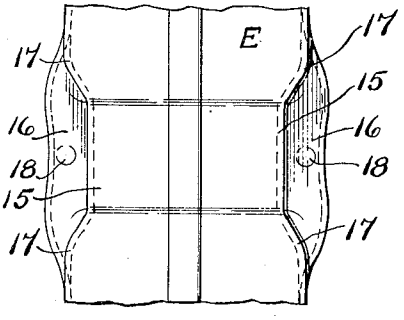



Fig. 4.

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# UNITED STATES PATENT OFFICE

2,047,443

## MUFFLER

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11 Claims. (Cl. 181—44)

This invention relates to improvements in mufflers or silencers, such for example as are used for reducing the noises accompanying the flow of gases in the exhaust or intake of internal combustion engines.

One of the objects of this invention is to provide a shell or tube for a muffler of this kind in which the shell or tube has one or more restrictions or contracted portions of improved construction. Another object of this invention is to provide a muffler of this kind with a shell or tubular member having an integral restriction formed therein. Another object of the invention is to provide a tubular member or shell for a muffler with an integrally formed restriction therein of novel construction and so formed that the shape of the restriction will not be changed by internal explosions which may occur in the muffler. Another object of the invention is to provide a muffler with a tubular member or shell having a restriction formed by bending a portion of the metal at the restriction inwardly toward the axis of the shell and forming outwardly extending folds or fins with the excess metal about the restriction, and then securing the metal of the folds or fins against displacement out of their folded positions. Further objects of the invention are to improve the construction of mufflers in other respects hereinafter specified.

The muffler shown in the accompanying drawing is intended primarily for use in connection with the silencing of noises accompanying the exhaust of an internal combustion engine, but it will be understood that it is not intended to limit this invention to mufflers of this kind, since the same may be used for other purposes such, for example, as the silencing of the intake of an engine.

In the accompanying drawing:

Fig. 1 is a longitudinal central sectional view of a muffler embodying this invention.

Fig. 2 is a fragmentary longitudinal central sectional view thereof, on an enlarged scale.

Fig. 3 is a fragmentary transverse section thereof, on line 3—3, Fig. 2.

Fig. 4 is a fragmentary longitudinal view of the restricted portion of the shell shown in Fig. 2.

Restrictions in tubular members or shells of mufflers may be used in connection with any of the shells of the muffler, in connection with any type of muffler, and such restrictions may be used for any suitable purpose, for example, to increase the flow of gases and sound waves into any suitable type of resonator or silencing chamber. In order to illustrate one application of restrictions forming the subject matter of this invention, a very simple type of muffler is shown in Fig. 1 and partly in Fig. 2, but this muffler is shown for purposes of illustration only, and it will be understood that tubes or shells having restrictions formed therein in accordance with this invention may be used in connection with any other desired or suitable type of muffler.

In the muffler shown in Fig. 1, A represents the outer imperforate shell of the muffler, the outer ends of which are closed by means of heads B and C, and head B at the inlet end of the muffler being provided with an inlet passage which may be in the form of a sleeve *b* forming a part of the inlet head, and the discharge head C may be provided with a similar integral tubular portion *c* with which the tail pipe of the muffler (not shown) may be connected. D represents the exhaust pipe which, in the construction shown, telescopes within the sleeve *b*. The muffler also includes an inner shell or conduit E which, in the construction shown, extends substantially throughout the length of the muffler and receives gases and sound waves at one end thereof from the exhaust pipe D and discharges the exhaust gases at the other end thereof through the tubular portion *c* of the discharge head C and through any tail pipe which may be connected therewith. The discharge end of the inner shell or conduit may be suitably secured to the discharge head, for example, by telescoping the same into the tubular portion *c* thereof and the receiving end of the inner shell or conduit may be secured to a shouldered portion of a sleeve 10, another shouldered portion of which may be secured to the head B, for example, within the tubular portion *b* thereof.

In the particular muffler shown, the inner shell or conduit is provided with a plurality of apertures 11 of any suitable kind which may be arranged in groups lengthwise of the inner conduit or shell, and one or more intermediate baffles or heads F may be provided, if desired, those shown extending from the inner conduit or shell to the outer shell. The apertures 11 may be of any suitable or desired shape or form, and in the particular construction illustrated, the apertures may be formed by making longitudinal slits in the shell or conduit E and forcing the metal at one side of each slit outwardly to form louvers or deflectors 12 which tend to impart to the gases and sound waves passing out of the apertures 11 a movement in a tangential direction in the chamber formed between the inner and outer shells.

In many types of mufflers, it has been found

that a marked increase in silencing effect is obtained by providing between adjacent groups of perforations in the inner shell or flow conduit a slight restriction or resistance to the flow of gases, so that a larger proportion of the gas and sound waves entering the conduit is forced to flow outwardly through a set of perforations arranged ahead of the restriction into the chamber between the conduit or inner shell and the next adjacent shell, and then again into the inner shell or conduit through other perforations therein located in rear of the restriction in the shell. Such restrictions cause some of the sound waves and gases to by-pass the restrictions by passing around the exterior of the part of the shell having the restriction. Sound waves thus passing out of and into the inner shell, travel through a greater distance than sound waves travelling straight through the inner shell and upon returning into the inner shell, such by-passed sound waves are out of phase with sound waves travelling straight through, thus producing a silencing effect. In order to cause a larger proportion of the gases to flow into and out of the inner shell, in the manner described, restrictions in the inner conduit embodying this invention can be used to advantage. One or more restrictions of this kind may be provided in a shell or conduit, and in the construction shown in Fig. 1, three restrictions 15 are provided, each of which is located between two sets or groups of apertures. The restrictions are formed by forcing or pressing some of the metal at a portion of the shell or conduit inwardly toward its axis. Since metal is substantially non-compressible, it has been found that these restrictions can be most easily and conveniently formed by forcing the excess metal at the restriction radially outwardly to form longitudinal folds in which the excess metal at the restricted portion of the shell is overlapped or folded back on itself as indicated at 16. These fins or folds 16 gradually taper or decrease in radial dimension as they approach the portion of the tube or shell of unchanged diameter. In order to prevent these restrictions from producing excessive resistance to flow through the flow conduit or shell, the opposite ends of the restricted portions preferably taper or incline toward the portions of the shell of unchanged diameter as indicated at 17.

It frequently happens that because of improper combustion of fuel in an engine, explosions occur in the exhaust, and it is desirable to prevent such explosions from changing in any way the arrangement or proportion of the parts within the muffler. Since generally the restrictions in the flow conduit or shell are carefully designed of definite size and proportions, any change in such restrictions may, of course, result in a material change in the silencing effect produced by the muffler. In order to prevent damage to the restrictions or change of shape or proportions of the same, means are provided for securing the metal of the shell at the folds 16 in correct and fixed relation to each other, since by preventing the opening or deformation of these folds, the balance of the restriction in the shell will not be deformed by explosions within the muffler, unless, of course, the explosions are of such violence as to destroy the muffler itself. The overlapping or juxtaposed parts of the metal at the folds may be secured in fixed relation to each other in any suitable or desired manner. For example, in the construction illustrated, the two parts of a fold may be secured together by spot welding as illustrated at 18.

The excess metal at the restriction may, of course, be formed into one or more folds, two being shown in the construction illustrated.

Restrictions of the kind described are very desirable in that they require no additional metal parts, being formed integral with a muffler shell, and furthermore, their shape or contour can be easily changed or modified as may be required in different types of mufflers. The restrictions described also form smooth walled gradually contracting and expanding flow passages so that no additional sounds or noises are produced by the gases flowing through the restrictions described. The restrictions, furthermore, have the added advantage that they can be made to be free from danger of deformation by internal explosions in the muffler by simply welding or otherwise securing the metal at the folds in fixed relation, so that restrictions will be of permanent contour and dimensions.

One or more restrictions of the kind described in the inner conduit of the muffler have also been found to eliminate or materially reduce the swishing or hissing noises frequently made by perforate conduits in mufflers as heretofore constructed. This may possibly be due to the fact that the restrictions tend to cause the gases to pass mainly through the axial portion of the conduit and to reduce the flow of gases close to the wall of the conduit across the perforations in the conduit, or to the fact that a greater flow of gases through the perforations reduces this sound.

We claim as our invention:

1. A metal shell for a muffler having an integral portion of smaller diameter than adjacent portions of said shell, a part of the metal at said smaller portion being bent inwardly toward the axis of said shell and the remainder of said metal extending outwardly in the form of a fold.

2. A shell for a muffler, said shell having an integral neck portion of reduced diameter formed in a portion thereof, a part of the metal at said neck portion being formed into a fold in which two layers of the metal of said shell lie in contact, and means for permanently securing said two layers in their contacting positions.

3. A shell for a muffler, said shell having an integral neck portion of reduced diameter formed in a portion thereof, a part of the metal at said neck portion being bent toward the axis of said tube and another part of said metal being in the form of a fold extending outwardly with reference to the axis of said shell.

4. A muffler shell having an integral neck portion of smaller diameter formed between adjacent parts of greater diameter, a part of the metal at said neck portion being bent inwardly toward the axis of said shell and other parts of the metal at said neck portion extending outwardly in the form of folds.

5. A muffler shell having an integral neck portion of smaller diameter formed between adjacent parts of greater diameter, a part of the metal at said neck portion being bent inwardly toward the axis of said shell and other parts of the metal at said neck portion extending outwardly in the form of folds, and means for permanently securing the metal of said folds in fixed position.

6. A muffler having an outer shell and end heads having inlet and outlet openings, an inner shell connected with said inlet and outlet openings and having perforations arranged lengthwise there-

of, said inner shell having an integral neck portion of smaller diameter than adjacent portions of said shell and arranged in an imperforate portion of said inner shell, a portion of the metal of said inner shell at said neck portion being bent outwardly with reference to the axis of said inner shell to form folds.

7. A muffler having an outer shell and end heads having inlet and outlet openings, an inner shell connected with said inlet and outlet openings and having groups of perforations arranged in spaced relation lengthwise thereof, said inner shell having an integral neck portion arranged in an imperforate portion of said inner shell located between groups of perforations, whereby differences in pressure in said inner shell at opposite ends of said neck portion cause gases to flow out of said inner shell through perforations located in advance of said neck portion and into said inner shell through perforations located rearwardly of said neck portion.

8. A muffler having an outer shell, an inner shell arranged within said outer shell and provided with apertures throughout the greater portion of the length thereof through which gases and sound waves can flow into and out of said inner shell through the space between said shells, said inner shell having a portion thereof formed to extend inwardly to restrict the passage of gas and sound waves through said inner shell and force a portion of said gas and sound waves through said apertures to bypass said restricted portion of said inner cell.

9. A flow conduit for a muffler through which gases can flow from end to end of said conduit, said conduit having at least one restriction formed therein, the unrestricted portions of said conduit being of substantially uniform diameter throughout its length, said restriction consisting of an integral portion of said conduit bent toward the axis of said conduit, and a fold formed of excess metal of said restriction and extending outwardly with reference to the axis of said conduit.

10. A flow conduit for a muffler through which gases can flow from end to end of said conduit, said conduit having at least one restriction formed therein, the unrestricted portions of said conduit being of substantially uniform diameter throughout its length, said restriction consisting of an integral portion of said conduit bent toward the axis of said conduit, a fold formed of excess metal of said restriction and extending outwardly with reference to the axis of said conduit, and means connecting juxtaposed parts of said fold for securely holding said parts in fixed relation to each other.

11. A flow conduit for a muffler through which gases can flow from end to end of said conduit, said conduit having at least one restriction formed therein and having perforations arranged in advance and in rear of said restriction, said restriction consisting of an integral portion of said conduit extending toward the axis thereof and a longitudinally and outwardly extending fold formed of the excess metal of said restriction, and means for securing the parts of the fold in correct relation to each other.

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