

Feb. 29, 1944.

J. P. MARX

2,343,152

MUFFLER

Filed Feb. 12, 1942

2 Sheets-Sheet 1

Fig. 1.

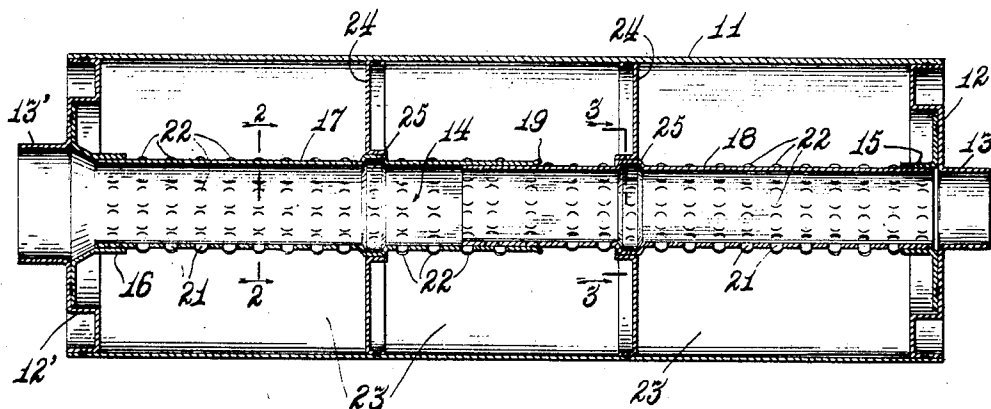


Fig. 2.

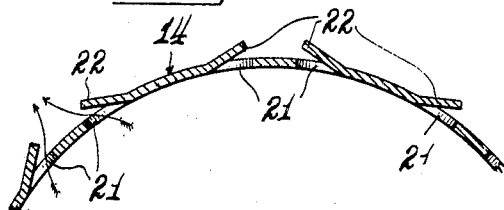


Fig. 3.

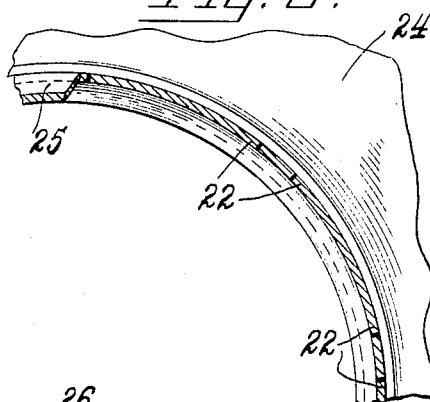


Fig. 4.

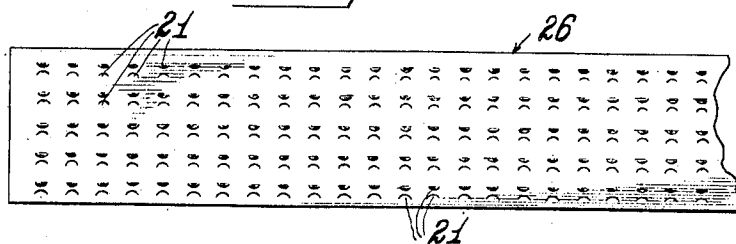
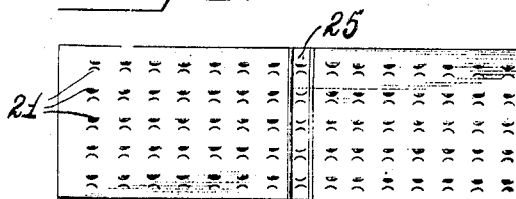


Fig. 5.



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2 Sheets-Sheet 2

Fig. 6.

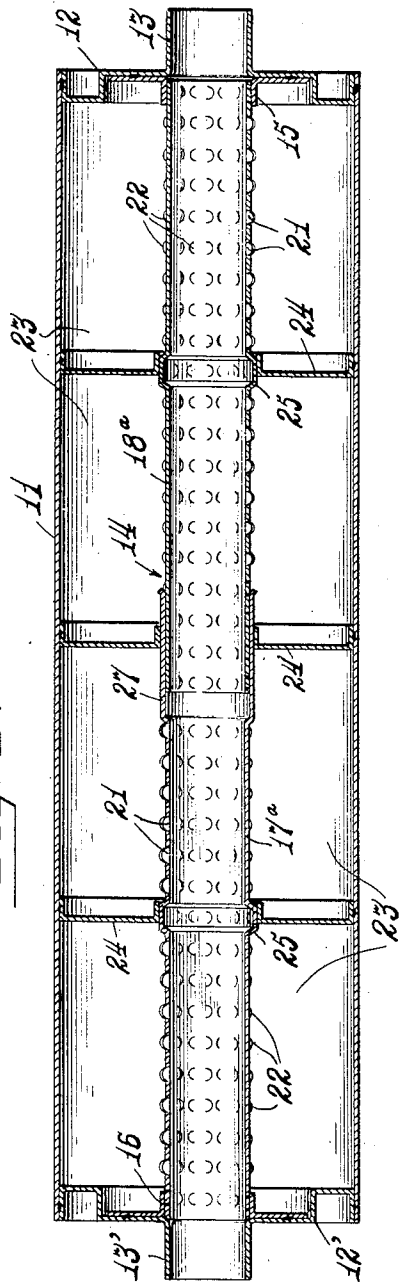


Fig. 7.

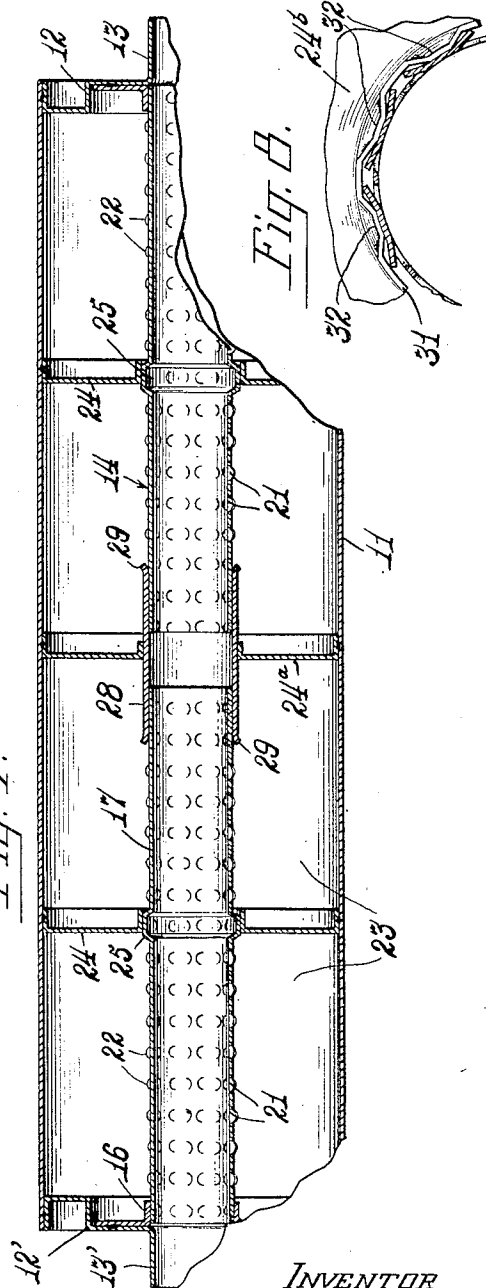
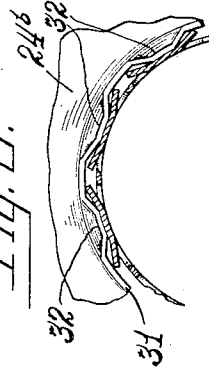


Fig. 8.



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MUFFLER

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18 Claims. (Cl. 181—48)

The invention relates to mufflers and particularly to an inexpensive muffler organization embodying novel structural characteristics for increasing the silencing effect thereof without retarding the flow of gases therethrough.

Known mufflers designed to silence the exhaust of internal combustion engines, or the like, obtain their maximum silencing effect only at the cost of increasing back pressure through the use of restrictions, tortuous passages or tangential and longitudinal deflection of the gases into an expansion chamber. Such mufflers, particularly those having means usually in the form of louvered perforations, which direct at least a portion of the gases in streams tangentially or longitudinally into or from an annular space surrounding a main passageway, frequently are the source of great annoyance because of the tendency of such uniformly pulsated streams of gases to set up a whistling noise or shell vibration. Also known types of mufflers having externally louvered perforations are impossible of mass production of interchangeable parts or from pre-fabricated pieces of stock but must be assembled from parts especially prepared for assembly into a muffler of a specific size or one having certain required muffling characteristics.

It is, therefore, an object of the invention to provide a muffler organization embodying novel means to cause hot exhaust gases and sound waves entering therein to be diffused into a turbulent flow so as to avoid localization of heat and eliminate objectionable exhaust sound waves and vibratory or whistling noises.

Another object is to provide a muffler having a substantially uniform exhaust passageway throughout its entire length to permit unrestricted flow of gases and thereby eliminate back pressure.

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

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

Another object is to provide a tubular conduit having means to facilitate its easy and inexpensive construction and installation in a muffler structure.

Another object is to provide a muffler having an exhaust passageway having all section areas equal to or larger than the section area of the

inlet pipe to the muffler and equal to or smaller than the section area of the outlet pipe so as not to impede the velocity of the gases and consequently eliminate back pressure.

5 Another object is to provide a muffler having a conduit with externally louvered perforations and means to facilitate leak and rattle proof mounting of the conduit within the muffler shell at and intermediate its ends.

10 Another object is to provide a two-piece conduit having a continuous unrestricted gas passageway therethrough with external louvers serving in some instances to deflect some gases through conduit perforations and in others to frictionally secure the two-piece conduit at its joining.

Another object resides in the method of fabricating a tubular conduit having external longitudinal and circumferential spaced pairs of louvered perforations and external gas proof circumferential mounting areas located therein irrespective of the relative spacing of the external louvered perforations.

25 The foregoing and such other objects of the invention as will appear hereinafter as the description proceeds, will be more readily understood from a perusal of the following specification, in which reference is had to the accompanying drawings, wherein:

30 Fig. 1 is a longitudinal sectional view through one embodiment of the improved muffler.

Fig. 2 is a transverse fragmentary sectional view through the louvered inner conduit, taken substantially on line 2—2 of Fig. 1.

35 Fig. 3 is a transverse fragmentary sectional view, taken substantially along line 3—3 of Fig. 1.

Fig. 4 is a plan view of a portion of a blank sheet, partially fabricated, used in making the perforated externally louvered conduit.

40 Fig. 5 is a plan view of a perforated sheet of selected size showing the external bead formed therein.

Fig. 6 is a longitudinal sectional view of a muffler illustrating another embodiment of the invention.

45 Fig. 7 is a longitudinal sectional view, similar to Fig. 6 but partially broken away, showing another modified form of construction.

Fig. 8 is a transverse fragmentary sectional view of a muffler conduit and partition, illustrating a modified form of partition mounting.

50 The mufflers illustrated in the drawings are of a type primarily designed for use in silencing the exhaust of internal combustion engines but, as will be understood as the description proceeds, the

invention may readily be embodied in other silencing devices specifically designed for use in association with other sound creating mechanisms.

In the embodiment illustrated in Figs. 1 to 5, the muffler consists of an outer cylindrical shell 11 having headers 12—12', one at each end thereof, which preferably are suitably flanged on their outer circumference to permit the headers to be welded to the shell as shown. Each of the headers is provided with an aligned axially located externally flanged opening 13—13' respectively, for connection with the usual inlet and outlet exhaust pipes. It is preferred that the flanged opening 13' be the same size at least, or substantially larger than the flanged opening 13 so as to avoid restriction of gases flowing through the muffler in the direction of header 12', as will be better understood as the description proceeds.

A conduit 14 is arranged within the shell 11 and is secured with its opposite ends in alignment with the flanged header openings by means of externally flanged sheet metal collars 15 and 16, thus providing a continuous passageway for gases. As shown, the collars 15 and 16 are telescoped respectively over the ends of the conduit and have their external flanges welded or otherwise secured against the inside faces of the respective headers 12—12'. The conduit 14 is of a size equal to or slightly larger than the diameter of the header opening 12 so that the flow of exhaust gases into the conduit is not restricted. The conduit preferably consists of two telescoping tubes 17 and 18, for a purpose to be more fully described in detail hereinafter, and at least the telescoped end of the tube 17 has an internal diameter but slightly exceeding the external diameter of the tube 18 whereby a relatively snug telescoping connection is afforded without restricting the passageway. If desired, the telescoped end of tube 17 may be flared outwardly slightly, as at 19, to guide insertion of the inner tube 18.

Silencing effect is obtained in the muffler by providing the conduit 14 with a plurality of perforations 21 having external louvers 22 which permit a portion of the gases and sound waves passing through the conduit to escape into the annular space between the conduit and the shell 11. These escaping gases return to said conduit also through said perforations and co-mingle with the main stream of gases passing therethrough. Maximum silencing efficiency with the least resistance to the flow of gases is obtained by arranging the louvered perforations in opposed pairs, as best illustrated in Fig. 2, so that the streams of gasses passing outwardly through each pair of perforations are directed toward each other by the opposed louvers so as to create a turbulent mass, as distinguished from a stream. This co-mingling of the gas streams effectively breaks up the otherwise uniform sound waves therein contained and further prevents streams of hot gases from flowing into direct contact with the shell 11. Accordingly, there is no localization of heat and premature burning out of the shell is avoided. Obviously the return flow of gases from the space between the conduit and the shell also is effectively disturbed by the divergence of the streams entering the main stream of gas flowing through the conduit. Because of the turbulence imparted to the gases entering the space between the shell and the conduit, sound waves entering the perforations with the flow of gases returning to the conduit will be out of phase with each other and because of this and the

variance in their velocity, said waves will all be out of phase with the sound waves in the stream passing straight through the conduit. Consequently, much of the sound will be eliminated.

An increased silencing effect is obtained by dividing the space between the conduit and the shell into a plurality of annular chambers 23. To this end one or more partitions 24 are provided therein. The partitions 24 preferably consist of annuluses having inner and outer circumferential mounting flanges, the latter being welded or otherwise secured to the shell 11 prior to insertion of the conduit 14. The inside diameter of the flanged inner circumference of the partition necessarily must be sufficiently large to permit extension of the externally louvered conduit therethrough. As a result, unless means is provided, preferably in the conduit, to engage the inner circumference of the partition, an annular space will remain between the conduit and said partition to permit leakage of gases from one chamber to the other. Such leakage or passage of gases frequently sets up a whistling sound or causes undue vibration of the partition and outer shell with its attending disturbing sound. Accordingly, the conduit 14 has external circumferential beads 25 suitably spaced longitudinally thereof to align with and fit snugly into the openings in the respective partitions when said conduit is properly positioned within the shell. The beads 25, therefore, serve a dual purpose of preventing passage of gases from one chamber to the other and provide a firm mounting for the conduit 14 intermediate its ends so as to prevent undue vibration thereof with its resultant disturbing sounds.

It is a feature of the present invention to provide the foregoing structure as a means of fabricating a muffler of any required length using partially fabricated stock sizes of sheet material for the conduit. As best illustrated in Fig. 4, a sheet of material 26 is initially blanked with a plurality of longitudinal and transversely aligned rows of pairs of opposed louvered perforations 21. These pre-fabricated sheets are used to provide conduit sections of such length as may be determined by the overall size of the muffler and the number of or spacing between partitions. Accordingly, the pre-fabricated sheet may be cut into standard lengths for forming conduits for muffler varying but slightly in their overall length. In production, the circumferential bead or beads 25 are not initially formed in the blank sheet 26 but are provided therein only after said blank (Fig. 5) has been cut to the necessary length. The position of the bead relative to the length of the conduit section is determined by the location of the partition 24 and frequently it coincides with one of the transverse rows of louvered perforations 21. When this occurs, the formation of the bead 25 substantially flattens the registering louvers into their perforations so as to prevent the escape of gases from the conduit at the beaded portions. After the bead 25 is formed the longitudinal edges of the sheet are brought together and butt or spot welded to form the tubular conduit.

In assembly, the shell 11 is initially fitted with header 12 and the partitions 24 are secured therein. The portion or tube 18 of the conduit 14 then is inserted through the open end of the shell and passed through the axial openings in partitions 24. Its entering end is then pressed or telescoped tightly into the previously mounted flanged collar 15. This telescoping of the parts is effected for a distance required to position the

bead 25 within the partition opening. Pressing the end of the conduit into the collar 16 effectively flattens out any louvers which may be contained on the telescoped portion. Naturally the louvers tend to retain their initial position, consequently, they bear tightly against the inner surface of the collar to increase the frictional binding of the mounting. After the tube portion 18 has been properly positioned, the other tube portion 17 is telescoped over its inner end sufficiently to position its external bead 25 within the circumferential opening in its respective partition 24. During the telescoping of the two tubes, any louvers contained on the inner telescoped portion of tube 18 also are substantially flattened and thereby frictionally increase the binding of the two tubes. The other header 12' then is fitted into place with its previously mounted flanged collar 16 similarly telescoped over the free outer end of the conduit tube 17. In some instances it may be practicable to mount the conduit tube 17 in the header collar 16 and subsequently mount the tube 17 and header 12' as a unit.

It should be obvious at this time that the exact length of the conduit tubes 17 and 18 is immaterial to the assembly inasmuch as any excessive length is readily compensated for by the telescoped relation of the parts and that the two-piece conduit 14 is rigidly held in place against axial or longitudinal displacement and rattling between the parts is definitely avoided by the tight frictional joinings. The exact positioning of the conduit tubes 17-18 is determined solely by the location of the partitions 25 which, as noted previously, must be secured within the shell prior to the conduit assembly.

In use, the end of the muffler having header 12 constitutes the front or inlet end of the muffler so that no obstruction to the free flow of gases through the conduit is afforded at any of the telescoped connections.

The muffler construction illustrated in Fig. 6 is substantially like that previously described except that in this instance the telescoped end of the conduit section 17a is enlarged circumferentially for considerable distance as at 27, so as to receive the opposed end of the other conduit section 18a. When the two sections are assembled, no restriction, however slight, to the free uninterrupted passage of gases therethrough is effected irrespective of which muffler end is used as an inlet.

In Fig. 7, the centrally located partition 24a carries an axially aligned sleeve 28 having outwardly flared ends 29, each to telescopically receive an end of tubular conduit portions 17. This structure is such as to facilitate the use, in a single muffler, of two identical conduit sections of a pre-determined length. Obviously any variation in the overall length of the muffler is compensated for by telescoping greater or lesser portions of the conduit sections into the sleeve 28.

In Fig. 8, the externally louvered conduit 14a is devoid of external circumferential beads but in this instance the internal circumferential flange 31 of the partition 24b is struck inwardly at spaced intervals 32 to contact the outside face of the muffler conduit between the louvers and thereby provide a firm support for the conduit and substantially prevent free passage of gases from one chamber to the other.

I claim:

1. A muffler having a conduit confined within an outer shell and forming a continuous passage from end to end thereof and having externally

louvered perforations over substantially its entire length through which gases and sound waves may pass to and from the space between said shell and said conduit, said conduit consisting of two tubes constructed to be telescoped partially one within the other without restricting the passage, and at least the end portion of one of said tubes having an internal diameter but slightly larger than the external diameter of the telescoping portion of the other tube whereby the louvers on the telescoped portion of the last named tube are substantially flattened when the tubes are telescoped so as to frictionally hold the tubes against relative movement.

2. A muffler having a conduit confined within an outer shell and forming a continuous passage from end to end thereof for a greater portion of the gases and sound waves entering said conduit and having externally louvered perforations over substantially its entire length through which a lesser portion of the gases and sound waves may pass to and from the space between said shell and said conduit, said conduit consisting of two tubes constructed to be telescoped partially one within the other without restricting the passage, and at least an end portion of one of said tubes having an internal diameter but slightly larger than the external diameter of the other tube to insure a relatively snug telescopic connection, the louvers on the telescoped portion of the inner tube being flattened when the tubes are telescoped to close their perforations.

3. A muffler having a conduit confined within an outer shell and forming a continuous passage from end to end thereof for a large portion of the gases and sound waves entering said conduit and having perforations over substantially its entire length through which a portion of the gases and sound waves may pass to and from the space between said shell and said conduit, said conduit consisting of two tubes partially telescoped one within the other without restricting the passage, and louvers over said perforations arranged to cause a turbulence in the gases and sound waves passing through said perforations, the louvers on the telescoped portion of the inner tube being flattened when the pieces are telescoped to close the apertures normally provided thereby.

4. A muffler having a conduit confined within an outer shell and forming a continuous passage for a portion of the gases and sound waves entering said conduit and having externally louvered perforations over substantially its entire length through which a portion of the gases and sound waves may pass to and from the space between said shell and said conduit, said conduit consisting of two substantially identical louvered tubes partially telescoped one within the other without restricting the continuous passage, the louvers on the inner telescoped tube portion being flattened when the pieces are telescoped to close the apertures normally provided thereby.

5. A muffler of the type described comprising an outer shell having inlet and outlet openings for exhaust gases, an inner conduit constituting a continuous passage between said openings, a chamber defined by the space between the shell and conduit, and a plurality of rows of louvered perforations in said conduit, said rows extending longitudinally over substantially the entire length of said conduit and being spaced apart circumferentially in pairs, and the louvers on each pair of perforations being integral on one longitudinal edge with the conduit and being disposed angularly towards each other outwardly to define op-

posed tangential openings to create a turbulence in the gases passing therethrough.

6. A muffler of the type described comprising an outer cylindrical shell, a header at each end of said shell having an externally flanged opening for connection with inlet and outlet pipes for exhaust gases, an internal tubular conduit substantially co-extensive with said shell, externally flanged collars one telescoped over each end of said conduit for securing it to the respective headers in axial alignment with the openings therein, a plurality of pairs of tangentially opposed externally louvered perforations in said conduit to allow passage of gases and sound waves into and out of the annular space between the shell and conduit, at least one partition dividing said space into annular chambers, said partition having a flanged opening to receive the louvered conduit therethrough, and a circumferential enlargement on said conduit arranged to fit snugly in said flanged partition opening to prevent direct passage of gases from one chamber to the other, the location of said enlargement coinciding with a plurality of louvered perforations which are held closed by its formation whereby a frictional binding is effected between the enlargement and partition flange.

7. A muffler of the type described comprising an outer cylindrical shell, a header at each end of said shell having an opening for connection with inlet and outlet pipes for exhaust gases, an internal tubular conduit substantially co-extensive with said shell, a reinforcing plate secured to the inside face of each header and having an inwardly turned flange surrounding an opening in axial alignment with the respective header openings, said flanges each telescopically receiving an end of said conduit, a plurality of pairs of tangentially opposed externally louvered perforations in said conduit to allow passage of gases and sound waves into and out of the annular space between the shell and conduit, at least one partition dividing said space into two chambers, said partition having an opening to receive the louvered conduit therethrough, an external circumferential bead on said louvered conduit arranged to fit snugly in said partition opening to prevent direct passage of gases from one chamber to the other, the location of said bead coinciding with a plurality of louvered perforations which are substantially closed by its formation, and the louvers of any perforations on telescoped portions of said conduit frictionally binding the complementary telescoped portion to retain the parts in place.

8. A muffler of the type described comprising an outer cylindrical shell, a header at each end of said shell having an externally flanged opening for connection with inlet and outlet pipes for exhaust gases, an internal tubular conduit substantially co-extensive with said shell, a reinforcing plate secured to the inside face of each header and having an inwardly turned flange surrounding an opening in axial alignment with the respective header openings, said flanges each telescopically receiving an end of said conduit, a plurality pairs of external tangentially opposed louvered perforations in said conduit to allow passage of gases and sound waves into and out of the annular space between the shell and conduit, at least one partition dividing said space into two annular chambers, said partition having a flanged opening to receive the louvered conduit therethrough, and an external circumferential bead on said conduit arranged to fit snugly in

said flanged partition opening to prevent direct passage of gases from one chamber to the other, said bead having a diameter at least equal to the largest diameter of the externally louvered conduit.

9. A muffler of the type described comprising an outer cylindrical shell, a header at each end of said shell having an externally flanged opening for connection with inlet and outlet pipes for exhaust gases, and internal conduit having a substantially uniform internal cross-section substantially co-extensive with said shell, externally flanged collars one telescoped over each end of said conduit for securing it to the respective headers in register with the openings therein, and a plurality of pairs of tangentially opposed externally louvered perforations over substantially the entire length of said conduit to allow passage of gases and sound waves into and out of the space between the shell and conduit, said conduit consisting of two tubular portions telescoped one into the end of the other, one of said portions having its telescoping end enlarged to snugly receive the opposed end of the other portion whereby any louvers on the inner telescoped portion are distorted inwardly sufficiently to prevent easy separation of the portions.

10. A muffler of the type described comprising an outer cylindrical shell, a header in each end of said shell having a flanged opening, a partition in said shell substantially midway between said headers having a sleeve axially aligned with said openings, an internal tubular conduit extending through said sleeve and connecting with said openings to provide a continuous passage for gas, said conduit being made of two axially aligned tubes having their opposed inner ends telescoped into said sleeve and their outer ends telescoped respectively in the flanges of the openings, a plurality of perforations in said conduit to permit the passage of gases into and from the partitioned spaces between the conduit and shell, and external louvers associated with said perforations to direct the flow of gases therethrough, the louvers in the telescoped portions of the conduit being substantially flattened during assembly to close their associated perforations and increase frictional binding of the telescoped connections.

11. A muffler of the type described comprising an outer cylindrical shell, a header in each end of said shell having a flanged opening, a plurality of partitions in said shell having openings aligned with the flanged openings, at least one of said partitions being arranged substantially midway between said headers and having an axially aligned sleeve in its opening, an internal tubular conduit extending through said sleeve and other partition openings connected at its ends with said flanged openings to provide a continuous passage for exhaust gases, said conduit being made of two axially aligned tubes having their opposed inner ends telescoped into said sleeve, a plurality of perforations in said conduit to permit the passage of gases into and from the partitioned annular spaces between the conduit and the shell, external louvers associated with said perforations to direct the flow of gases, and circumferential external beads in said tubes providing a support for the said other partitions, the louvers in the inner telescoped portion of the conduit and in the beads being substantially flattened to close their perforations and increase the frictional binding of the telescoped connection and partition mountings.

12. The method of constructing an inner tubular conduit for a muffler having louvered perforations therein, consisting in first striking a plurality of transverse rows of louvers in flat stock, cutting said stock to a required length, forming at least one transverse offset in the same direction as and in alignment with one transverse row of said louvers, the aligned louvers being flattened by such offsetting to close the apertures initially formed thereby, and finally rolling said flat stock into tubular form with the offset and louvers disposed outwardly.

13. The method of constructing an inner tubular conduit for a muffler having louvered apertures therein, consisting in first striking a plurality of pairs of louvers over substantially the entire area of a piece of flat stock, cutting said stock to a required length, forming at least one transverse offset in said stock, said offsetting flattening any louvers aligned therewith to close their respective apertures, and finally forming said flat stock into a tube with the offset and louvers disposed outwardly.

14. A muffler of the type described comprising an outer cylindrical shell, a header in each end of said shell having axially aligned openings, a partition in said shell substantially midway between said headers, a tubular conduit section mounted at one end in one of said headers and having its other end portion extending through an axially aligned opening in said partition, a second tubular conduit section mounted at one end in the other of said headers and having its other end portion telescoped into the end portion of the first named conduit section to provide a continuous tubular passageway between the openings in said headers, and means on one of said telescoped conduit sections to frictionally co-act with the complementary conduit section to prevent relative movement of said conduit sections at their joining.

15. A muffler of the type described comprising an outer cylindrical shell, a header in each end of said shell having axially aligned internally flanged openings, a partition in said shell substantially midway between said headers, a tubular conduit section having one end telescoped into the flanged opening of one of said headers and having its other end portion extending through an axially aligned opening in said partition, a second tubular conduit section having one end telescoped into the flanged opening of the other header and having its other end portion telescoped into the end portion of the first named

conduit to provide a continuous tubular passageway between the openings in said headers, and louvers on at least a part of each telescoping connection to frictionally co-act with the complementary part to wedge the parts in place and prevent movement of the conduit sections relative to each other and to the headers.

16. A muffler of the type described comprising an outer shell, a header in each end of said shell having axially aligned openings, a tubular conduit section mounted at one end in one of said headers and having its other end portion terminate within said shell substantially midway between said headers, a second tubular conduit section mounted at one end in the other of said headers and having its other end portion telescoped into the free end portion of the first named conduit section to provide a continuous tubular passageway between the openings in said headers, and a plurality of projections on one of the said telescoped conduit portions to frictionally co-act with the complementary conduit portion to prevent unintentional relative movement of said conduit sections.

17. A muffler of the type described comprising an outer cylindrical shell, a header in each end of said shell having axially aligned openings, a partition in said shell substantially midway between said headers, a tubular sleeve in said partition in axial alignment with the header openings, a tubular conduit section mounted at one end in one of said headers and having its other end portion telescoped into one end of said sleeve, a second tubular conduit section mounted at one end on the other of said headers and having its other end portion telescoped into the other end of said sleeve to provide a continuous tubular passageway between the openings in said headers, and means at least on the telescoped end portions of said sections to frictionally co-act with the sleeve to prevent movement of said conduit section relative to each other and to the sleeve.

18. The method of constructing an inner tubular conduit for a muffler consisting in first providing two lengths of tubing having externally louvered perforations over substantially their entire length, telescoping one end of one of said tubes into an end of the other tube so that the louvers on the inside tube portion are substantially flattened to frictionally bear against the inside surface of the outer tube portion to resist separation.

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