

Oct. 12, 1943.

W. H. POWERS

2,331,344

SILENCER

Filed March 31, 1941

2 Sheets-Sheet 1

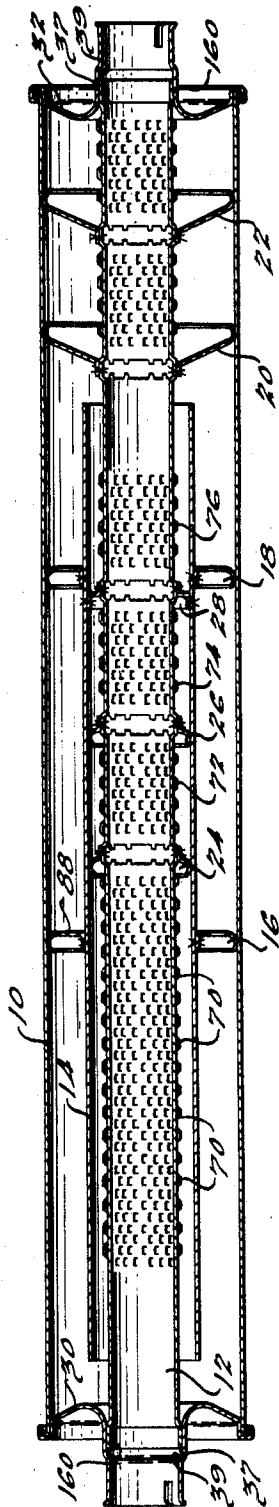


FIG. 2.

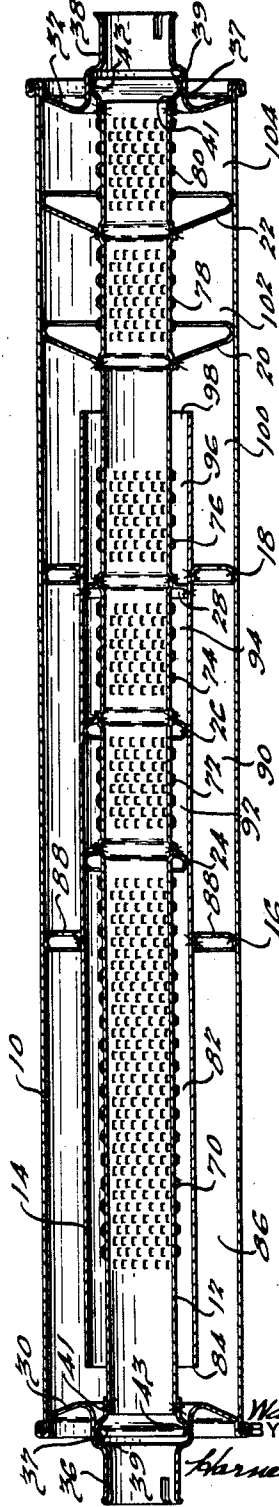


FIG. 1.

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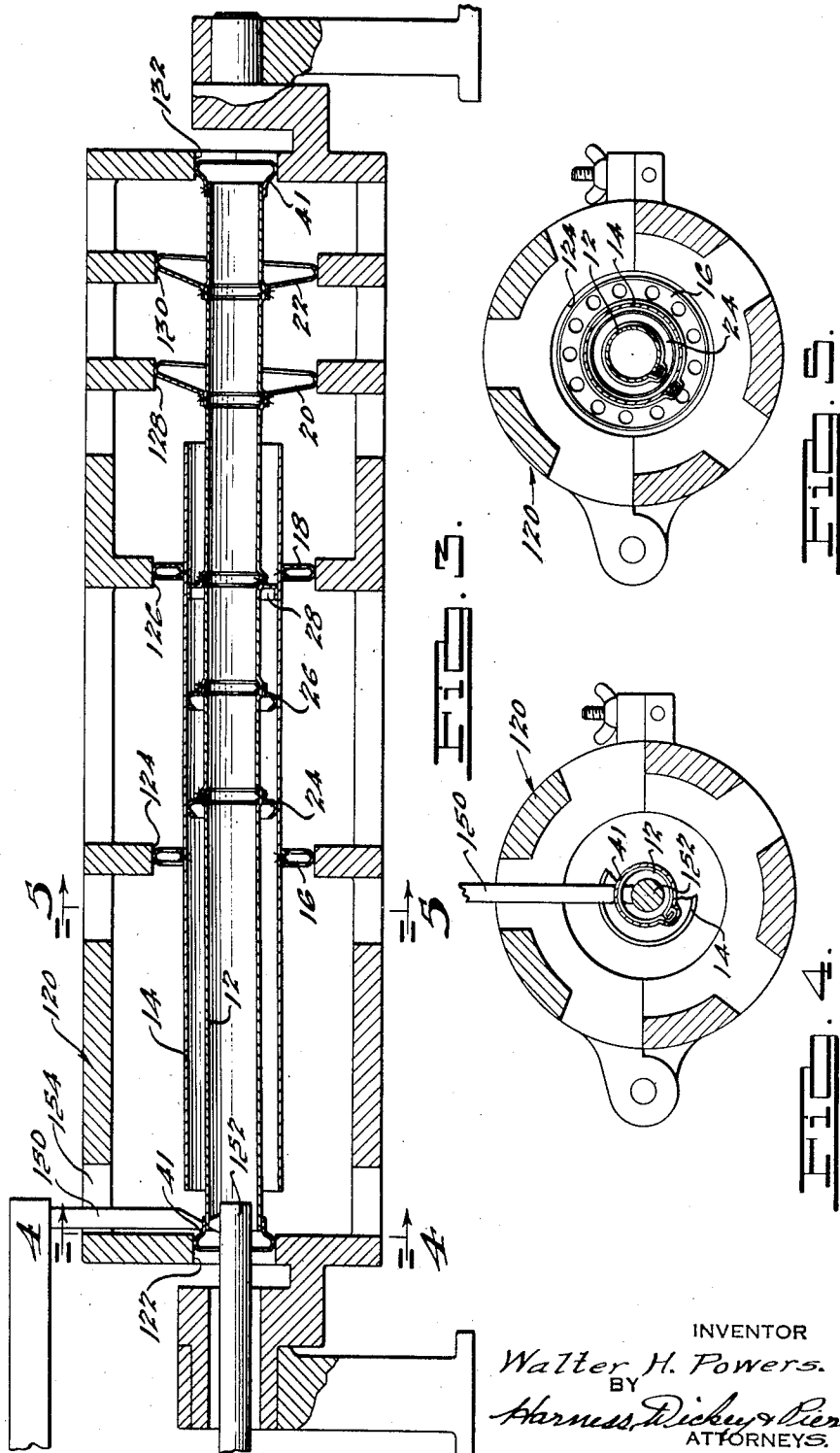
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2 Sheets--Sheet 2



UNITED STATES PATENT OFFICE

2,331,344

SILENCER

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Application March 31, 1941, Serial No. 386,052

2 Claims. (Cl. 29—84)

The present invention relates to improved silencing structures and particularly to such structures which are especially adapted for automotive service, and provides improvements upon the structure and method disclosed and claimed in the copending United States application for Letters Patent of Gunnar Jensen, Serial No. 326,455, filed March 28, 1940.

At the present time, automobile silencers conventionally include an outer shell arranged for connection at one end of the exhaust pipe of the engine and arranged for connection at the other end at the usual tail pipe. Such outer shells conventionally enclose one or more tubular exhaust passages or conduits through which the exhaust gases flow in travelling through the silencer. The walls of the exhaust passages or conduits are conventionally provided with a series of relatively small openings through which the exhaust gases may pass from the interior of the conduit to the chamber space between the outer shell and the conduit. In order to divide this space into a plurality of different chambers, and also support the conduit within the shell, one or more partitions are conventionally provided which extend between the shell and the conduit.

It has been found exceedingly difficult with present-day production methods to form both the outer shell and the inner conduit so that they are both truly cylindrical and so that they can be telescoped together in truly concentric relation. Instead, it has been found that in forming these elements, particularly the inner or primary exhaust conduit, the rolling process introduces a longitudinal bow or arch therein. When the longitudinally bowed or arched conduit is introduced into the outer shell, which may be assumed to be of cylindrical form, it will be understood that the inner conduit is not truly concentric throughout its entire length with the outer shell. Other factors also make it difficult to arrange the conduits in truly concentric relationship to the outer shell members. For example, the partitions which extend between the inner conduit and the cooperating shell members are usually seated upon annular embossments which extend radially outwardly from the main surface of the conduit. The embossments are usually pressed from the body of the conduit before the latter is rolled into tubular form, and in many cases the embossment is not truly concentric with the conduit.

Due to the lack of concentricity between the conduit and the cooperating outer shell member, caused by the above or other circumstances, when

the partition members are introduced between the conduit and the shell, certain parts of the partition bind upon the adjacent parts of the shell or conduit, thus interfering with the above mentioned sliding action. This difficulty is evidenced by the loud and objectionable clicking noise which usually accomplishes the cooling down of a silencer structure.

With the foregoing considerations in view, one of the primary objects of the present invention is to provide an improved method of assembling a silencer construction so as to permit the proper relative sliding movement between the elements thereof as the temperature of the construction varies.

Another object of the present invention is to provide an improved construction in which the inner primary conduit and the outer shell float with respect to each other during both heating and cooling.

Other objects of the present invention will become apparent from the following specification, the drawings relating thereto, and from the claims hereinafter set forth.

In the drawings, in which like numerals are used to designate like parts in the several views throughout:

Figure 1 is a longitudinal vertical cross-sectional view of one form of silencer embodying features of the present invention;

Fig. 2 is a view similar to Fig. 1 illustrating another modified form of the present invention;

Fig. 3 is a diagrammatic view in longitudinal section, illustrating the improved method of assembling the structure of Fig. 1;

Fig. 4 is a cross-sectional view taken substantially along the line 4—4 of Fig. 3; and

Fig. 5 is a cross-sectional view taken substantially along the line 5—5 of Fig. 3.

Referring to Fig. 1, the silencer structures there shown comprise an outer shell 10, a primary exhaust passage or conduit 12, an intermediate shell 14, partitions 16, 18, 20, 22, 24, 26, and 28, and end heads 30 and 32. It will be appreciated that the outer shell 10 may conventionally be formed of sheet metal of relatively light gauge, rolled into cylindrical form, and having a rolled seam extending along one side thereof. The heads 30 and 32 serve to close the ends of the shell 10 and are provided with end nipples 35 and 38 which are adapted for connection respectively to the exhaust pipe of the engine and to the usual tail pipe. Such end members 30 and 32 are provided with enlarged annular portions 37 which adjoin the nipple por-

tion 36 and 38 with annular shoulder portions 39, for purposes which will be described hereinafter.

End members 41 are telescopically received over both of the ends of the primary exhaust passage or conduit 12 and are fixedly secured thereto by welding in a manner which will be pointed out hereinafter. Such end members 41 are each formed with outwardly pressed bead or embossed portions 43. The conduit 12 with the end members 41 properly secured thereto are positioned within the shell 10 so that the embossed portions 43 slidably bear within the annular portion 37 at both ends of the silencer. The slidable movement is limited by the annular shoulders 39 at both ends so that the conduit member 12 floats or is free to slide longitudinally with respect to the shell 10 at both ends thereof.

The intermediate shell 14 is positioned in surrounding relationship with respect to the conduit 12 so that when positioned within the outer shell 10 the forward end thereof is spaced somewhat rearwardly from the front head 30 and with the rear end thereof spaced considerably forwardly from the rear head 32. The intermediate shell 14 is fixedly secured to the conduit 12 by welding the partition 28 to the shell 14. The intermediate shell 14 is supported within the outer shell 14 by means of the partitions 16 and 18. The partitions 16 and 18 are secured to the intermediate shell 14 by a plurality of circumferentially distributed spot welds; and the peripheral rounded portions of the partition slidably engaged the inner surface of the outer shell 10.

The partitions 20, 22, 24, 26 and 28 serve to divide the interior of the silencer into a plurality of sound absorbing silencing chambers. For this purpose, the partitions 20 and 22 extend between the conduit 12 and the outer shell 10. The partitions 20 and 22 are rigidly secured, as by spot welding, at circumferentially distributed points to the conduit 12; and their rounded outer peripheral surfaces slidably engage the inner surface of the outer shell 10. The partitions 24, 26 and 28, in turn, are rigidly secured, as by welding at circumferentially spaced points, to the conduit 12; and the rounded outer peripheral surfaces of the partitions 24 and 26 slidably engage the inner surface of the intermediate shell 14. The outer peripheral edge of partition 28 is welded at circumferentially spaced points to the shell 14, as mentioned above.

The conduit 12 is provided with a plurality of groups of small openings 70, 72, 74, 76, 78 and 80 which afford communication between the interior of this conduit and the several silencing chambers into which the interior of the shell is divided by means of the previously mentioned partitions and the intermediate shell 14. The individual openings may be arranged in any of a variety of ways, but it is preferred that these openings be of the tangential form described and claimed in the Gunn Patent No. 1,949,074, granted February 27, 1934, and assigned to the assignee of the present application.

According to the present invention, it is proposed to first form the shell and conduit members into tubular form in accordance with prior practice. The partition members 24, 26, and 28 are relatively close together so that the relative amount of bowing in section 12 between the points at which the partitions 24 and 28 are connected to the conduit member is relatively slight. However, with a slight bow at the center, the ends

of the conduit 12 may be substantially out of line or non-concentric with the inner shell 14 or outer shell 10. It is proposed, therefore, to first secure the partition members 24, 26 and 28 to the member 12 and slide the inner sleeve 14 thereover. The partition members 16 and 18 may already have been applied to the shell 14 because such shell is truly cylindrical in form, as pointed out above.

Thereafter, the partitions 20 and 22 and the end members 41 are fitted over the member 12 to loosely seat upon their proper embossments or on the proper ends thereof.

The assembly, including the conduit 12, having the inner shell 14 thereon and having the partitions 20 and 22 and the end members 41 loosely seated thereon is then introduced into a fixture such as that generally indicated at 120 in Figs. 3, 4, and 5. This fixture is formed in separable halves hinged along one side and clamped along the other as best shown in Figs. 4 and 5. The fixture is formed with a plurality of annular surfaces such as 122, 124, 126, 128, 130 and 132, corresponding in number, longitudinal spacing, inside diameter, and form to the corresponding shell portions with which the left end member 41, the partitions 16, 18, 20 and 22 and the right end member 41 are to be associated. It will thus be seen that the annular portions 124, 126, 128 and 130 have the same inside dimension as the outer shell 10 and that the annular portions 122 and 132 have the same inside dimension as the annular portion 37. It will also be understood that such annular portions are arranged in truly concentric relationship to each other.

As mentioned above, the fixture 120 is longitudinally split or divided in half sections, thus enabling the fixture to be opened to permit the conduit member 12 and intermediate shell 14 with the end members and partition members as shown in Fig. 3 to be inserted in place. Upon insertion of such conduit and shell members with their associated partitions into the fixture, it is to be expected that by virtue of the bow in conduit 12 or any non-concentricity of any of the portions thereof, or both, the outer peripheries of all or some of the partitions will be out of concentric relation to the corresponding surfaces, particularly surfaces 122, 128, 130 and 132. Since the partition members 16 and 18 are fixed to the intermediate shell 14, which is truly cylindrical in form, the outer peripheries of members 16 and 18 will be in concentric relationship and have been welded to the shell 14 before insertion in the fixture.

Upon closing the fixture upon itself, the end portions 122 and 132 of the fixture engage the end members 41, and since such end members are only loosely fixed on the ends of member 12, the members 41 will be concentrically aligned, which will result from a tilting of one or both of such members. The partition members 20 and 22 may likewise be tilted so that such partition members are brought into accurately concentric relationship.

The tilting action of the partition members 20 or 22 and the end members 41 thus compensates for any bow in the conduit 12 by an amount just sufficient to bring about the desired concentric relationship.

It will be understood that the previously mentioned loose fit between the smaller necks of the members 41 and the ends of the member 12, while not introducing an objectionable amount of gas leakage, does accommodate the just-men-

tioned tilting movement of the members 41. The spot welds between the members and the conduit 12, however, rigidly secure the members 41 in place in the adjusted positions thereof. It will be recognized, also, that the tilting of the members 41 causes the larger peripheral surfaces thereof, as well as the just-mentioned necks, to present a slight oval shape to the cooperating surfaces 37 and the ends of the conduit 12. This ovality is so slight, however, that it has been found to have no objectionable effect on the sliding action between the larger peripheral surfaces of the members 41 and the cooperating surfaces 37. The ovality of the necks, also, is not objectionable, since it is readily taken up by the initially loose fit.

While the elements are retained within the fixture, suitable welding apparatus, illustrated as comprising the electrodes 150 and 152, are introduced through openings such as 154 in the outer wall of the fixture and longitudinally through the conduit 12. Thereafter, such electrodes are brought together and supplied with welding current. Openings such as 154 are distributed circumferentially around the fixture, the number of such openings being determined in accordance with the number of spot welds which it is desired to provide at each of the end members or partitions. Such openings may also be provided through the fixture adjacent any of the partitions at the points at which it is desired to perform the welding step.

It will thus be seen that since the end members 41 and the partition members 16, 18, 20 and 22 are in concentric relationship to each other that the conduit 12, with the shell 14, may be inserted within the outer shell 10, so that the elements may move longitudinally, due to unequal expansion or contraction, without binding.

Referring to Fig. 2, a modified form of silencer is illustrated in which such silencer is shown as being substantially the same as that illustrated in Fig. 1 except that the end members 41 are dispensed with. Instead of using the individual end members 41 which are applied in the assembly as described above, the conduit member 12 is made slightly longer and the outer ends thereof are pressed outwardly to provide annular end portions 160 which are slidably received within the annular portions 37. Neither of the end portions 160 is fixed to the end members 30 or 32 so that both ends are free to slide with respect thereto. It will thus be seen that the structure

of Fig. 2 affords the same floating or sliding action as the construction described in connection with the illustrated embodiment of Fig. 1.

Formal changes may be made in the specific embodiments of the invention described without departing from the spirit and substance of the invention, the scope of which is commensurate with the appended claims.

What is claimed is:

10 1. A method of assembling a structure having an at least partially enclosed, elongated tubular shell member and an at least partially enclosed, elongated tubular inner member telescoped therewith, and further having at least one partition member extending between the shell member and the inner member and seated upon the inner member at a point intermediate its ends, said inner member being deformed so that said point and said ends are not so aligned as to enable proper telescoping of said members together, which comprises fitting annular members onto the ends of said inner member, adjusting said annular members so that the peripheries thereof are so aligned with the periphery of partition as to enable proper said telescoping, rigidly securing said annular members to said inner members in the adjusted positions thereof, and thereafter telescoping the assembly comprising said inner member, said partition and said annular members into said shell.

2. A method of assembling a structure having an at least partially enclosed, elongated tubular shell member and an at least partially enclosed, elongated tubular inner member telescoped therewith, and further having at least one partition member extending between the shell member and the inner member and seated upon the inner member at a point intermediate its ends, said inner member being deformed so that said point and said ends not so aligned as to enable proper telescoping of said members together, which comprises fitting conical member onto the ends of said inner member, tilting said conical members so that the peripheries thereof are so aligned with the periphery of partition as to enable proper said telescoping, rigidly securing said conical members to said inner members in the tilted positions thereof, and thereafter telescoping the assembly comprising said inner member, said partition and said conical members into said shell.

WALTER H. POWERS.

CERTIFICATE OF CORRECTION.

Patent No. 2,331,344.

October 12, 1943.

WALTER H. POWERS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 7, for "accomplishes" read --accompanies--; page 3, second column, line 42, claim 2, for "member" read --members--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of November, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

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