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G. JENSEN

2,331,325

METHOD OF ASSEMBLING SILENCERS

Filed March 28, 1940

2 Sheets-Sheet 1

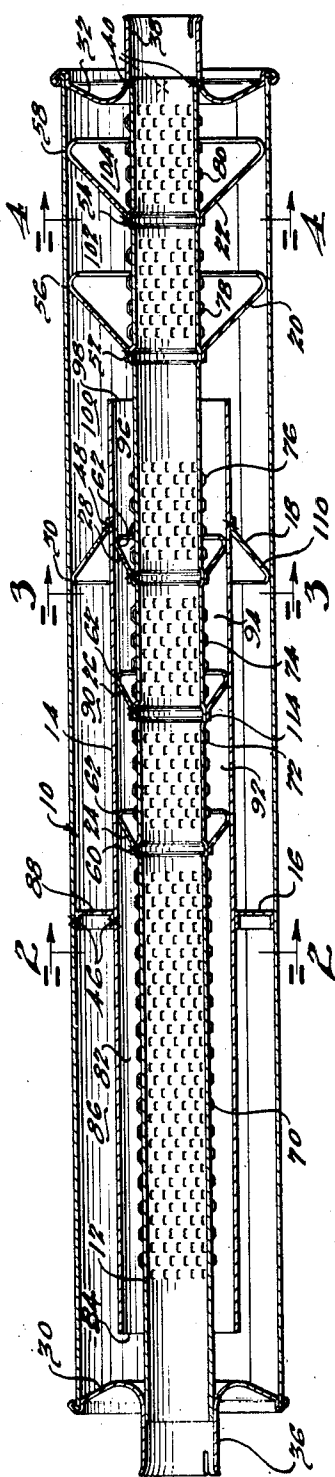


FIG. 1.

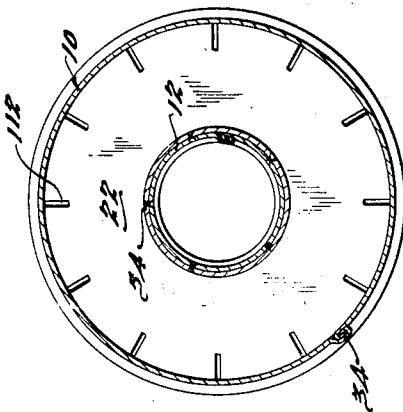


FIG. 4.

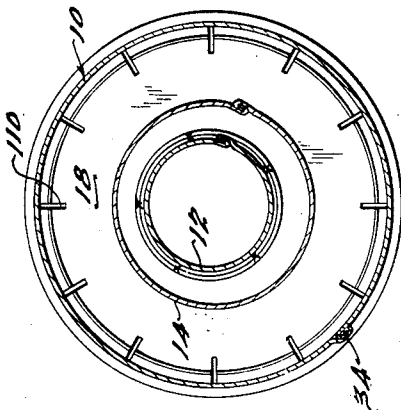


FIG. 3.

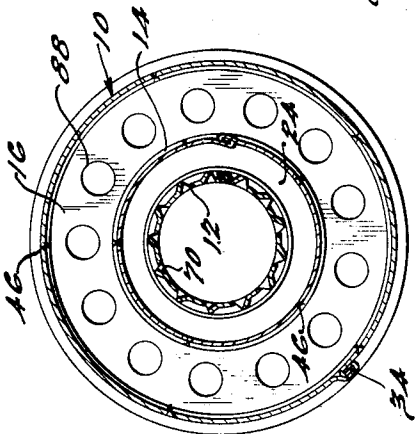


FIG. 2.

INVENTOR
Gunnar Jensen.
BY
Harness, Dickey & Pierce.
ATTORNEYS

Oct. 12, 1943.

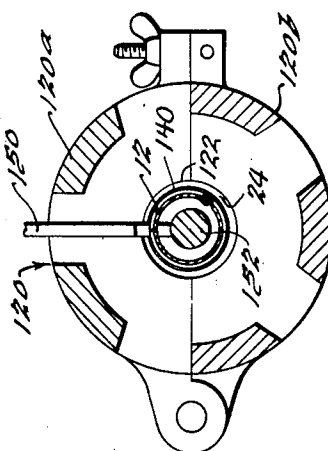
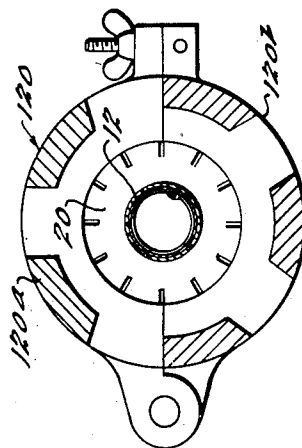
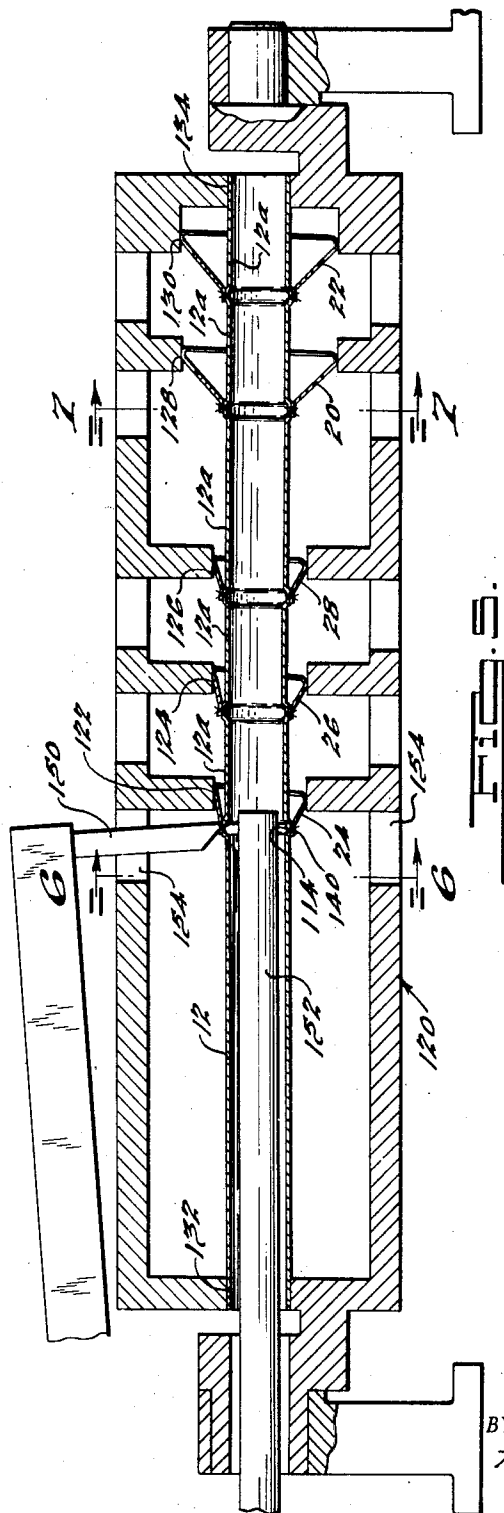
G. JENSEN

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2 Sheets-Sheet 2



INVENTOR
Gunnar Jensen.
BY
Horness, Dickson & Pierce.
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,331,325

METHOD OF ASSEMBLING SILENCERS

Gunnar Jensen, Jackson, Mich., assignor to
Walker Manufacturing Company of Wisconsin,
a corporation of Wisconsin

Application March 28, 1940, Serial No. 326,455

3 Claims. (Cl. 29—84)

The present invention relates to silencing structures and, in particular provides an improved process for assembling automotive silencers.

At the present time automobile silencers conventionally include an outer shell arranged for connection at one end to the exhaust pipe of the engine and arranged for connection at the other end to the usual tail pipe. Such outer shells conventionally enclose one or more tubular exhaust passages or conduits through which the exhaust gases flow in traveling through the silencer.

It has been found exceedingly difficult with present day production methods to form up both the outer shell or shells and the inner conduit or conduits so that they are both of truly cylindrical or other desired shape, and so that they can be telescoped together in truly concentric, or other properly centered relation. Instead, it has been found that in forming up these elements, particularly the inner or primary exhaust conduit, such forming process introduces a longitudinal bow or arch therein. When the longitudinally bowed or arched conduit is introduced into its outer shell or shells, which may be assumed, for example, to be longitudinally straight, it will be understood that the inner conduit is not truly concentric, or otherwise properly centered, throughout its entire length, relative to the shell or shells. Other factors also make it difficult to arrange the conduit in properly centered relation to the outer shell members. For example, as is pointed out hereinafter, the partitions which customarily 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, or other properly centered relation, between the conduit and the cooperating outer shell member, caused by the above or other circumstances, when the partition members are interposed between the conduit and the co-operating shell or shells, certain parts of the partitions bind upon the adjacent parts of the shell or conduit, thus interfering with the sliding action which is desired between the partitions and the shell. This difficulty is evidenced by the loud and objectionable clicking noise which usually accompanies the cooling down of a silencer structure.

With the foregoing general considerations in view, the principal objects of the present inven-

tion are to provide an improved process of assembling silencers so as to effectively overcome the defects enumerated above, as well as other defects and to provide such a process of assembly characterized in that before being secured to a shell member or an inner conduit, the partitions are adjusted so as to compensate for any non-concentricity between the outer shell and that part of the inner conduit which is engaged by the partition.

With the above as well as other objects in view, which appear in the following detailed description and in the appended claims, a preferred but illustrative embodiment of the invention is shown in the accompanying drawings, throughout the several views of which corresponding reference characters are used to designate corresponding parts and in which:

Figure 1 is a view in longitudinal vertical section of a silencer embodying the invention;

Fig. 2 is a view in transverse vertical section, taken along the line 2—2 of Fig. 1;

Fig. 3 is a view in transverse vertical section, taken along the line 3—3 of Fig. 1;

Fig. 4 is a view in transverse vertical section, taken along the line 4—4 of Fig. 1;

Fig. 5 is a diagrammatic view in longitudinal section, illustrating the improved method of assembling the structure of Fig. 1;

Fig. 6 is a view in transverse vertical section, taken along the line 6—6 of Fig. 5; and

Fig. 7 is a view in transverse vertical section, taken along the line 7—7 of Fig. 5.

Referring first to Figures 1 through 4, the illustrated silencer (to the structure whereof no claim is herein made) comprises 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. The shell has a rolled seam 34 extending along one side thereof, and the heads 30 and 32, which serve to close the ends of the shell 10, are provided with nipples 36 and 38, adapted for connection, respectively, to the exhaust pipe of the engine and the usual tail pipe. The front end of the conduit 12 is slidably received within the nipple 36 of the head 30, and the rear end of the conduit 12 is rigidly secured to the nipple 38 as by a plurality of circumferentially distributed spot welds such as 40.

The intermediate shell 14 is supported within the outer shell by means of the partitions 16 and 18. The partition 16 is directly secured both to the outer shell 10 and the intermediate shell 14 as by means of a plurality of circumferentially

distributed spot welds such as 43. The partition 18, in turn, is rigidly secured, as by a series of welds 48, to the intermediate shell 14, but the outer periphery thereof is reversely bent to a slight degree to define a rounded engaging surface 50, which slidably engages the inner surface of the outer shell 10. This rounded surface is provided with slots 110 to make it somewhat yielding, and the corresponding rounded surface of partition 22 is slotted at 112.

The partitions 20, 22, 24, 26, and 28, in addition to their supporting functions, serve to divide the interior of the silencer into a plurality of sound absorbing silencing chambers. Partitions 20 and 22 are rigidly secured, as by spot welding at circumferentially distributed points, such as 52 and 54, to the conduit 12, and their rounded outer peripheral surfaces 56 and 58 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 points such as 60, to the conduit 12, and their rounded outer peripheral surfaces, such as 62, slidably engage the inner surface of the intermediate shell 14.

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 silencing action produced by the above structure forms no part of the present invention and need not, therefore, be described.

In the operation of the above structure, the relatively hot gases passing in large part directly through the inner conduit 12, and in smaller part radially outwardly from this conduit into the above mentioned silencing chambers, heats the several structural elements of the silencer, causing them to expand and contract at differing rates and to differing degrees. This expansion and contraction appears principally as changes in axial lengths of the shells 10 and 14 and the conduit 12.

By virtue of the aforesaid slidable connections, a difference in degree of longitudinal expansion or contraction of the inner conduit 12 and the outer shell 10 or the intermediate shell 14, produces a sliding movement of the partitions 20 and 22 relative to the outer shell, a sliding movement of the partitions 24, 26, and 28 relative to the intermediate shell 14, and a sliding of the conduit 12 relative to the nipple 33.

Similarly, while partition 16 is rigidly secured to both the outer shell 10 and the intermediate shell 14, and while the companion partition 18 is rigidly secured to the intermediate shell 14, the latter partition is slidable relative to the outer shell 10. Consequently, differing degrees of longitudinal expansion or contraction between the intermediate shell 14 and the outer shell 10 produce a sliding movement of the partition 18 relative to the outer shell 10.

In order to overcome by binding and resistance to said sliding, which, as aforesaid, results from the irregularities produced in forming up the silencer elements, it is proposed, in accordance with the present invention, to effect the assembly of a structure of the type shown in Figures 1 to 4, by first forming up the shell and conduit members into tubular form in accordance with the prior practice. Thereafter, the partitions, such as 20, 22, 24, 26, and 28, associated with the inner conduit 12, are fitted thereover and are

seated upon the embossments, such as 114, individual thereto. As will be understood, the embossments project radially from the surface of conduit 12 sufficiently to enable the annular partitions 20, 22, 24, 26 and 28 to fit thereover from either end.

The assembly comprising the conduit 12 and the partitions loosely fitted thereon, is introduced into a fixture such as 120, which has a plurality of annular surfaces such as 122, 124, 126, 128, and 130, corresponding in number, longitudinal spacing, inside diameter, and form (in this case, cylindrical) to the corresponding shell portions with which the partitions 20, 22, 24, 26 and 28 are to be associated. It being assumed as aforesaid, that the outer shell 10 and the intermediate shell 14 can readily be formed into substantially true cylindrical forms, and thus can be telescoped together in truly concentric relation, it will be understood that the annular surfaces 122, 124, 126, 128, and 130 are arranged in concentric relation to each other and to the cylindrical end surfaces 132 and 134 which receive the ends of conduit 12. The fixture 120 is longitudinally split, and the upper and lower parts 120a and 120b are hinged together, thus enabling the fixture to be opened to permit the conduit 12 and partitions 20, 22, 24, 26 and 28 to be inserted in place. Upon insertion of the conduit 12 and its associated partitions into the fixture, it is expected that by virtue of the bow in the conduit 12, or any non-concentricity of the embossments 114 or both the outer peripheries of all or some of the partitions will be out of concentric relation to the corresponding surfaces 122, etc. Upon closing the fixture upon itself, however, the end portions 132 and 134 of the fixture engage and solidly support the ends of the conduit 12 in accurately concentric relation to the intermediate surfaces 122, etc. The closing movement of the fixture also enables the individual surfaces 122, etc. to engage and tilt the respective partitions 24, etc. relative to the conduit 12, thus bringing the rounded outer peripheral surfaces of these partitions into accurately concentric relation to the surfaces 132 and 134, and consequently, into accurately concentric relation to the respective ends of the conduit 12.

This tilting movement causes the reduced neck portion such as 140 of each partition to slide somewhat relative to the corresponding embossment 114. It is preferred that these neck portions, such as 140, have a relatively snug frictional fit with the corresponding embossments 114, so as to minimize any tendency to leakage between the neck portion and the embossment, but it is found in practice that this snug fit relatively readily permits the required tilting movement without deforming either the partitions or the embossments.

In further accordance with the present invention, and while the conduit 12 and the partitions 20, 22, etc., are retained within the fixture 120, 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, after which such electrodes are brought together and supplied with welding current so as to form the previously mentioned spot welds and rigidly secure the partitions to the lower tube in properly adjusted and aligned positions. It will be noticed that the openings, such as 154, are distributed circumferentially around the fixture, the number of such openings

being determined, of course, in accordance with the number of spot welds which it is desired to provide at each partition. The openings 154 are also arranged in series, one such series of openings being provided adjacent each partition.

It will be understood that the completed assembly comprises a conduit 12 and its partitions can be inserted into an intermediate shell, such as 14, without introducing any binding between the partitions and the inner surface of the shell. It will also be understood that, in completing the assembly, partially assembled structure comprising the conduit 12, the intermediate shell 14, and the associated partitions, is introduced into the outer shell 10, after which the heads 30 and 32 are secured in place. This latter action brings the outer ends of the conduit 12 into accurately concentric relation to the shell 10. In view, however, of the fact that all outer peripheral partition surfaces which engage the shell 10 have been brought, by the previously described assembly process, into accurately concentric relation to the ends of the conduit 12, the securing in place of the heads 30 and 32 does not introduce any binding between such partitions and the outer shell 10.

It will be recognized that the surface bounded by the outer peripheral surface of each tilted partition, when viewed on a line at right angles to the axis of the silencer structure, is very slightly oval rather than being truly circular. It is found in practice, however, that by employing a proper conical angle in the partitions and also by employing the previously described rounded outer peripheral surfaces on the partitions, the surface so bounded by each tilted partition departs from a true circular form to only a negligible extent and that any such departure is readily taken up by the yieldability of the co-operating shell member and by the yieldability of the outer peripheral surface of the partition.

From the foregoing, it will be appreciated that the present invention provides an extremely simple and effective method of overcoming the binding heretofore encountered in structures of the type to which the invention relates. The present embodiment of the invention is to be regarded in an illustrative and not in a limiting sense.

What is claimed is:

1. The method of assembling a silencer structure comprising a pair of at least partially enclosed tubular members telescoped together in predetermined centered relation, at least one of the members being longitudinally deformed so that the ends thereof are not in proper alignment with portions intermediate such ends, said deformity being such that when the members are telescoped together the inner member is not properly centered throughout its length relative to the outer member, and further comprising at least one annular member extending between the said members at an intermediate point along their length, said annular member being disposed to slidably engage the other said member and to be fixedly secured to the said intermediate portion of the deformed member, which comprises fitting the annular member and the deformed member together, effecting a relative adjustment between the ends of the deformed member and the annular member sufficient to

substantially compensate for said deformity and so as to bring the ends of the deformed member and that portion of the annular member which engages the other member into proper aligned relation to each other, securing said adjusted elements in said positions of relative adjustment, and thereafter assembling the deformed member and the annular member with the other member.

2. The method of assembling a silencer structure comprising a pair of at least partially enclosed tubular members telescoped together in predetermined centered relation, the inner one of the members being longitudinally deformed so that the ends thereof are not in proper alignment with portions intermediate such ends, said deformity being such that when the members are telescoped together the inner member is not properly centered throughout its length relative to the outer member, and further comprising at least one annular member extending between the said members at an intermediate point along their length, said annular member being disposed to slidably engage the outer member and to be fixedly secured to the inner member, which comprises fitting the annular member and the inner member together, effecting a relative adjustment between the ends of the inner member and the annular member sufficient to substantially compensate for said deformity and so as to bring the ends of the inner member and that portion of the annular member which engages the outer member into proper aligned relation to each other, securing said adjusted elements in said positions of relative adjustment, and thereafter assembling the inner member and the annular member with the outer member.

3. The method of assembling a silencer structure comprising a pair of at least partially enclosed tubular members telescoped together in predetermined centered relation, the inner one of the members being longitudinally deformed so that the ends thereof are not in proper alignment with portions intermediate such ends, said deformity being such that when the members are telescoped together the inner member is not properly centered throughout its length relative to the outer member, and further comprising at least one conical member extending between the said members at an intermediate point along their length, said conical member being disposed to slidably engage the outer member and to be fixedly secured to the said intermediate portion of the inner member, which comprises fitting the conical member and the inner member together with a fit which is relatively snug but permits tilting of the conical member relative to the inner member without deforming either of said members, tilting the conical member by an amount sufficient to substantially compensate for said deformity and so as to bring the ends of the inner member and that portion of the conical member which engages the outer member into proper aligned relation to each other, securing the conical member to the inner member in said tilted position, and thereafter assembling the inner member and the conical member with the outer member.

GUNNAR JENSEN.