Oct. 5, 1965 H. L. BROWN 3,209,438

MUFFLER MANUFACTURING METHOD

Filed Oct. 28, 1960 2 Sheets-Sheet 1

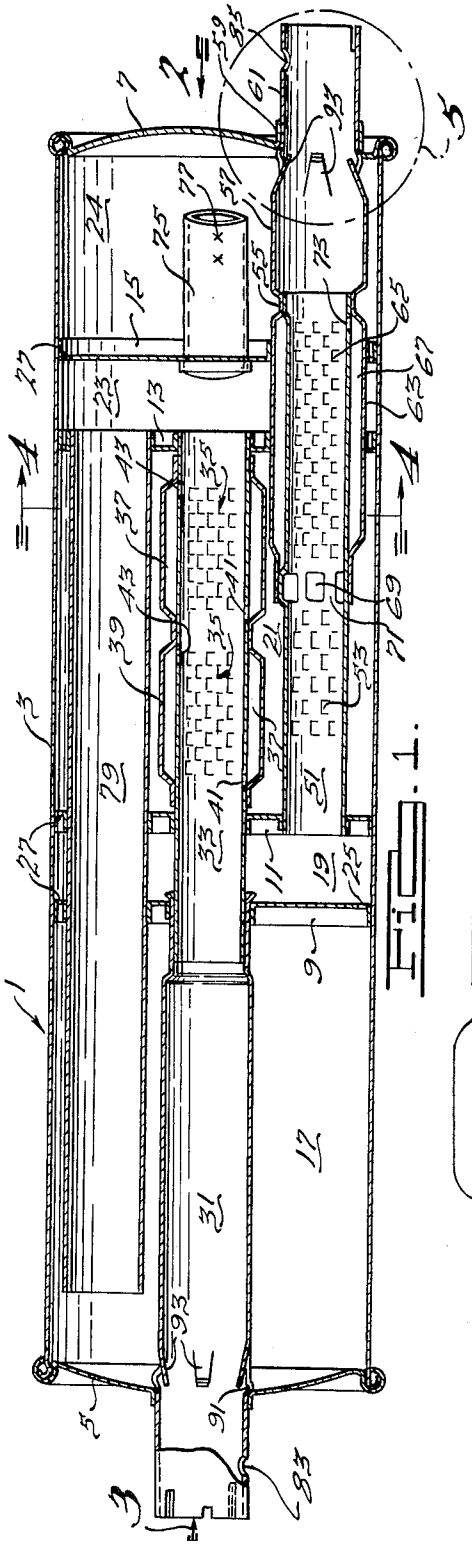


Fig. 1.

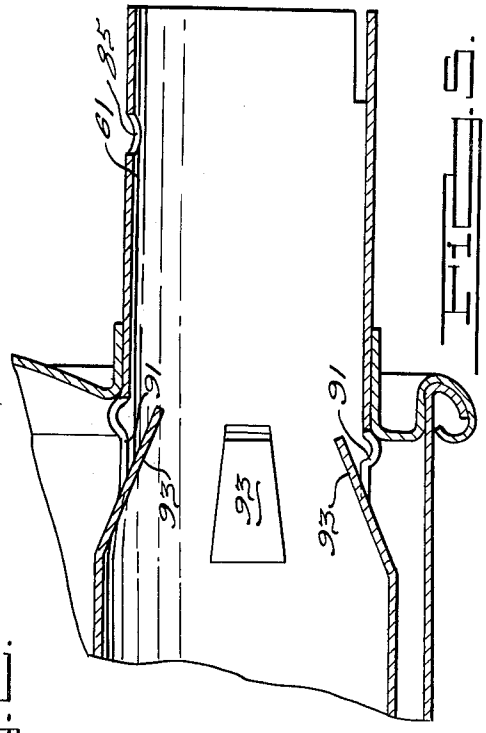


Fig. 2.

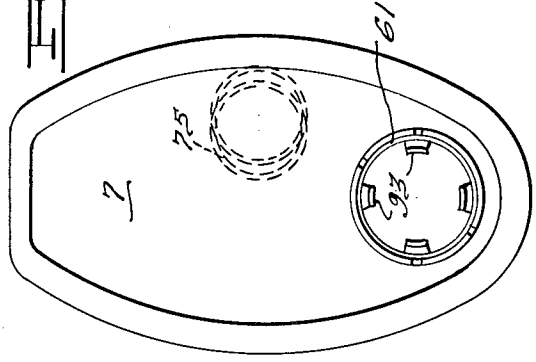


Fig. 5.

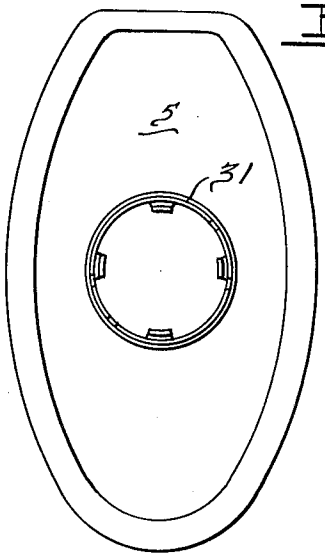
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Fig. 3.



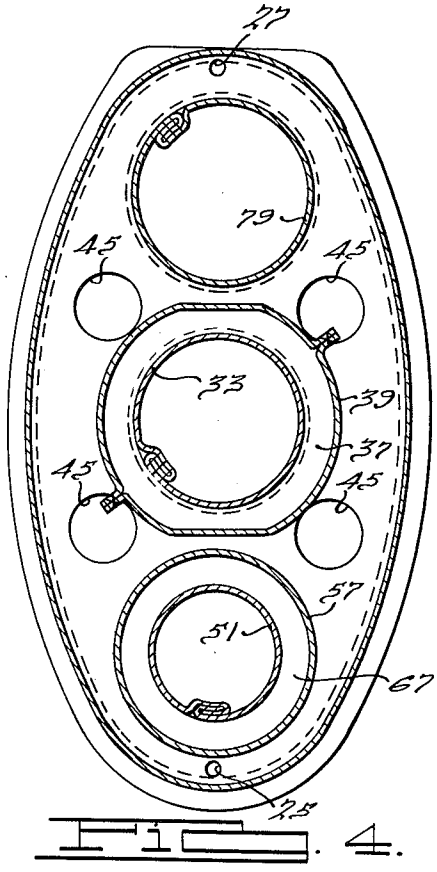


Fig. 4.

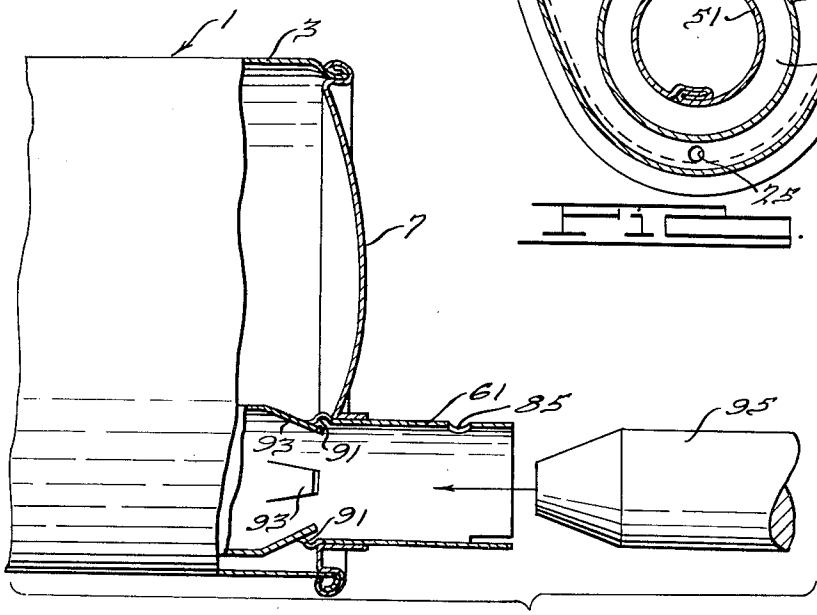


Fig. 6.

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United States Patent Office 3,209,438 Patented Oct. 5, 1965

3,209,438

MUFFLER MANUFACTURING METHOD

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Filed Oct. 28, 1960, Ser. No. 65,768
7 Claims. (Cl. 29—157)

My invention relates to exhaust mufflers and, in particular, to exhaust mufflers that are coated with an anti-corrosive ceramic. The invention constitutes an improvement upon the invention disclosed in the copending application of my co-worker, Walter H. Powers, Serial No. 65,767, filed October 28, 1960, now Patent No. 3,082,841, which application is assigned to my assignee.

As pointed out in the copending Powers application, the problem of internal and external drainage during the coating of a complicated structure such as an exhaust muffler is a difficult one and one which must be solved satisfactorily in order that 100% of the surface within the muffler be properly coated with the ceramic. Failure to give a complete coating will result in corrosion at the uncoated areas so that the beneficial effects of the anti-corrosive ceramic coating are lost.

One of the important problems in coating the interior of an exhaust muffler concerns the admission and drainage of the various fluids which come in contact with the surfaces to be coated during the coating process since incomplete admission or drainage may result in a defective coating or in plugging of acoustic openings, As disclosed in the Powers application, in order to provide for proper internal drainage, the muffler is provided with suitable holes in the interior partitions that will permit the proper flow of fluids through the internal chambers; and, for external drainage, the end headers of the muffler are provided with suitable openings. The present invention concerns an improved method of external drainage, that is, drainage between the inside and the outside of the muffler body wherein the use of apertures or plugs in the end headers is avoided.

The invention contemplates a structure wherein tongues are formed in the inlet and outlet conduits adjacent to the inlet and outlet headers. These tongues expose openings which are relatively large in area so that fluids can flow freely into and out of the muffler during the coating operation. After the muffler has been coated an expanding tool is inserted into the inlet and outlet of the muffler to force the tongues back into position in the normal periphery or surface of the inlet and outlet conduits to provide, in effect, a solid-walled tubing.

The invention is disclosed in a preferred form in the accompanying drawings in which:

FIGURE 1 is a longitudinal section through a muffler embodying the invention and shows it in a condition ready for a coating process;

FIG. 2 is an elevation taken from the right of FIG. 1;

FIG. 3 is an elevation taken from the left of FIG. 1;

FIG. 4 is a section taken along the line 4—4 of FIG. 1;

FIG. 5 is an enlarged view of the structure shown within the circle D of FIG. 1; and

FIG. 6 is a view similar to FIG. 5 showing schematically how an expanding tool will be used to force the tongues back into position.

The muffler 1 that is illustrated in the drawings is shown in assembled condition prior to ceramic coating with an anti-corrosive ceramic. As pointed out in the copending application previously referred to, the coating is preferably applied by immersing or dipping the complete muffler 1 into a suitable bath of anti-corrosive ceramic of a type available on the open market. The problem, of course, is to cause the ceramic slip to contact and properly coat all of the surfaces within the interior of the muffler.

Failure to do this would expose a sheet steel surface at some point within the muffler which would be susceptible to rust and which might deteriorate or disintegrate in a relatively short time as compared with the properly coated portions of the muffler. As pointed out in the copending application, to insure proper coating it is necessary to provide properly located passages for the entrance and escape of fluid from each of the chambers within the muffler (internal drainage) as well as between the inside and outside of the muffler (external drainage).

Turning first to the overall contsruction of the muffler from the standpoint of its function as a silencing component of an internal combustion engine exhaust system, the muffler comprises an outer shell 3 and this is closed by end headers 5 and 7 at the inlet and outlet ends, respectively. Suitable rolled or interlocked joints may be used between the end headers and the shell as illustrated. The muffler shown in FIG. 1 does not include additional layers of asbestos and metal around the shell 3 but these may be used if desired. If used, it is preferable that they be applied to the muffler after the structure shown in FIG. 1 has been ceramic coated. Within the muffler there are a plurality of longitudinally spaced, transversely extending partitions 9, 11, 13, and 15, respectively, which have circumferential flanges that are spotwelded to the shell 3. These partitions divide the interior of the shell 3 into a plurality of chambers 17, 19, 21, 23, and 24. Each of the partitions, 9, 11, 13, and 15 has a small opening 25 adjacent the bottom and as close as possible to the shell 3 and about 5/16 inch in diameter and, likewise, has a corresponding opening 27 at the top of the same size and located also as close as possible to the shell 3. The openings 25 and 27 provide an internal drainage means for flow of fluids between the respective chambers 17, 19, 21, 23, and 24.

Exhaust gas enters the muffler 1 through an inlet bushing 31 which is supported in the header 5 and a neck in partition 9. Fitting inside a reduced end of the bushing 31 is an inlet tube 33 and this is supported at its outlet end in a neck in the partition 13. The tube 33 has two sets of louver openings 35 formed in its side walls and these provide communication between the interior of the tube 33 and a pair of chambers 37 formed by the pancake section 39 which is fitted around and spot-welded to tube 33. The inlet tube 33 has openings 41 and 43 on opposite sides adjacent the ends of the chambers 37 which, as pointed out in the aforementioned copending Powers application, provide means for the flow of fluid in and out of the chambers 37. The inlet tube 33 empties into a crossover chamber 23 which causes gas to reverse its direction of flow and pass through a series of large openings 45 in the partitions 13 and 11, flowing through the chamber 21, to enter the crossover chamber 19. Gas in the chamber 19 will reverse its direction of flow and go out through an outlet tube 51. The tube 51 is supported at one end on partition 11 and has a set of louvers 53 opening into the chamber 21, the chamber 21 thus acting as a large spit chamber. The tube 51 enters into and is supported on a reduced portion 55 of a shell 57 which in turn is supported in the neck 59 of the outlet header 7, the end of the shell 57 forming the outlet bushing 61. It is apparent that gases flowing through tube 51 will enter the shell 57 and flow out through the bushing section 61 to leave the muffler. The shell 57 has an enlarged section 63 which surrounds a set of louvers 65 in the tube 51 to form a spit chamber 67.

The tube 51 is of lock-seamed construction, in accordance with the teachings of Moss Patent No. 2,251,369 and thus has a series of up-raised flat sections 69 which are separated from one another by passages 71. The end of the shell 57 fits around and seats on the section 69 and

is spot-welded to it but the passages **71** form exit openings from the chamber **67** which will act along with an opening **73** at the other end of the chamber **67** to provide means for the in and out flow of fluids during the coating process.

The crossover chamber **23** is connected to a tuning chamber **24** at the outlet end of the muffler by means of a canted tuning tube **75** that is spot-welded in and supported on a neck of the partition **15** and the end of which engages the shell **3** and is spot-welded to it as indicated at **77**. A very long imperforate tuning tube **79** is supported in suitable necked openings in partitions **9**, **11**, and **13** to connect the crossover chamber **23** with the resonator chamber **17** formed at the inlet end of the muffler **1**.

Internal drainage is specifically provided by the openings **25** and **27**, the holes **41** and **43**, the passages **71**, and the opening **73** to insure proper flow of fluids from one chamber to the next when the muffler is suspended during dipping by means of either hole **83** or **85** in the inlet and outlet bushing, respectively.

In order to provide for admission of fluids to the interior of the muffler and for drainage of fluids from the muffler, openings **91** are formed in the inlet tube **31** and the outlet shell **57**, as close as possible to the headers **5** and **7**, respectively. These are formed by shearing out tongues **93** from the metal periphery of the tube **31** and shell **57**, the free ends of the tongues being located at the outer ends. These tongues are preferably ¾ of an inch long and taper from a maximum width at their base of 9/16 of an inch to ½ inch and are bent about ⅛ of an inch inside dimension from the surface of the shell or the tube. For a conventional size muffler three or four of the openings **91** are used and they are spaced and located so that one of them is at as low a point as possible in the muffler interior when the muffler is suspended from hole **83** or hole **85**. Thus, one of the openings **91** at each end is preferably on or as close as possible to a line through the center of gravity and the suspension hole at the other end.

After the coating procedure is completed so that it is not necessary to drain any more fluids from the muffler, a mandrel or tool **95**, as shown in FIG. 6, is inserted in each of the ends of the muffler, that is, in the inlet conduit **31** and in the outlet shell **57**. This has a tapered end that will fit inside the tongues **93** and upon continued pressure the sides of the tool will force the tongues to be deformed back into the surface of the shell **57** and the tube **31** so that they will, in effect, be continuations of the tubular surfaces. Preferably, this is done after the muffler has been fired and the ceramic coat hardened. It may be done just before firing but in this case it is preferable to spray the interior of the flaps with ceramic slip to cover up surface areas where the coating may have been removed by contact with the mandrel.

I claim:

1. The method of improving the corrosion resistance of a muffler, comprising the steps of forming the various components of a muffler including inlet and outlet conduits, forming drainage openings with closure flaps by shearing-out portions of the inlet and outlet conduits located inside the muffler adjacent to the ends of the muffler structure so as to provide passages for the in and out flow of fluids during a coating process, assembling the various muffler components together to form a complete muffler structure, immersing the complete and assembled muffler structure into an anti-corrosive ceramic slip, removing the muffler from the slip and draining the slip from the muffler through a drainage opening, firing the coated muffler and inserting a tool within the muffler to bend the flaps to close the drainage openings.

2. The method of making a corrosion-resistant muffler, comprising the steps of forming non-acoustic openings in the inlet and the outlet conduits of the muffler to provide inlet and outlet flow passages for coating fluids, assembling the various component parts of the muffler into an assembled muffler structure, immersing the muffler structure in a bath of anti-corrosive ceramic, and then firing the ceramic and closing said conduit openings.

3. The method of corrosion-proofing a muffler comprising forming the various component parts of the muffler, forming a drainage opening in the inlet and outlet conduits of the muffler, assembling the muffler, immersing the muffler in a ceramic bath, draining the muffler through a drainage opening and closing said openings to prevent adverse acoustic effects thereof.

4. A method of manufacture of a muffler having a closed casing and tube means extending therein, comprising the steps of: forming drainage passages in said tube means by radial displacement of integral flap portions thereof, coating the interior of said muffler by flowing a coating material through said muffler, and closing said drainage passages by reverse radial displacement of said integral flap portions.

5. A method of manufacture of a muffler having a closed casing and oppositely located inlet and outlet tubes, comprising the steps of: forming transverse drainage passages in the side walls of said inlet and outlet tubes by displacement of integral flap portions thereof from a position lying substantially in the plane of the side walls to a position radially inwardly displaced therefrom, coating the interior of said muffler by flowing a coating material, through at least one of said drainage passages, and closing said drainage passages by displacement of said integral flap portions from the radially inwardly displaced position to the original position lying substantially in the plane of the side walls.

6. The invention as defined in claim **5** and including the additional step of applying coating material to the flap portions and adjacent muffler areas after closing said drainage passages.

7. A method of coating the interior surfaces of a muffler having a closed casing and tube means extending therein, comprising the steps of: forming drainage passage means in the tube means inside of the closed casing, coating the muffler by flowing a coating material through the tube means and into and through the drainage passage means and into and through the muffler, and thereafter closing the drainage passage means inside of the closed casing.

References Cited by the Examiner

UNITED STATES PATENTS

1,070,736	8/13	Rogers	29—530
2,187,431	1/40	Powell	29—157
2,367,753	1/45	Buck	29—157
2,922,485	1/60	Muller	181—54
2,950,777	8/60	Deremer	181—54

FOREIGN PATENTS

126,776	2/48	Australia.
507,464	6/39	Great Britain.

OTHER REFERENCES

"Muffler That Won't Rot Away," Business Week, June 11, 1960, pp. 170 and 172.

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