March 26, 1963 W. H. POWERS 3,082,841

MUFFLER

Filed Oct. 28, 1960 3 Sheets-Sheet 1

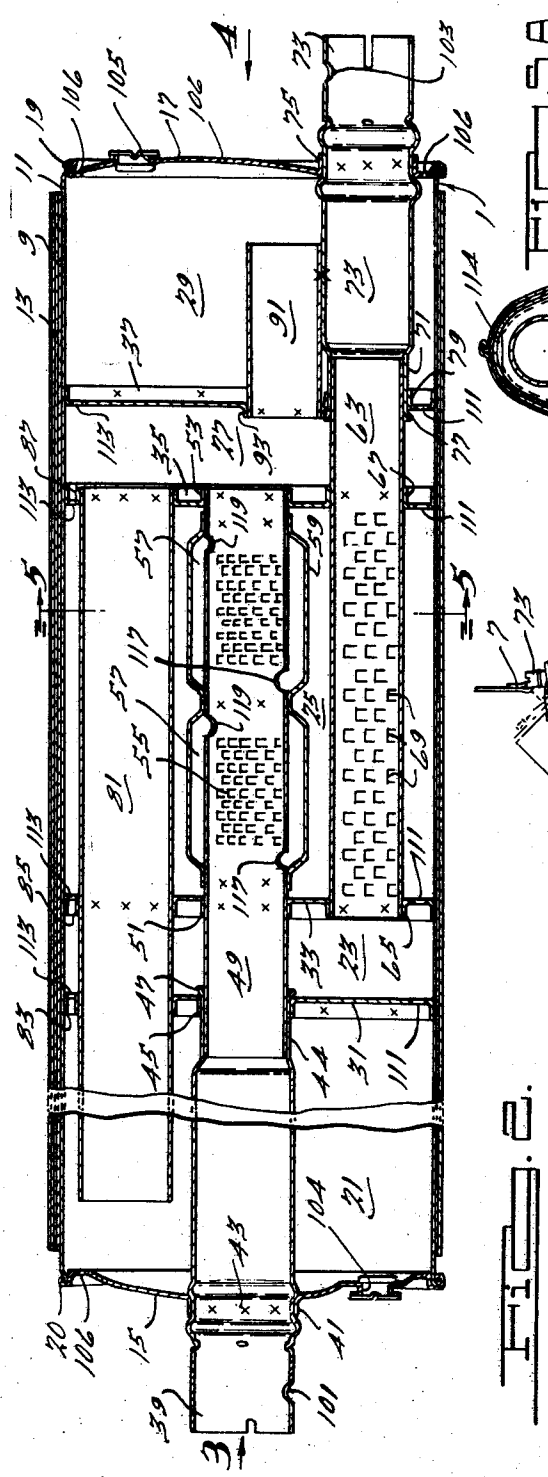


FIG. 2.

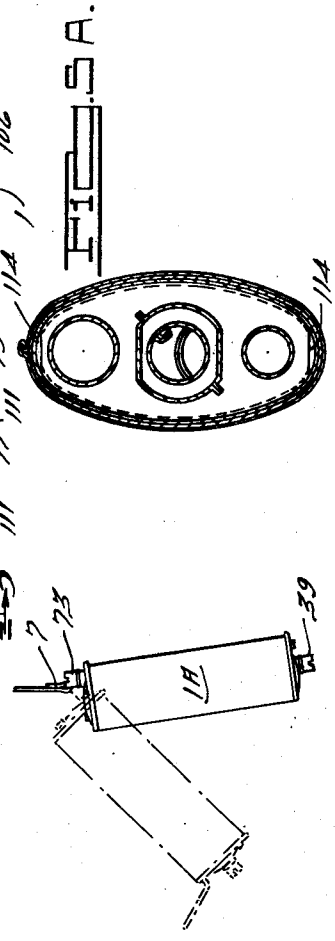


FIG. 5A.

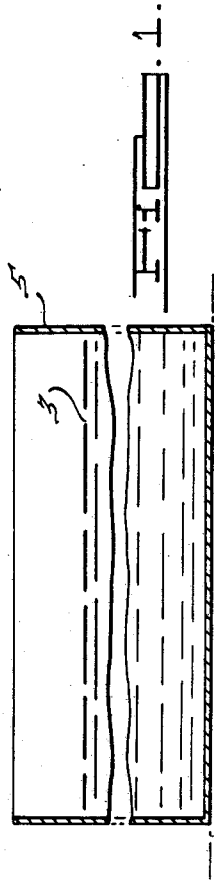


FIG. 1.

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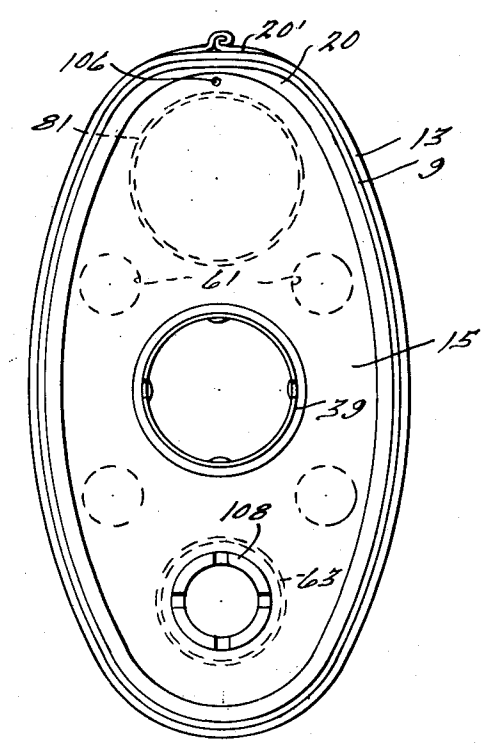


FIG. 3.

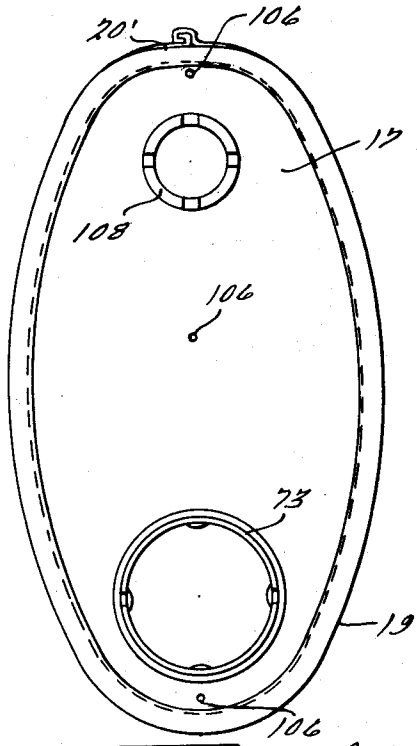


FIG. 4.

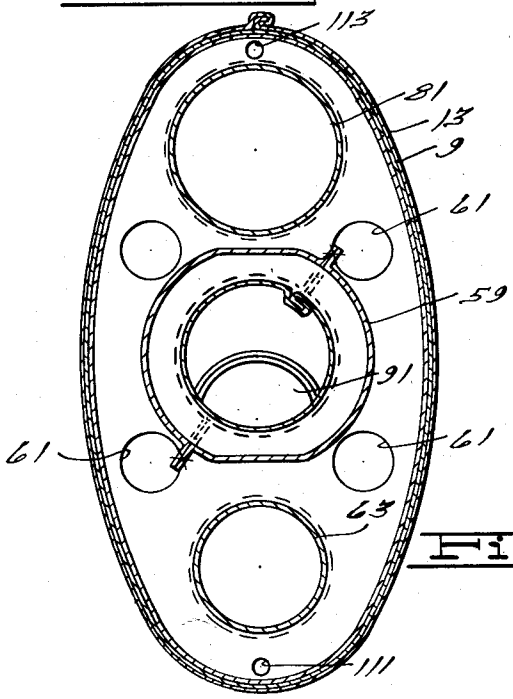


FIG. 5.

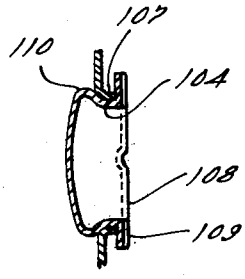


FIG. 6.

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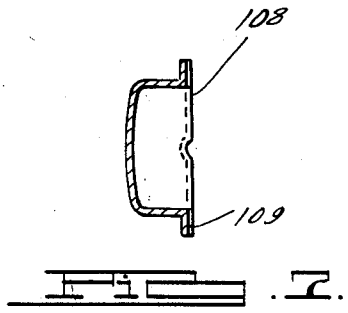


Fig. 7.

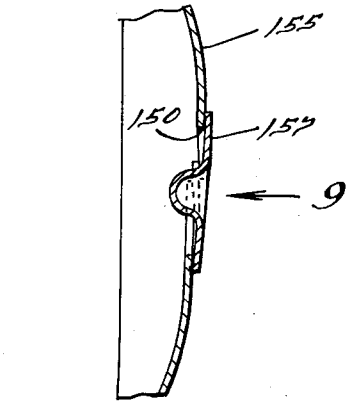


Fig. 8.

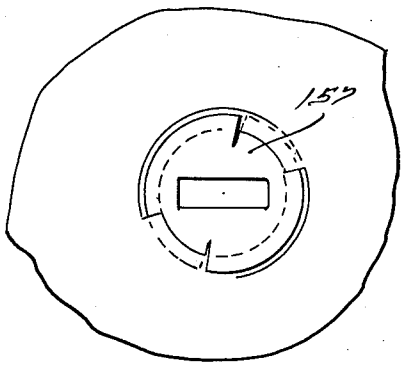


Fig. 9.

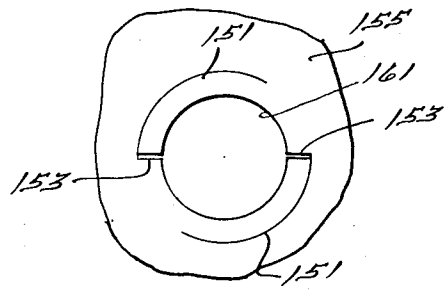


Fig. 11.

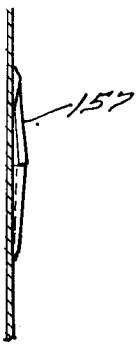


Fig. 10.

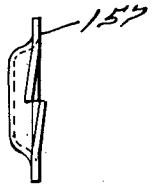


Fig. 12.

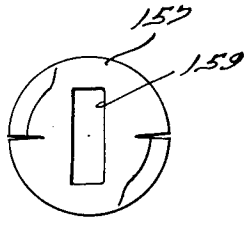


Fig. 13.

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United States Patent Office 3,082,841 Patented Mar. 26, 1963

3,082,841

MUFFLER

Walter H. Powers, Racine, Wis., assignor to Walker Manufacturing Company, a corporation of Delaware

Filed Oct. 28, 1960, Ser. No. 65,767
20 Claims. (Cl. 181—54)

My invention relates to mufflers of the type used to silence the exhaust of internal combustion engines.

It is the object of my invention to greatly reduce or eliminate the corrosion of exhaust mufflers.

In accomplishing the object of my invention I coat the surfaces of the muffler with an anti-corrosive ceramic material of a type available on the open market and which can be applied to a steel surface. I have found that it is best to coat the muffler surfaces after assembly rather than to try to coat the surfaces of individual parts or subassemblies. Thus, I contemplate the dip coating of the muffler in an anti-corrosive ceramic slip. My invention provides a muffler construction that can be successfully coated with ceramic by the dipping process or by other processes if desired.

The conventional muffler contains a series of internal chambers within an outer shell. These form many internal pockets that interfere with the proper drainage of liquids and gases during the coating process. Improper drainage at various stages of the ceramic coating process is very likely to result in incomplete surface coverage and probably in subsequent rust-out at the uncovered areas.

Thus, a further object of my invention is to provide a muffler construction with means for external and internal drainage so that it can be properly ceramic coated.

The invention provides for proper drainage by means of holes located at the correct positions in the various internal chambers. These are located and sized so that they do not have an adverse acoustic effect. The term drainage opening or drainage hole as used hereinafter refers to openings or holes whose primary purpose is for drainage or venting during the coating of a muffler, as distinct from holes intended primarily for exhaust gas flow or for acoustic purposes.

My invention is illustrated in the accompanying drawings in which:

FIGURE 1 is a side elevation, somewhat diagrammatic, showing the muffler **1** in position for dipping in a bath of suitable corrosion resisting ceramic;

FIG. 2 is a longitudinal cross-section through a typical muffler that may be dip coated in accordance with the principles of this invention;

FIG. 3 is an end elevation taken from the left of FIG. 2;

FIG. 4 is an end elevation taken from the right of FIG. 2;

FIG. 5 is a cross-section taken along the line **5—5** of FIG. 2;

FIG. 5A is a cross-section showing a modified form of partition that is cut off to provide air and liquid escape holes;

FIG. 6 is a cross-section taken through the plug of FIGS. 3 and 4;

FIG. 7 is a cross-section through the plug of FIG. 6 prior to insertion;

FIG. 8 is a section similar to that of FIG. 6 showing a modified form of plug;

FIG. 9 is a view taken from the right of FIG. 8;

FIG. 10 is a section similar to that of FIG. 8 with still another form of plug;

FIG. 11 is a view similar to that of FIG. 9 taken from the right of FIG. 10;

FIG. 12 is a side elevation of the plug of FIGS. 10 and 11; and

FIG. 13 is a side elevation of the plugs of FIGS. 10–12.

FIG. 1 illustrates dip ceramic coating of a carbon steel muffler **1A**. The ceramic is in the form of a suitable slip or bath **3** contained in a suitable tank **5**. The muffler **1** may be suspended by a hook **7** which provides the means for lowering the muffler down into the bath and after all surfaces, internal and external, have been coated, for removing the muffler from the bath **3**.

FIG. 2 is a longitudinal cross-section through a typical muffler **1**. It differs slightly from the muffler **1A** illustrated in FIG. 1 in that it shows a layer of asbestos **9** wrapped around the muffler casing **11** and held in place by an external layer of sheet metal **13**. In the coating process I prefer to omit the asbestos layer **9** and the sheet metal **13** since the asbestos **9** will tend to soak up the various liquids involved and the material so absorbed may create difficulties in the subsequent coating and firing of the ceramic dipped muffler.

The muffler **1** has a casing **11** which is formed of sheet steel (as are the internal parts) that is rolled into an oval shape and the overlapping edges spot-welded together or lock-seamed in accordance with standard practice. In the form shown in FIG. 2, the lock-seams would be along the bottom edge of the shell **11**. The opposite ends of the casing **11** are closed by the headers **15** and **17**. The outer peripheries of the headers are tightly connected to the end of the casing **11** in interlocked joints **19** and **20** and in accordance with the invention the top sides of the joints **19** and **20** (opposite the shell joint) are bent inwardly or downwardly so that the outer surface of the casing **11** is exposed at each end, thus enabling the outer shell **13** to be formed as a sheet and wrapped around the layer of asbestos **9** and then lock-seamed by lock-seaming equipment which passes over the flat bent-in portions **20'** after the muffler **1A** has been coated and fired.

The silencing structure within the muffler shell **11** is typical of various types that can be used and will illustrate how such structure should be adapted for the application of protective coatings presenting the same problems as a dip ceramic coating. Thus, the interior of the casing **11** is divided into a series of longitudinally separated chambers **21**, **23**, **25**, **27**, and **29** by a series of transverse sheet steel partitions **31**, **33**, **35**, and **37**. Each of the transverse partitions has, in accordance with the usual practice, an annular flange around its outer periphery and this is spot-welded to the casing **11**. Gas enters the casing **11** through an inlet bushing **39** which is supported in and spot-welded to a neck **41** formed in the inlet header **15**. The inner end of the bushing **39** is necked-down or reduced in diameter at **44** and is supported in and spot-welded to a neck **45** in the partition **31**. The extreme inner end of the bushing **39** has a slit or slotted flare **47** to facilitate the insertion of the end of an inlet conduit **49**, such conduit being slipped inside of the reduced end **44** of bushing **39** at assembly when it and the associated parts to be described are inserted inside of the shell **11**. The conduit **49** is supported in and spot-welded to flanged necks **51** and **53** of the partitions **33** and **35**, respectively. A pair of sets of louvers **55** within the walls of the conduit **49** permit sound waves to enter spit chambers **57** that are formed around the conduit by means of a pancake-type chamber-forming construction **59** consisting of complemental stamped halves that have flanges that are spot-welded together and necks which are spot-welded to the conduit **49**, such construction being more fully described in my copending application, Serial No. 575,404, filed April 2, 1956.

Gases leaving the inlet conduit **49** enter the chamber **27** and reverse the direction of flow to go back toward the inlet end of the muffler. In doing this, the gases

flow back through the volume of the chamber **25** between the partitions **33** and **35**. These partitions have a series of relatively large openings **61** formed in them so that the gases can flow freely and without restriction from the chamber **27** to the chamber **23**. Gases in the chamber **23** flow toward the outlet header **17** through an outlet conduit **63** which is supported in and spot-welded to necks **65** and **67** formed respectively in the partitions **33** and **35**. The section of the tube **63** within chamber **25** may be provided with louvers **69** opening into the chamber **25**. The outer end of the outlet tube **63** is slidably fitted in and supported in the inner reduced end **71** of the outlet bushing **73** which is expanded and spot-welded to the neck **75** in the outlet header **17**. The inner end **71** of the bushing **73** is slit and flared slightly at **77** to enable it to be slipped over the end of the tube **63** and is also spot-welded to the neck **79** in the partition **37**. The slits in flares **77** and **47** facilitate ceramic drainage as will be self-evident hereinafter.

An unusually long tuning tube **81** is supported in and spot-welded to flanged necks **83**, **85**, and **87** of the partitions **31**, **33**, and **35**, being spot-welded to the latter two partitions only. The tube **81** is imperforate and connects the crossover chamber **27** to the chamber **21** and since it provides the only inlet and outlet to such chamber it is apparent that this constitutes a resonator chamber for notes of low frequency. The chamber **29** at the outlet end of the muffler is arranged to act as a resonator chamber by means of a relatively short tuning tube **91** which is spot-welded in a flanged neck **93** of the partition **37** and one end thereof is preferably spot-welded to the bushing **73**.

Coating an assembled muffler, such as the one just described, with a ceramic material involves a series of processing steps or operations such as the following. First, the muffler is heated to about 1300° F. and held for 5 minutes or so to burn off grease, soap, oil, etc. After cooling, the muffler is detergent washed by dipping for about 10–20 minutes in either or both alkali and acid baths, depending upon the materials to be removed, and water rinsed after each wash. Next it is held in a pickling bath, or acid bath, to roughen the surface so as to promote a bond with the ceramic. After this, it is rinsed and dipped in a neutralizing bath and rinsed again. Next it is dipped in a nickel bath to give it a "primer" coating that promotes the bond with the ceramic. Then it is rinsed and neutralized if necessary. After any or all of the various liquid dipping operations of the type just described have been completed (the order may be varied), the muffler may be held in a tank in which hot dry air is blowing so that it can be dried out.

After the foregoing or equivalent preparatory steps are completed and the muffler surfaces are clean and prepared for ceramic, the muffler is dipped in a bath **3** of anticorrosive ceramic slip, drained, dried in hot air, and fired in a furnace at about 1500° F.

It will be recognized that the success of most of the above steps is dependent upon the admission of a fluid to the interior of the muffler so that it contacts all of the muffler surface and then the drainage of all of such fluid from the the interior of the muffler so that the next fluid can contact all of the muffler surfaces. In the steps involving liquids (such as detergent washes, rinses, pickling, neutralizing, and nickel coating) the muffler is preferably suspended from one end, lowered into a bath containing the liquid, raised out of the bath, and drained by gravity flow of the liquid out of the muffler and back into the bath. In mass production of ceramic coated automobile mufflers it is not only necessary that these various operations be performed well but they must also be performed quickly and automatically without the need for individual attention and inspection. The effectiveness with which the surfaces are contacted by the various fluid and the completeness of subsequent drainage as well as the speed with which the fluid enter and leave the muffler all depend upon the use of the proper suspension means and drainage means in the muffler itself. The drainage means, however, must not adversely affect the acoustic characteristics of the muffler.

Referring first to the suspension means, this comprises holes **101** and **103**, respectively, in the inlet and outlet bushings **39** and **73**. These holes receive the end of a hook **7** or other suitable suspending device. A vertical line from the hole **101** or **103** through the center of gravity of the muffler when suspended determines the angle of inclination of the muffler, especially the angle the various transverse partitions, headers, and walls will make to the horizontal. It is evident that in no case can the muffler be suspended by holes **101** and **103** so that the transverse walls will be perfectly horizontal. Thus, whether the muffler is suspended from the inlet or the outlet end, each chamber will have a low point toward which liquid in the chamber will flow. In the case of the flat interior partitions **31**, **33**, **35**, and **37** these low points will be at the corners between the small diameter ends of the partitions and the shell. At these corners I provide internal drainage means in the form of small openings **111** and **113**, respectively, which are preferably about 5/16 inch in diameter and as close as possible to the shell wall. Alternatively, the ends of the partitions could be sliced off as shown at **114** in FIG. 5A to provide drainage openings. It will be noted that when an opening **111** is on the low side the corresponding opening **113** will be on the high side of the adjacent chamber. Thus, as liquid escapes, air can enter to prevent a vacuum lock in the muffler during drainage.

The end headers **15** and **17** of the muffler are provided with external drainage means in the form of large (preferably 1 inch diameter) openings **104** and **105**, respectively, each of which has an outwardly extending neck **107**. These openings are closed after the coating operation is completed by flanged, cup-shaped caps **108** as will be described hereinafter. Additionally, end header **15** may be provided with a 1/16 inch drain hole **106** and header **17** with three such drain holes located as shown in FIGS. 3 and 4. More of these holes may be used if desired since they are small enough to plug up with ceramic during the coating operation and therefore do not cause adverse acoustic effects.

The spit chambers **57** are provided with internal drainage means in the form of holes **117** and **119** located in diagonally opposite corners, the holes **117** being on the inlet and plug **104** sides of the chambers. The holes **117** are preferably about 1/4 inch in diameter and as close as possible to the end walls of the chambers **57** so as to eliminate any pockets that might retain liquid during draining.

The coating operation is carried out with the muffler just described, that is, the muffler of FIG. 2 but before the plugs **108** have been inserted or the outer layers **9** and **13** added to the shell **11**. During the preparatory steps, wherein the muffler is dipped in various free flowing liquids as outlined above, the muffler is preferably suspended from the suspension hole **101** in the inlet bushing **39**. The muffler will hang at an angle defined by a line through the hole **101** and the center of gravity. When this is done the holes **104** and **105**, respectively, will be very close to, if not actually, the high and low points of the space inside the shell **11**. When the muffler is suspended from the bushing **39** and lowered into a liquid bath, the liquid will enter hole **105** and bushing **73** and flow upwardly toward the inlet header **15**. The air replaced by this liquid can escape externally through openings **104** and **106** in the header **15** as well as through inlet tube **49** and bushing **39**. Air in the internal chambers can escape through the uppermost of the various internal drainage openings, in this case, the openings **111** and **117**. Liquid can enter the internal chambers through the various tubes as well as through the lower openings **113**. After the muffler is completely submerged and

held for the desired period of time it will be raised out of the bath and suspended over it so that the liquid will drain-out—principally through opening **105**. Internally the liquid will drain from one chamber to the next through the lower opening **111** and air can enter from the top to replace it through the same openings as it flowed through to leave the muffler. Liquid in spit chambers **57** will drain into tube **49** through low openings **119**. The centrally located hole **106** in header **17** will provide an outlet for any liquid tending to form a puddle in the concave portion of the header. The foregoing arrangement of suspending means and drainage means will enable free flowing liquid to enter and completely leave the muffler without any shaking or agitation, thus facilitating mass dipping of the mufflers without individual attention by an operator.

The ceramic slip **3** is considerably thicker and more viscous than the liquids used in the various preparatory steps and thus flows more slowly than the other liquids. In order to decrease the time required to coat the muffler **1** with ceramic slip, I prefer to suspend it from the outlet bushing hole **103** so that it is oriented more or less as shown in FIG. 1. When this is done the chamber **21** instead of the smaller chamber **29** will be on the bottom. Thus, slip can enter and leave the chamber through large opening **104** instead of openings **111** and **113** and the time required to fill and drain the muffler with slip is reduced substantially. After dipping in the bath of slip **3**, a hook (not shown) is used to engage bead **20** and pivot the muffler up about 45° to the left in FIG. 1, thus putting the various drainage holes at the low points in their respective chambers. After dipping in slip **3**, the mufflers are shaken somewhat by the operators so that the slip is agitated sufficiently to drain out. This contrasts with the drainage during the preliminary steps which is accomplished without shaking of the muffler.

After the muffler has been lifted from tank **3** and drained over it, it is dried to remove as many fluids as possible before firing. The drying may include a step of subjecting the muffler to circulating hot air (as is done after the preparatory steps) and it will be noted that the location of hole **104** on a side opposite tube **81** will prevent short-circuiting such as might occur if the hole were located on the other side of header **15**. During firing of the muffler at an appropriate temperature, normally about 1500° F., it is preferably suspended by hole **101** as this will tend to minimize distortion that might occur due to the heat.

After firing the ceramic is cleaned off the butt ends of necks **107** to expose metal and plugs **108** are inserted in holes **104** and **105**. The plugs are hat-shaped and preferably formed of a non-corrosive, high chrome muffler steel. The flanges **109** on the plugs have projections or ribs formed on them to engage the cleaned edges of necks **107**. Both plugs are projection-welded to the necks in one cycle by simultaneous engagement of both plugs with welding electrodes, the welding current flowing from the plug at one end of the muffler through the muffler shell, which acts as a conductor, to ground or the low potential side by way of the plug at the opposite end of the shell. After this the interiors of the plugs are expanded radially as seen at **110** to engage behind the header material surrounding the holes **104** and **105** and provide a positive engagement against blow-out.

The ceramic layer will build up on the edges of and tend to bridge the various holes and reduce them in size. In order to obtain the desired results, I prefer to make the various louvers, such as louvers **55** and **69**, of rectangular shape and about .030–.040" oversize to avoid clogging or bridging.

In FIGS. 8–13 I have illustrated a different method of plugging the opening in the header. In this form the opening **150**, as shown in FIG. 11, is not flanged and would be preferably about 1 inch in diameter and arcs **151** extending through approximately a quarter-circle would be slit in the material surrounding the opening to form partly annular tabs which would be slit diametrically along line **153** and then lifted up from the plane of the header **155** as seen in FIG. 10. The plug **157** will comprise a flat plate having a rectangular dished T portion **159** which will receive some type of instrument, such as a screw driver, so that the plug can be twisted into place. Sections of the periphery of the plug are slit and deformed from the plane of the plug surface in a manner complementary to the ears **151** so that, as seen in FIGS. 8–9, the plug can be inserted in the openings **150** and then twisted so that these sections will lie over and under the ears **151** and the plug will interlock with the header **155**. The plug is coated with ceramic before insertion so that upon firing a gas-tight seal is obtained.

While, as illustrated, the principles of my invention are shown in connection with ceramic coating, it is possible for these features to be used in the coating of mufflers or other sheet metal devices by other means, such as painting or gaseous diffusion, wherever ventilation of the interior of the muffler may be required during the process.

I claim:

1. A muffler for dip coating and draining comprising an elongated casing having end walls at opposite ends, wall means inside said casing forming a plurality of chambers in the casing, said wall means having at least two spaced small drainage openings located adjacent the casing therein with at least one pair for each chamber, the openings of each pair being located so that they are vertically spaced from each other when the muffler is dipped in a ceramic bath or the like, one of the openings in each pair comprising an air inlet and outlet for its chamber and being located at an uppermost portion of the chamber when the muffler is dipped so that the internal surfaces of the muffler are coated by elimination of air pockets within the muffler.

2. The invention set forth in claim 1 wherein said end walls each have an opening therein and plugs fitting in said opening and secured to said walls to close the openings, said end wall openings providing external drainage means for the flow of air and liquid into and out of the muffler during dipping.

3. A muffler comprising a housing having end headers and internal silencing structure, at least two spaced small internal drainage openings provided in said silencing structure adjacent said housing, said end headers having relatively large external drainage openings therein whereby the internal surfaces of the muffler may be coated by flow of a coating material through the muffler during a coating operation, and plugs inserted in said external drainage openings to eliminate adverse effects of said external drainage openings upon operation of the muffler, said plugs having sections overlapping the inside of the headers whereby pressure within the muffler will force the sections against the headers to prevent blow-out of said plugs during use of the muffler.

4. A muffler comprising a shell having end headers at opposite ends and silencing structure including transverse partitions inside, at least two spaced small internal drainage openings provided in said silencing structure adjacent said shell, one of said headers having a large external drainage hole therein, the other end of said shell having a suspension means formed thereon, said external drainage hole and suspension means being located so that an imaginary line between them passes in close proximity to the center of gravity of the muffler, said drainage openings and hole providing for drainage and venting of the muffler interior during a dip coating operation.

5. The invention set forth in claim 4 wherein said imaginary line is non-perpendicular to said transverse partitions, and at least two of said internal drainage openings being in each of said partitions on opposite sides thereof adjacent the shell.

6. A muffler comprising a sheet steel outer shell, internal silencing structure in the shell, said shell being coated with ceramic, at least two spaced small drainage openings in said internal silencing structure adjacent said outer shell to

provide for flow of coating liquid therethrough and a layer of asbestos around the outside of said shell in contact with the coating of ceramic, and protective wrapper means holding the asbestos in place to protect the ceramic coating on said shell.

7. A muffler of the type having an elongated casing closed by header means and having internal conduits and partition means dividing the casing into a plurality of chambers, said partition means having at least two spaced small drainage openings located adjacent the casing, and said openings being arranged to enable ceramic slip or the like when applied internally to coat all interior parts of the muffler.

8. The invention as defined in claim 7 and wherein the spaced small openings of adjacent partition means are arranged to be located on different horizontal levels when ceramic slip is applied to the muffler to provide for escape of air and entry of slip between chambers.

9. The invention as defined in claim 7 and wherein said header means have relatively large drainage openings provided therein, and plug means mounted in said relatively large drainage openings with sections overlapping the inside of the headers whereby pressures created within the muffler during use will force the sections against the headers and retain the plug means in place in the drainage openings.

10. The invention as defined in claim 7 and wherein one of said header means is provided with a relatively large drainage hole therein at one end of said muffler, and the other of said header means on the other end of said muffler having suspension means integrally formed thereon to support said muffler during internal application of ceramic slip or the like, said relatively large drainage hole and said suspension means being located on said header means so that an imaginary line extending between them passes in close proximity to the center of gravity of the muffler.

11. A muffler of the type having an elongated substantially oval casing closed by header means and having internal conduits and oval partition means dividing the casing into a plurality of chambers, the casing having top and bottom wall portions connected by side wall portions, said partition means having at least two oppositely arranged small internal drainage openings adjacent the wall portions of the casing, said openings providing liquid drainage and air vent paths within the muffler between each of said chambers.

12. An internally coated muffler of the type having an elongated casing closed by header means and having internal conduits and partition means, said partition means having at least two oppositely arranged small internal drainage openings adjacent the casing, said openings enabling a coating material or the like when applied internally to coat all internal parts of said muffler.

13. A muffler having an internal ceramic coating substantially completely covering the internal surfaces thereof and of the type having an elongated closed casing and having internal conduits and partition means, said partition means having at least two oppositely arranged small internal drainage openings adjacent the casing, said casing having external drainage openings at the ends thereof; said drainage openings enabling ceramic slip or the like when applied internally to coat all internal parts of said muffler.

14. A muffler having an internal ceramic coating substantially completely covering the internal surfaces thereof and of the type having an elongated substantially oval casing closed by header means and having internal conduits and oval partitions dividing the casing into a plurality of chambers, said oval partitions having major and minor axes, the casing having top and bottom wall portions located adjacent the ends of the minor axes of said partitions and side wall portions located adjacent the ends of the major axes of said partitions, said oval partitions having at least two oppositely arranged small internal drainage openings adjacent the side wall portions of the casing, said openings enabling ceramic slip or the like when applied internally to coat all the internal parts of the muffler.

15. A muffler adapted to be coated after assembly of internal parts by dipping in a ceramic bath comprising an elongated casing, said casing having header means closing opposite ends, transverse partition means dividing the casing into a plurality of chambers, hanger receiving means provided on at least one end of said casing and located to support said muffler during a coating operation in a tilted position with the longitudinal axis of the muffler inclined to the vertical, and said partition means having at least two small spaced internal drainage openings located closely adjacent the casing and spaced from one another and the center of gravity of the muffler so that one of said two small openings acquires a position vertically spaced from the other of said small openings when the muffler is supported by said hanger receiving means to provide for drainage and venting of said chambers internally of said muffler during a coating operation.

16. A muffler adapted to be coated after assembly of internal parts by dipping in a ceramic bath comprising an elongated casing, said casing having header means closing opposite ends, transverse partition means dividing the casing into a plurality of chambers, hanger receiving means provided on at least one end of said casing and located to support said muffler during a coating operation in a tilted position with the longitudinal axis of the muffler inclined to the vertical, said partition means having at least two small spaced internal drainage openings located closely adjacent the casing and spaced from one another and the center of gravity of the muffler so that one of said two small openings acquires a position vertically spaced from the other of said small openings when the muffler is supported by said hanger receiving means to provide for drainage and venting of said chambers internally of said muffler during a coating operation, external drainage holes formed at the ends of the casing to provide for drainage and venting of the casing as a whole during dipping in a ceramic bath, and closure means for covering said external drainage holes after coating.

17. A muffler adapted to be coated by being suspended in a ceramic bath comprising an elongated casing, headers closing the ends of the casing and having inlet and outlet bushings, a plurality of transverse partitions forming chambers inside said casing, said partitions extending at right angles to the longitudinal axis of the muffler, one of said bushings having a hook receiving hole therein, said hole being located so that an imaginary line through it and the center of gravity of the muffler will be inclined to the longitudinal axis of the muffler whereby said partitions will be at an angle to the horizontal when the muffler is suspended by said hook hole, and at least two small spaced internal drainage openings provided in said partitions adjacent the casing for drainage and venting of said chambers when said muffler is suspended in a bath by means of said hook hole.

18. A muffler adapted to be ceramic coated after assembly by dipping, comprising an elongated casing, headers closing opposite ends of the casing and having inlet and outlet bushings therein, transverse partitions dividing the casing into a plurality of chambers, a support opening for a hook provided in one of said bushings to enable said muffler to be suspended during dipping in a bath, at least two small spaced internal drainage openings provided in each of said partitions on opposite sides thereof and adjacent the casing, said internal drainage openings providing for internal venting and draining of said chambers during dipping of the assembly muffler in a bath, the header at the end opposite to said hook support opening having a relatively large external drainage opening therein to provide for external draining and venting of the muffler during dipping in a bath, said external drainage opening and said hook opening being located so that an imaginary

line extending therethrough is located close to the center of gravity of the muffler and inclined to the longitudinal axis of the muffler whereby said external drainage opening will be substantially at the low point of the muffler and said partitions will be inclined to the horizontal when said muffler is suspended by means of said hook support opening, said two internal drainage openings in each partition being located so as to be respectively at substantially the high and low points of their respective partitions when said muffler is suspended by means of said hook support opening, the header at the hook support opening end of said muffler being provided with a relatively large external drainage opening.

19. A muffler for dip-type ceramic coating or the like, comprising an elongated casing having a longitudinal axis, transverse partitions inside the casing extending at right angles to said axis, suspension means on the muffler for vertically suspending said muffler so that said longitudinal axis is inclined to the vertical and said partitions are inclined to the horizontal whereby coating liquids in said chambers tends to accumulate in a lowermost portion thereof when the muffler is suspended by said suspension means, said partitions having at least two spaced openings formed therein located adjacent the casing, one of said openings being located in the lowermost portion to provide for drainage of liquid from said lowermost portion and the other of said openings being located above said one opening to provide for venting of said chambers when said muffler is suspended by said suspension means.

20. The method of manufacturing a muffler having an elongated casing closed by header means and internal gas passages and partition means dividing the casing into a plurality of chambers, comprising the steps of; forming drain passage means, including at least two spaced small drainage openings adjacent said casing in said muffler; assembling the muffler; and thereafter dipping the assembled muffler in a ceramic slip or the like to internally coat the muffler.

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