

Oct. 4, 1966

F. WHITE

3,276,108

METHOD OF MAKING A MUFFLER

Filed Feb. 21, 1964

2 Sheets-Sheet 1

FIG. 3

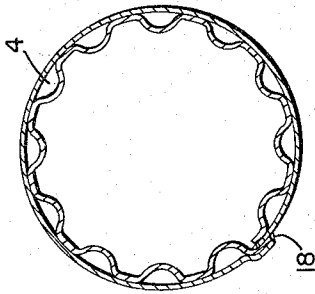
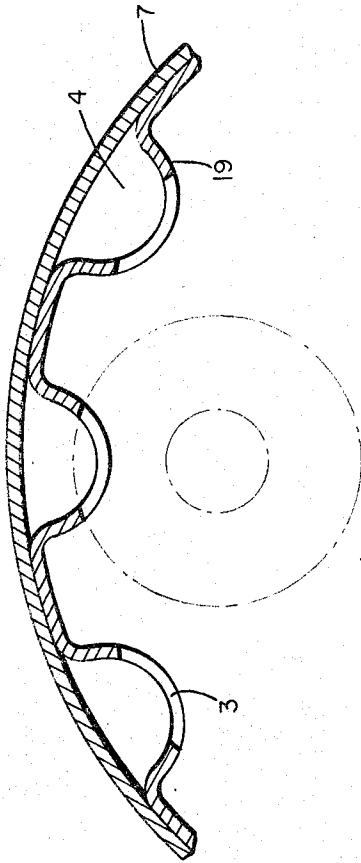


FIG. 2

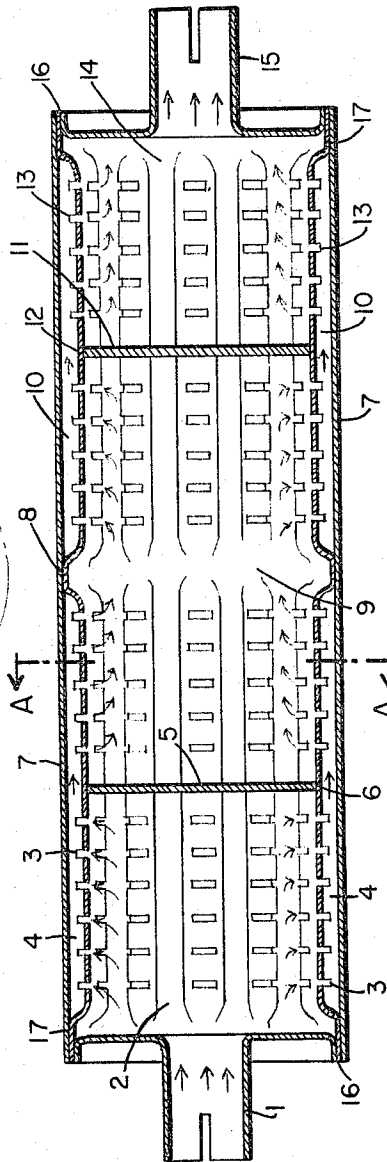


FIG. 1

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2 Sheets-Sheet 2

FIG. 4

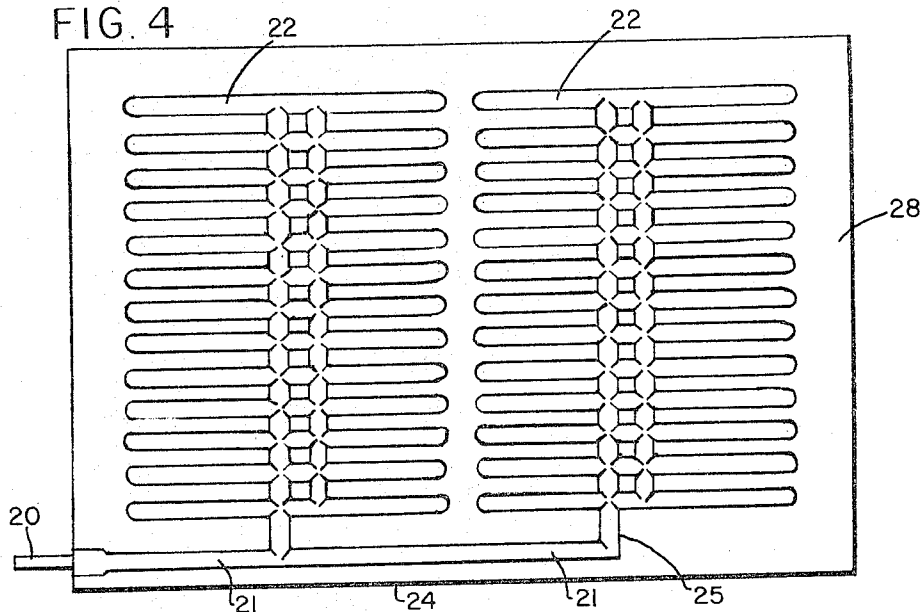


FIG. 5

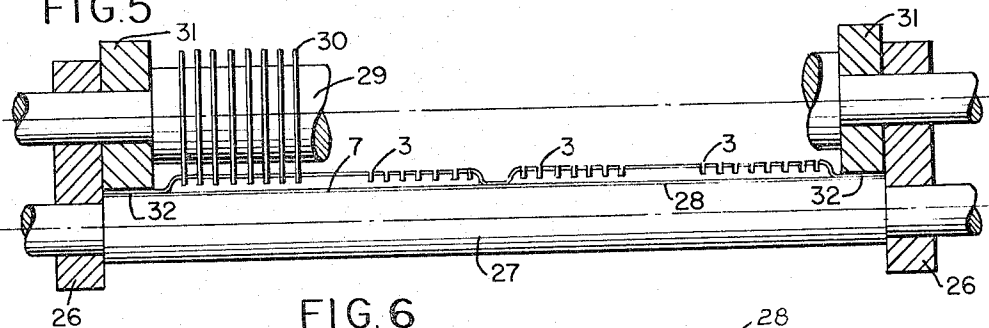
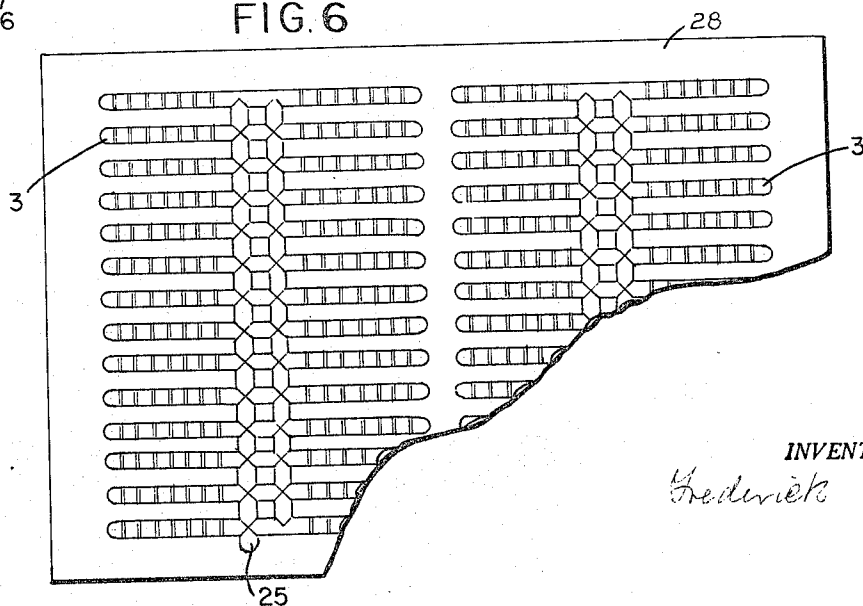


FIG. 6



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METHOD OF MAKING A MUFFLER

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5 Claims. (Cl. 29—157)

This invention relates to a method of manufacture of a muffler such as is normally used to reduce noise from the exhaust of an internal combustion engine. A common form of muffler construction comprises a box-like structure having inlet and outlet pipe connections arranged to interrupt the free flow of exhaust gas from the engine to the atmosphere and level out the gas pulsations. A muffler is usually divided into a series of chambers and exhaust gas is arranged to flow through perforated holes in a tubular member connecting successive chambers. In most cases of existing mufflers no special arrangements are made to cool the exhaust gas during its passage from muffler inlet to outlet.

According to the present invention the muffler casing is comprised of tubed sheet. This is a common name given to laminated sheet in which ducted passages are formed between the laminations. By suitably arranging the position of the ducted passages and piercing holes in them exhaust gas is made to flow through them while passing from one chamber to another. In this manner the exhaust gas temperature is reduced by conduction of heat to the cool outer surface of the muffler. A reduction in exhaust gas temperature will result in decreased volume and speed of gas flow. Another advantage of this invention is that the construction of a muffler can be simplified because fewer parts are needed in its construction. A further advantage is that due to its improved heat conducting ability a muffler of smaller dimensions is made possible.

Another object of this method is to show a way to form apertures into the ducted passages of the tubed sheet before it is bent into shape to form the muffler casing.

All the references to tubed sheet contained herein apply to a well known method whereby two sheets of metal are bonded together by a rolling process and subsequently separated locally in a predetermined pattern of ducts. The invention is not confined to any particular method of manufacture of tubed sheet but rather to the application of such to muffler construction. The invention has particular reference to aluminum tubed sheet because of its high heat conductivity and resistance to corrosion.

In the accompanying drawings FIG. 1 shows a longitudinal section through a muffler indicating by arrows the path of exhaust gas. FIG. 2 shows a cross section through the muffler taken along line A—A of FIG. 1 indicating ducted passages in its outer casing. FIG. 3 shows an enlarged section of a portion of the outer casing ducted passages which indicates the position of slots communicating with the muffler interior. FIG. 4 shows a plan view of the tubed sheet from which the muffler casing is constructed. FIG. 5 shows a sectional elevation of the tubed sheet in process of being slotted through the raised ducted passages. FIG. 6 shows a plan view of the inside surface of a tubed sheet while it is still in its flat form before being bent to shape.

Now referring to FIG. 1, the pipe connection 1 is arranged to connect with the engine exhaust pipe to conduct exhaust gas into the first expansion compartment 2 and thence through slots 3 cut into ducted passages 4. The first baffle 5 which is sealed at 6 around its periphery, compels exhaust gas to follow a path adjacent

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to outer shell 7 of the muffler casing. Arrows indicate the path of the exhaust gas and it will be seen that in passing from one chamber to another the gas contacts outer shell 7 of the muffler casing through which it can release some of its heat to the surrounding atmosphere. In the case of an automobile muffler, the added cooling of the muffler due to the motion of the vehicle would help to increase muffler efficiency. Ducted passages 4 are interrupted at 8 so as to force exhaust gas into the second expansion chamber 9 before entering ducted passages 10. Second baffle 11 is sealed to the inner surface of the muffler casing at 12 in a similar manner to the first baffle 5. From ducted passages 10 the exhaust gas is lead through slots 13 into the third expansion chamber 14 and thence to pipe connection 15 which is connected to the exhaust tail pipe. Both pipe connections 1 and 15 are securely fastened to the muffler casing at 16 and the ducted passages are shortened at 17 to provide a smooth surface for forming a gas tight joint.

FIG. 2 shows a section through the muffler at line A—A of FIG. 1 and indicates at 18 where the tubed sheet is joined between adjacent ducted passages after bending to shape. FIG. 3 shows an enlarged section of the muffler casing in which ducted passages 4 are formed by hydraulically separating the inner lamination 19 from outer shell 7. Slots 3 which are cut into ducted passages 4 are arranged in width and depth to give the desired degree of exhaust passage area without undue back pressure.

In one method of manufacturing tubed sheet the pattern of ducted passages is first printed on to a sheet of metal using a graphite ink. After drying another sheet is placed on top covering the pattern and the two sheets are hot rolled together. After cooling the composite sheet is sheared to expose one end of the printed pattern and a tube is inserted at this point between the two sheets for connecting to a pump. The composite sheet is then placed in a press and hydraulic pressure from the pump inflates the ducted passages following the path of the printed pattern. The ducted passages can be raised from the composite sheet on both sides or from one side only. The drawings illustrating the invention of this application show the ducted passages formed on one side only.

FIG. 4 shows a plan view of the tubed sheet after hydraulically inflating a pattern of ducted passages. The hydraulic pressure is applied to tube inlet 20 through main ducted passage 21 raising the main groups of ducted passages 22 in the flat tubed sheet 28. The size of tubed sheet 28 is made large enough to allow side 24 with ducted passages 21 to be sheared off and the ends of ducted passages at 25 are flattened down and sealed off as shown in FIG. 6.

After shearing to size the tubed sheet is passed through a milling machine, shown in FIG. 5, where all the slots 3 are cut in one pass of the tubed sheet through the machine. The milling machine comprises rigid supports 26 carrying roller 27 for supporting tubed sheet 28. A rotatable cutter spindle 29 supporting cutters 30, is positioned to cut slots 3 at the required depth without touching outer shell 7 of tubed sheet 28. Bearings 31, free to rotate on cutter spindle 29, are arranged to contact the tubed sheet at 32 pressing against roller 27. Cutters 30 are locked to cutter spindle 29 and rotate with it. Roller 27 is rotated to drive tubed plate through the machine while slots are cut into successive ducted passages. FIG. 6 shows the tubed sheet 28 after it has passed through the milling machine and the slots have been cut. The completed tubed sheet 28 is then bent into shape as shown in FIG. 2 and a suitable gas tight joint 18 (FIG. 2) formed along its whole length. Pipe connections 1 and 15 also first baffle 5 and second baffle

11 are enclosed and sealed into the tubed sheet 28 as it is bent.

The invention is not confined to an application wherein exhaust gas is transferred through slots to the ducted passages as it would be equally effective if holes were used instead of slots. Alternatively, the slots into the ducted passages could be made longitudinally instead of radially as shown in the drawings. In this latter case it would be necessary to seal off the slots at points 6 and 12 where the two baffles 5 and 11 are fitted.

Having now fully described one embodiment of the invention, what I claim is:

1. A method of manufacturing a muffler comprising the steps of forming a laminated sheet material having bonded and unbonded areas and further having longitudinally extending marginal portions, inflating the unbonded areas to form passageways which extend longitudinally along the laminated sheet, providing a plurality of apertures through the laminated sheet along the passageways formed by inflating the unbonded areas of said laminated sheet, bending said laminated sheet to form a longitudinal seam at the longitudinally extending marginal portions of said laminated sheet, and connecting inlet and exhaust pipes to opposite ends of said bent laminated sheet.

2. A method of manufacturing a muffler comprising the steps of forming a laminated sheet material having bonded and unbonded areas and further having longitudinally extending marginal portions, inflating the unbonded areas to form passageways which extend longitudinally along the laminated sheet, providing a plurality of apertures through the laminated sheet along the passageways formed by inflating the unbonded areas of said laminated sheet, bending said laminated sheet into tubular form to provide a longitudinal seam at the longitudinally extending marginal portions of said laminated sheet and forming thereby an interior passageway, said apertures in said inflated portions of said laminated sheet providing communication between the longitudinally extending passageways formed by inflation of the unbonded areas of said laminated sheet and the interior of the passageway formed by bending said laminated sheet into tubular form, and connecting inlet and exhaust pipes to opposite ends of said bent laminated sheet.

3. A method of manufacturing a muffler comprising the steps of forming a laminated sheet material having bonded and unbonded areas and further having longitudinally extending marginal portions, inflating the unbonded areas to form passageways which extend longitudinally along the laminated sheet, providing a plurality of apertures through the laminated sheet along the passageways formed by inflating the unbonded areas of said laminated sheet, bending said laminated sheet into tubular form to provide a longitudinal seam at the longitudinally extending marginal portions of said laminated sheet and forming thereby an interior passageway, said apertures in said inflated portions of said laminated sheet providing communication between the longitudinally extending passageways formed by inflation of the unbonded areas of said laminated sheet and the interior of the passageway formed by bending said laminated sheet into tubular form, securing baffle means to the inflated portions of said laminated sheet within the interior passageway formed by bending said laminated sheet into tubular form, and connecting inlet exhaust pipes to opposite ends of said bent laminated sheet.

4. A method of manufacturing a muffler comprising the steps of forming a laminated sheet material having

bonded and unbonded areas and further having longitudinally extending marginal portions, inflating the unbonded areas to form a first set of longitudinally extending passageways and a second set of longitudinally extending passageways which are longitudinally spaced from said first set of longitudinally extending passageways, providing a plurality of apertures through the laminated sheet along the passageways formed by inflating the unbonded areas of said laminated sheet, bending said laminated sheet into tubular form to provide a longitudinal seam at the longitudinally extending marginal portions of said laminated sheet and forming thereby an interior passageway, said apertures in said inflated portions of said laminated sheet providing communication between the longitudinally extending passageways formed by inflation of the unbonded areas of said laminated sheet and the interior passageway formed by bending said laminated sheet into tubular form, and connecting inlet and exhaust pipes to opposite ends of said bent laminated sheet.

5. A method of manufacturing a muffler comprising the steps of forming a laminated sheet material having bonded and unbonded areas and further having longitudinally extending marginal portions, inflating the unbonded areas to form a first set of longitudinally extending passageways and a second set of longitudinally extending passageways which are longitudinally spaced from said first set of longitudinally extending passageways, providing a plurality of apertures through the laminated sheet along the passageways formed by inflating the unbonded areas of said laminated sheet, bending said laminated sheet into tubular form to provide a longitudinal seam at the longitudinally extending marginal portions of said laminated sheet and forming thereby an interior passageway, said apertures in said inflated portions of said laminated sheet providing communication between the longitudinally extending passageways formed by inflation of the unbonded areas of said laminated sheet and the interior passageway formed by bending said laminated sheet into tubular form, securing baffle means to each set of the inflated portions of said laminated sheet within the interior passageway formed by bending said laminated sheet into tubular form, and connecting inlet and exhaust pipes to opposite ends of said bent laminated sheet.

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