June 12, 1962 L. O. HEDBLOM 3,038,552

MUFFLER CONSTRUCTION

Filed May 2, 1960

2 Sheets-Sheet 1

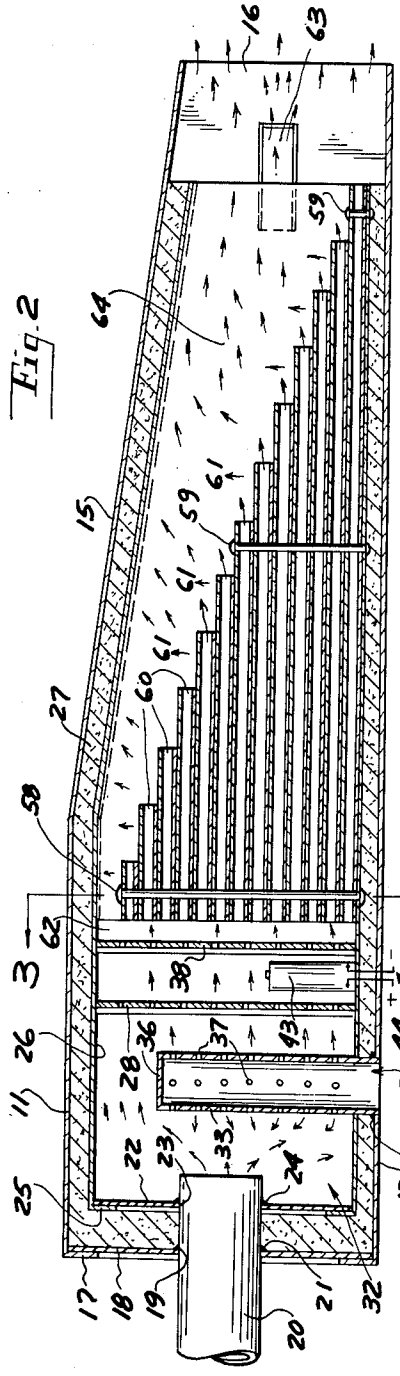

Fig. 2

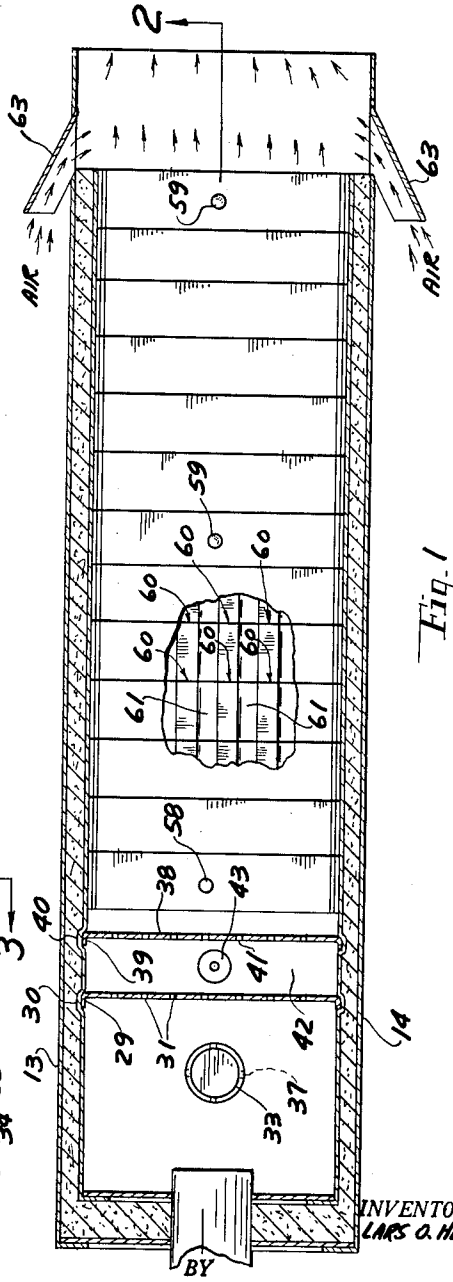

Fig. 1

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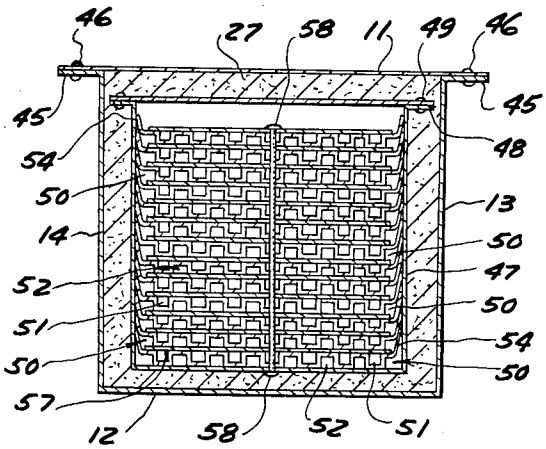


Fig. 3

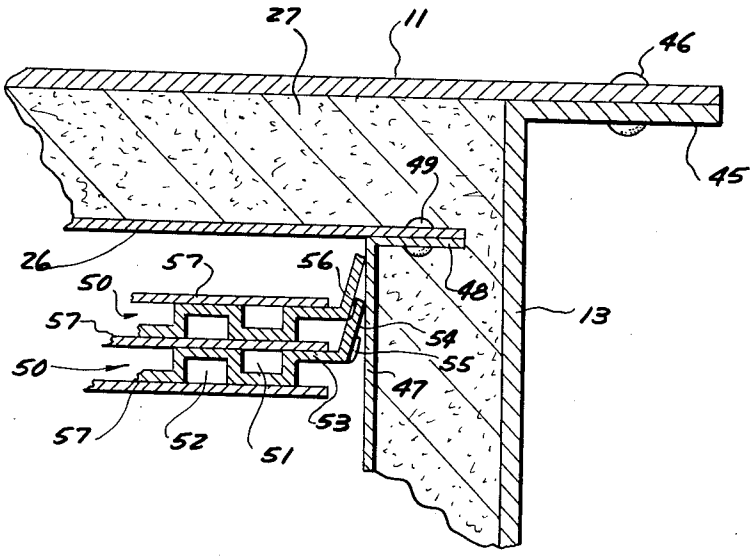


Fig. 4

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# MUFFLER CONSTRUCTION

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7 Claims. (Cl. 181—56)

This invention relates to a muffler construction and more particularly to an improved silencer device for the exhausts of internal combustion engines.

Heretofore there have been a large number of mufflers developed in an effort to improve their efficiency, and at the same time minimize as much as possible the larger portion of the undesirable and volatile, or otherwise noxious products of combustion. Various efforts have been made to provide a means of afterburning the exhaust gases to eliminate the combustibles as much as possible from the products of combustion and at the same time provide an effective exhaust muffler.

It is an object of the present invention to provide a timed muffler wherein the products of combustion on entering the muffler housing are combined with atmospheric air for the purpose of further combustion within the exhaust casing and for subsequent distribution through a series of muffler passages for eventual distribution of the end products of combustion from the internal combustion engine.

It is a further object of the present invention to provide an insulated type of muffler housing together with an air mixing chamber and a separate and independent burning chamber together with means for breaking up the exhaust gases and delivering the same through a plurality of different length passages for eventual distribution through the outlet portion of the exhaust pipe.

It is a further object of the present invention to provide a timed silencer or timed muffler assembly together with a plurality of honeycombed type passages of a constricted character for breaking up the mixture of products of combustion and atmospheric air so as to provide an efficient muffler and at the same time to minimize to the greatest extent the noxious products of a volatile character or the products which are the result of incomplete combustion and to the extent possible purify the exhaust gases passing through the said muffler.

These and other objects will be seen from the following specification and claims in conjunction with the appended drawings in which:

FIG. 1 is a plan longitudinal section of the present muffler.

FIG. 2 is a longitudinal section taken on line 2—2 of FIG. 1.

FIG. 3 is a section taken on line 3—3 of FIG. 2.

FIG. 4 is a fragmentary view similar to FIG. 3 showing a portion of the assembly on an enlarged scale.

It is understood that the above drawings illustrate merely a preferred embodiment of the invention and that other embodiments are contemplated, within the scope of the claims hereafter set forth.

Referring to the drawings, the present muffler includes a sheet metal outer casing which includes top and bottom walls 11 and 12 respectively and the side walls 13 and 14, the top wall as shown in FIG. 2 terminating in the downwardly tapered rearwardly extending wall 15, and defining at its end the exhaust outlet 16.

The said top and bottom and side walls at their rear ends are inwardly flanged as at 17 so as to cooperatively and retainingly engage the closure plate 18 which is apertured centrally at 19 to receive the exhaust pipe 20 fixedly secured thereto as by the welds 21.

The exhaust pipe 20 also projects through a central opening 23 in the second closure plate 22, being fixedly secured thereto by the welds 24. This second closure plate 22 is retainingly engaged by the ends flange 25



which is directed inwardly throughout the perimeter of the inner casing 26 of the muffler. Said casing is spaced inwardly from the respective top and bottom, side and end walls of the outer casing above described.

Interposed between the outer casing and the inner casing there is nested throughout a suitable insulating material 27 of heat resisting material such as asbestos, steel wool, expanded slag, pumice aggregate, cinder, rock wool, or the like.

Positioned within the inner casing 26 and inwardly of its end wall 22 is the parallel spaced upright partition 28 apertured throughout at 31 and having a peripheral flange 29 which is retainingly nested within an annular internal groove 30 defined within the interior casing. Partition 28 thus defines with end wall 22 the air mixing chamber 32 into which projects the air pipe 33 which extends through and opens outwardly from the outer casing being fixedly secured thereto as by welds 34 shown in FIG. 2.

The air intake 35 delivers air to the interior of the pipe 33 whose upper end is closed as at 36 but which is provided with a series of right angularly related rows of outlet apertures 37 providing communication with the products or combustion within chamber 32 from the exhaust pipe 20.

A second upright partition 38 apertured throughout at 41 is spaced inwardly of the first partition 28 within the interior casing 26 and also has an annular flange 39 which is retainingly nested within an annular groove 40 formed within the said inner casing to thus define between the partitions 28 and 38 the firing chamber 42.

A glow plug is generally indicated at 43 with electrical connections 44 diagrammatically shown in FIG. 2, being positioned centrally within the chamber 42 as a means of burning products of combustion mixed with air as they enter the said chamber 42.

It is contemplated that any other firing means may be employed such as a conventional spark plug for the primary purpose of completing a combustion of exhaust products which had not therefore been fully burned, and for burning as much as possible the volatile products of combustion from the internal combustion engine. The pressure conditions are such that the expanded and further burned exhaust products pass through the apertures 41 in the partition 38 and into the main exhaust chamber 62 defined within the interior casing 26 and which is best illustrated in FIG. 2.

From the chamber 62, the products of combustion are transmitted through a series of honeycomb type of elongated passages, into chamber 61 and thence exhausted through the outlet 16, as will be hereafter described.

Referring to FIGS. 3 and 4 the construction of the outer casing is shown in further detail and wherein the respective side walls 13 and 14 extend up to the top wall 11 and have outwardly extending flanges 45 which are secured to the top wall and by the series of longitudinally spaced rivets 46. The same thing is true with respect to the side walls 47 of the interior casing 26 which extend up to the corresponding top wall thereof and have outturned longitudinally extending flanges 48, which are secured to undersurface portions of the top wall of the casing as by a series of longitudinally spaced rivets 49.

The main muffling assembly for the present construction which extends from chamber 62 and into chamber 61 of the interior casing 26 consists of a series of elongated corrugated assemblies 50 providing longitudinally extending parallel oppositely arranged upwardly opening channels 51 and respective downwardly opening channels 52. The corrugated assembly 50 extends transversely of the width of the interior casing 26 as best shown in

FIG. 3 with respective ends of the individual formed channel assemblies **50** having outwardly extending elongated flanges **53** which terminate in the upwardly and outwardly inclined mounting flanges **54**.

In the layup shown in FIGS. 3 and 4, it is seen that above the bottom assembly **50**, which rests upon the bottom wall of the inner casing **26**, there is provisioned a horizontally elongated rectangular plate **57**. Thereabove there is provided an additional corrugated channel assembly **50** and thereafter a series of such channel assemblies **50** with plates **57** interposed alternately and stacked, as shown in the finished FIG. 3. The important factor, however, is that the bottom channel assembly **50** is the longest channel assembly and thereafter the respective stacks of channel assemblies are of decreasing length going upwardly until you will note in FIG. 2 that the top channel assembly is substantially short.

The respective corrugated channel assemblies are secured together by the series of rivets **58** and **59** to provide a rigid assembly. The respective flanges **54** of each of the channel assemblies have the upwardly inclined outwardly extending keys or depressions **55** which are adapted to cooperatively nest within corresponding recesses formed in adjacent flanges so as to maintain a fixed relationship between the respective channel members.

In FIGS. 1 and 2, as well as in FIG. 4, the downwardly opened channels **52** are of course closed by the corresponding plate **57** arranged therebelow. Accordingly, the channels **52** terminate at their ends in the outlets **60**. For each particular channel assembly **50** there are provided a series of longitudinally extending parallel passages **52** each terminating in an outlet **60**, all within the same upright plane. The same thing is true with each successive individual channel assembly **50**. These also respectively terminate in additional outlets **60**. It is seen that there is thus provided a stepped and staggered relation with the said transversely extending rows of outlets **60** from a particular channel assembly being arranged rearwardly and upwardly with respect to the one thereunder.

Each of the respective channel assemblies **50** also includes a series of parallel upwardly opening passages **51** which are alternated with the downwardly opening passages **52**. These are of course, closed at their upper surfaces by the adjacent plate **57**.

These upwardly opening channels, of course, have a pair of outlets. One set of outlets being at the respective ends of the channels **51** corresponding to the outlets **60** of the downwardly opening channels. Additionally, however, to the extent that an upwardly opening channel **51** is exposed by the next succeeding channel assembly of reduced length, however, there is thus provided adjacent the ends of the respective upwardly opening channels, the upwardly opening outlets **61**, best shown in FIG. 1; and so on for each of the upwardly opening channels **51**. These are, of course, covered by the respective plates **57**. However, for illustration, the first plate working from the bottom upwardly, and as shown in FIG. 2 does not extend to the full length of the bottom channel assembly **50**. This means that the upwardly opening channels **51** in the said bottom assembly not only are open at their respective outer ends for communication with the outlet **16**, but accordingly also open upwardly extending back to the second channel assembly thereabove and which is of reduced length.

The same thing may be said with respect to each of the upwardly opening channels for each of the succeeding channel assemblies. Thus the downwardly opening channels **52** for any particular channel assembly only have outlets at their respective ends as at **60**, whereas the upwardly opening channels **51** have not only outlets at their ends but also the upwardly extending outlets designated at **61** in FIG. 1 and schematically shown in FIG. 2.

This series of elongated passages of honeycombed type



provides a means of breaking up the products of combustion from the exhaust pipe **20** and additionally for transmitting the same after having passed through the secondary combustion chamber **42** into the main exhaust chambers **62** and **64**.

As viewed in FIGS. 1 and 2, a pair of angular fittings **63** of semi-circular cross sectional shape are provisioned so as to extend angularly into the outlet end **16** of the muffler assembly. These are employed for the introduction of additional atmospheric air into the stream of exhaust gas flowing outwardly of the muffler.

Primarily, however, the fittings act as air scoops directing streams of air through the outlet **16** for the purpose of producing a reduced air pressure condition or vacuum and for increasing the velocity of flow of exhaust segments through the tubes **51—52**. With the muffler moving with the vehicle, air is forced into the outlet end of the muffler to comingle with the flow of gases at the outlet **16**.

The present muffler is designed to break up the exhaust gases without obstruction or back and forth movement so that no back pressure is produced upon the engine exhaust system. Consequently the engine develops more power in proportion to its size than with a conventional muffler, which creates back pressure.

The respective outlets **60** and **61** deliver the broken up streams of exhaust to the exhaust chamber **64**, which is open to exhaust outlet **16**. Thus the muffler acts like a silencer.

As the channels **51** and **52** are of different lengths, there is a time differential at the outlets of the unit areas of exhaust as delivered to the respective inlets of the individual channels. This timed delay results in a large number of minute explosions to produce the silencing factor. It is contemplated that the top of the inner and outer casing may be cut away and open to the atmosphere and that a very efficient silencing muffler assembly is nevertheless produced.

Very often three or more mufflers are employed with certain automobiles and tractors. It is contemplated as a part of the present invention that one of the present mufflers may suffice for this purpose.

Having described my invention, reference should now be had to the following claims.

I claim:

1. In a timed muffler for the exhaust of an internal combustion engine, a hollow elongated outer casing having an outlet at one end, a hollow elongated inner casing spaced inwardly thereof and having an outlet at one end, longitudinally spaced centrally apertured closure walls at the other ends of said casings, an exhaust pipe extending through said closure walls and secured thereto, insulation means interposed between said casings, a first variably apertured partition secured within the inner casing longitudinally spaced from its closure wall defining a mixing chamber, a fresh air intake pipe secured within said chamber extending through said casings and opening outwardly, said intake pipe being perforated so that exhaust gases in passing through said mixing chamber draw air thereinto for mixing with said exhaust gases from said exhaust pipe, a second variably apertured partition secured within the inner casing longitudinally spaced from said first partition, said inner casing defining with said second partition an exhaust chamber, consisting of a series of vertically spaced rows of exhaust channel members arranged longitudinally within said exhaust chamber, with succeeding rows thereabove being of decreasing length, each row consisting of a series of parallel spaced elongated channels having a cross sectional area a small fraction of that of said inner casing, the inlets of each of said channels lying in a vertical plane spaced forwardly of said second partition, each of said exhaust channel members being in the form of a laterally corrugated unit, a series of plates mounted over the top surfaces of each of said exhaust channel members and extending throughout their widths

and the length of the next upwardly succeeding exhaust channel member, the channels in each of said exhaust channel members opening axially at their ends, the respective channels in each of said exhaust channel members alternately opening upwardly back to the next vertically succeeding exhaust channel member whereby the products of combustion are broken up and dispersed into the exhaust chamber for subsequent exhausting to the atmosphere, and fastening means interconnecting said exhaust channel members together as a unit.

2. In the timed exhaust muffler of claim 1, the said exhaust channel members being vertically stacked upon each other, with the respective axial outlets at the ends of each of the channels of the respective channel members being arranged progressively at different points throughout substantially the length of the exhaust chamber, and with alternate channels in each of said channel members at their outer ends opening upwardly beyond the axial outlet of the next vertically succeeding rearwardly spaced channels of succeeding channel members respectively.

3. In a timed muffler for the exhaust of an internal combustion engine, a hollow elongated outer casing having an outlet at one end, a hollow elongated inner casing spaced inwardly thereof and having an outlet at one end, longitudinally spaced centrally apertured closure walls at the other ends of said casings, an exhaust pipe extending through said closure walls and secured thereto, insulation means interposed between said casings, said inner casing defining an exhaust chamber, and an exhaust transmission means within said exhaust chamber consisting of an elongated member having a series of reduced area channels extending longitudinally thereof arranged in a honeycomb form throughout the dimensions of the exhaust chamber with the said channels being arranged in a series of transversely extending rows, with the bottom row of channels extending substantially throughout the length of the exhaust chamber, and with the respective vertically succeeding series of rows being of reduced length to provide a series of exhaust outlets within the exhaust chamber communicating therewith arranged substantially throughout the length of said exhaust chamber, alternate channels at their outlet ends in each of the respective rows of channels opening upwardly beyond the axial outlets of the next vertically succeeding row of channels to thus provide a plurality of outlets for said exhaust transmission means into said exhaust chamber and for subsequent transmission through the outlets of said casings.

4. In the timed muffler of claim 1, side portions of each of said exhaust channel members terminating in elongated upwardly and outwardly inclined mounting flanges, with the mounting flanges of one exhaust channel member cooperatively receiving and supporting the exhaust flanges on the opposite sides of the succeeding vertically stacked exhaust channel members respectively.

5. In the timed muffler of claim 1, side portions of each of said exhaust channel members terminating in elongated upwardly and outwardly inclined mounting flanges, with the mounting flanges of one exhaust channel member cooperatively receiving and supporting the exhaust flanges on the opposite sides of the succeeding vertically stacked exhaust channel members, each of said inclined flanges at the opposite sides of said exhaust channel members having a depression formed therein, each of said flanges also having upon its opposite sides a corresponding projection adapted for interlockingly nesting with the recess in the flange thereunder for effecting a preassembled relationship between the respective exhaust channel members.



6. In a timed muffler for the exhaust of an internal combustion engine, a hollow elongated outer casing having an outlet at one end, a hollow elongated inner casing spaced inwardly thereof and having an outlet at one end, longitudinally spaced centrally apertured closure walls at the other ends of said casings, an exhaust pipe extending through said closure walls and secured thereto, insulation means interposed between said casings, said inner casing defining an exhaust chamber, and an exhaust transmission means within said exhaust chamber, consisting of a series of vertically spaced rows of exhaust channel members arranged longitudinally within said exhaust chamber substantially throughout its height and width, the lower row of exhaust channels extending throughout the length of said exhaust chamber, with succeeding rows thereabove being of decreasing length, each row consisting of a series of parallel spaced elongated channels having a cross sectional area a small fraction of that of said inner casing, the inlets of each of said channels lying in a vertical plane, each of said exhaust channel members being in the form of a laterally corrugated unit, a series of plates mounted over the top surfaces of each of said exhaust channel members and extending throughout their widths and the length of the next upwardly succeeding exhaust channel member, the channels in each of said exhaust channel members opening axially at their ends, the respective channels in each of said exhaust channel members alternately opening upwardly back to the next vertically succeeding exhaust channel member whereby the products of combustion are broken up and dispersed into the exhaust chamber for subsequent exhausting to the atmosphere, and fastening means interconnecting said exhaust channel members together as a unit.

7. The muffler of claim 6, side portions of each of said exhaust channel members terminating in elongated upwardly and outwardly inclined mounting flanges, with the mounting flanges of one exhaust channel member cooperatively receiving and supporting the exhaust flanges on the oppposite sides of the succeeding vertically stacked exhaust channel members, each of said inclined flanges at the opposite sides of said exhaust channel members having a depression formed therein, each of said flanges also having upon its opposite sides a corresponding projection adapted for interlockingly nesting with the recess in the flange thereunder for effecting a preassembled relationship between the respective exhaust channel members.


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