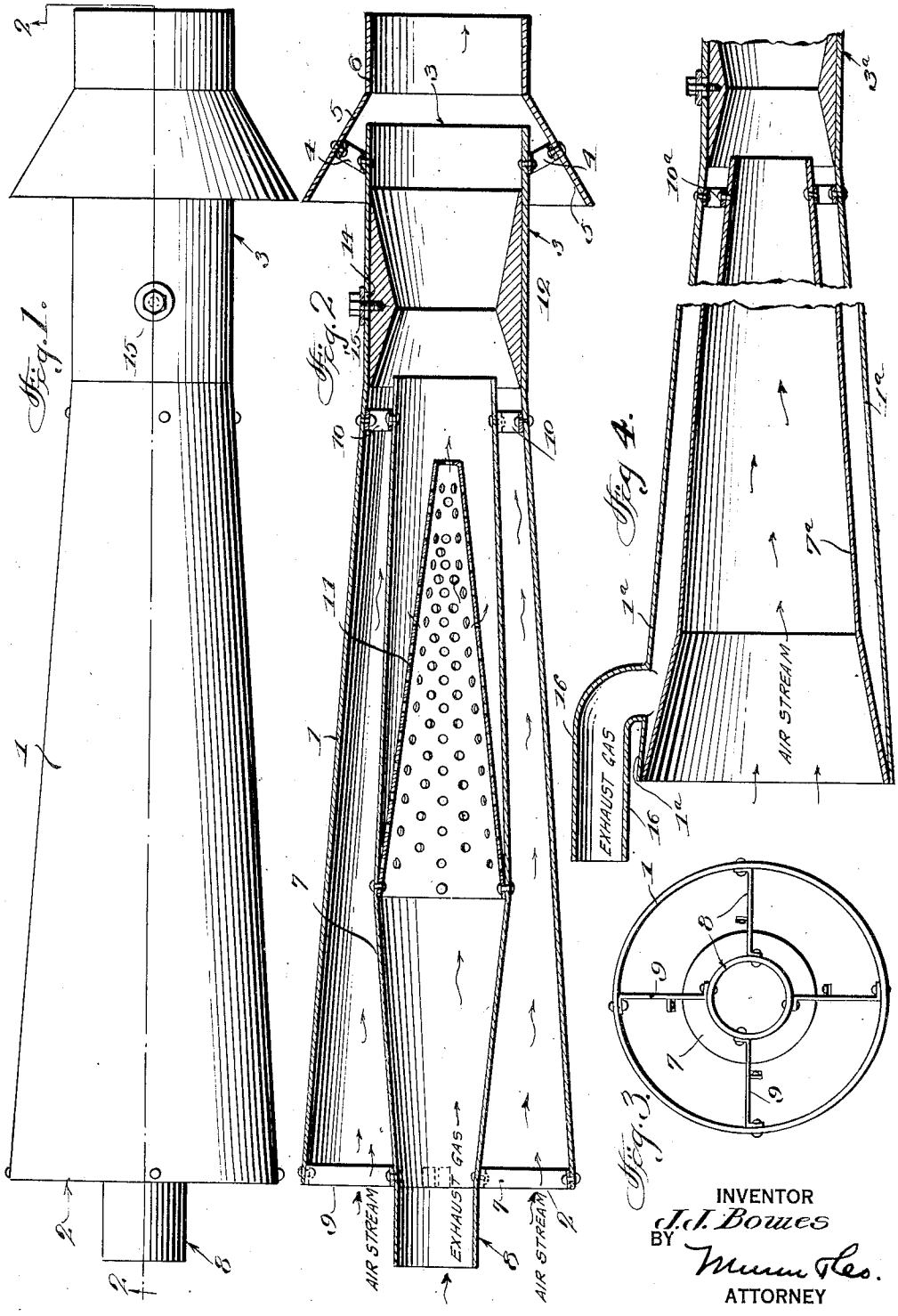
Feb. 24, 1931. J. J. BOWES 1,794,276

EXHAUST MUFFLER

Filed Dec. 14, 1929



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Patented Feb. 24, 1931 1,794,276

UNITED STATES PATENT OFFICE

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EXHAUST MUFFLER

Application filed December 14, 1929. Serial No. 414,097.

This invention relates to exhaust mufflers for explosion motors, such as the motors of automobiles, aircraft, etc., and is more particularly concerned with the provision of a muffler of relatively simple construction effective to scavenge the motor cylinders by complete exhaustion of gases and to reduce the noise of discharge of the exhaust gases, without creating back pressure.

In carrying out my invention, a succession of alining tubes are utilized to increase the rate of discharge flow of the gases, and means are provided to produce forced draft air streams to cooperate therewith to increase tube created suction and coincidentally to cool and cause contraction of the gases passing through the tubes and thereby eliminate back pressure.

The invention consists in the constructions, arrangements and combinations of parts hereinafter described and claimed and will be more clearly apparent from the following detailed description which is to be read in conjunction with the accompanying drawings in which:—

Figure 1 is a view in top plan of the muffler of the present invention.

Figure 2 is a longitudinal vertical section through the muffler taken on line 2—2 of Figure 1.

Figure 3 is an end elevation of the intake end of the muffler.

Figure 4 is a fragmentary longitudinal sectional view of a modified form.

Reference to the drawings will show that the muffler is provided with an outer tubular shell or casing 1, which may be circular or oval in cross section as desired, and which tapers inwardly from an intake end 2 of maximum diameter to a discharge end 3 of uniform but relatively less diameter.

Adjacent to its discharge end 3, a band 4 is fixed externally to the casing and supports through a plurality of spacing legs 4 an air injector 5 formed substantially as a hollow truncated cone with its forward half of greater diameter overlying and spaced from the exterior of the discharge end 3 of shell 1 by the supporting legs 4. A tubular extension 6 from the rear end of the truncated cone 5 is spaced rearwardly of the end 3 of the shell and is of coincident diameter, providing a discharge nozzle alining with and spaced outwardly from the discharge end of the shell.

Within the outer casing 1 and spaced therefrom is a long Venturi tube 7 extending from the intake end 2 to a point adjacent but inwardly of the discharge end 3 of the shell. This Venturi tube is intended to receive the exhaust motor gas through an appropriate conduit connection to its intake end 8. It is centered within the shell by a plurality of radial spacing legs 9 supporting its intake end 8 from the interior of the shell at its intake end 2, and by a series of radial spacing legs 10 similarly supporting the discharge end of the Venturi tube from the interior of the shell.

The Venturi tube 7 tapers in opposite directions from an intermediate point of maximum diameter. That portion of the tube between its discharge end and said intermediate point houses a perforated baffle cone 11 of truncated form decreasing in diameter toward the discharge end of the Venturi tube and spaced from its sides. As shown, the cone is appropriately fixed at its larger end to the interior of the Venturi tube at said intermediate point of maximum diameter.

The Venturi tube 7 is positioned within the shell with its discharge end terminating adjacent but appreciably inwardly of the discharge end 3 of the shell and appreciably spaced from the walls thereof and extending partly within the intake end of a second relatively short tube 12 constituting a Venturi tube. This second venturi has its exterior formed to correspond to the uniform diameter and cross section of the discharge end 3 of the shell. It is adjustably fixed therein by means of a lag screw 13 passing through an elongated slot 14 in the shell with the head of the lag screw engaging a washer 15 overlying the slot. An air passage is thus formed between the internal wall of the second venturi at its intake end and the outer side of the first venturi at its discharge end.

The exhaust gases from the explosive motor will pass through a suitable conduit

such as the usual exhaust pipe to the intake end 8 of the first exhaust Venturi tube 7, will impinge the baffle cone 11 and pass through its perforate sides and discharge at its end as a jet to the discharge end of the tube 7 where it passes through the second and successive venturi 12.

The hot exhaust gases passing through the first venturi 7 and broken up by the baffle cone therein, are cooled and contract through the effect of the stream of air which passes through the outer shell 1 over the venturi. This cooling air stream, with the motor vehicle or air craft in motion, is a forced draft of high cooling power and substantial force. Even with the land or air vehicle stationary, a forced draft of less intensity is created by the back wash from the plane propeller or from the usual cooling fan of the land vehicle. The cooling action of this draft on the Venturi tube and on the hot exhaust gases passing therethrough will have the effect of causing contraction of these gases in offset of back pressure caused by the baffle cone.

As the partially cooled gases exit from the elongated tubular cooling element 7 into the intake end of the Venturi tube 12, their speed is accelerated and they are further cooled by the injection of the forced draft air stream passing therewith into the intake of venturi 12 over the exterior of the discharge end of tube 7, which air stream is provided by the annular conduit formed by the space between the interior of shell 1 and the exterior of tube 7.

As the cooled and broken up gases exit from the venturi 12 and from the exit end 3 of the shell 1 which in effect is the exit end of venturi 12 and nests in the intake end of cone 5, they are ejected from the nozzle 6 of the external terminal cone 5 on the shell at an accelerated speed by a second forced draft air stream passing over the exterior of the shell and into the interior of the terminal cone 5, which constitutes in effect, an aspirating air cooled discharge nozzle.

Thus the aspirating action of these forced draft air streams not only tends to create suction and muffle the noise of explosion, but accelerates the passage of the exhaust gases, offsetting back pressure and effecting thorough scavenging of the cylinders, but thoroughly breaks up and cools the gases at the exit end of the muffler shell.

The described construction has the advantage of combining simplicity and relatively low cost of construction with effective operation. The adjustment provided for the venturi 12 has the added advantage of permitting, by adjustment of the area of aspirating orifice, coordination of the aspirating action of the forced draft air stream passing into the second venturi 12 over the exterior of the edge of the discharge end of the first Venturi tube 7 to the speed of the exhaust gases discharging from tube 7 into the venturi 12.

It will be noted that the tubes 7 and 12 constitute in effect a succession of alined Venturi tubes with the discharge end of the first tube nesting in and spaced from the interior of the intake end of the next succeeding tube to provide annular injection openings and that an air conduit passes a stream of air through said annular opening with the gases further cooled and diffused by the second air stream injected therein at the nozzle of the discharge cone.

At the intake end of the muffler, the gas and air receiving functions of the tube 7 and shell 1 may be reversed. In the modified form shown in Figure 4 of the drawings, the first tube 7*a* is used as the first air stream conduit, its intake end being tapered outwardly to a junction with the end of the outer casing 1*a* with the tube 7*a* taking a tapered form converging to a discharge end positioned within the intake end of the venturi 12, as in the form shown in Figure 2, and similarly supported within the casing 1*a* by spacing legs 10*a*. The annular space between the exterior of the tube 7*a* and the interior of casing 1*a* now constitutes the exhaust passage, the hot exhaust gases being discharged therein through an offset tube 16 communicating with this annular conduit at its intake end. With this arrangement, the hot exhaust gases are cooled by air streams externally of casing 1*a* and internally of tube 7*a* between which streams the exhaust gases pass.

While the illustrated structures represent preferred forms of the invention, they are intended as illustrative rather than restrictive thereof, and are subject to change and modification in adaptation to different conditions of manufacture and use in consonance with the spirit of the invention and the scope of the appended claims.

What I claim, therefore, and desire to secure by Letters Patent is:

1. A muffler for exhaust gases of explosive motors comprising a series of nested tubes with the discharge ends of those tubes forwardly of the terminal tube nesting in and spaced from the interior of the intake ends of the next succeeding tube to provide annular air injection openings therebetween, and annular air conduits externally of said forward tubes having discharge ends communicating with said annular air injection openings, the first tube of said series having its intake end arranged to receive exhaust gases therein and having mounted on its interior a perforate conical baffle providing a discharge jet at its rear end directed toward the discharge end of said first tube.

2. A muffler for the exhaust gases of explosive motors comprising a tubular outer cas-

ing tapering from an intake end of maximum diameter to a discharge end of reduced and uniform diameter, an elongated tubular intake conduit supported within said casing in spaced relation thereto providing an annular conduit therebetween and extending from its intake end toward the discharge end of said casing, a Venturi tube seated within and contacting the interior of the casing adjacent to its discharge end with the intake end of said Venturi tube of greater internal diameter than the exterior of the discharge end of said conduit and extending partially thereover to provide an aspirating passage therebetween communicating with said annular conduit, means for adjusting said Venturi tube longitudinally of the outer casing to vary the position of its intake end relatively to the discharge end of said tubular intake conduit for varying the area of said aspirating passage.

3. A muffler for the exhaust gases of explosive motors comprising an open ended tubular outer casing tapering from an intake end of maximum diameter to a discharge end of reduced diameter, an elongated gas receiving tube supported within said casing in spaced relation thereto to provide an annular air passage therebetween and extending from the intake end of said casing toward its discharge end, a perforate truncated conical baffle mounted within said elongated tube with its rear end providing a discharge jet positioned forwardly of the discharge end of said tube, a Venturi tube seated within said casing at its discharge end and engaging the walls thereof with the intake end of said Venturi tube of greater internal diameter than the exterior of the discharge end of the gas receiving tube and extending partially thereover to provide an aspirating air passage therebetween communicating with the discharge end of the annular air passage between said casing and first tube.

4. A muffler for the exhaust gases of explosive motors comprising an open ended tubular outer casing tapering from an intake end of maximum diameter to a discharge end of reduced diameter, an elongated gas receiving tube supported within said casing in spaced relation thereto to provide an annular air passage therebetween and extending from the intake end of said casing toward its discharge end, a perforate conical baffle suspended within said elongated tube, a Venturi tube seated within said casing at its discharge end and engaging the walls thereof with the intake end of said Venturi tube of greater internal diameter than the exterior of the discharge end of the gas receiving tube and extending partially thereover to provide an aspirating air passage therebetween communicating with the discharge end of the annular air passage between said casing and first tube, and a third tube mounted externally over and spaced from the discharge end of the outer casing and tapering into alinement with the Venturi tube and provided with a discharge nozzle spaced rearwardly from and alined with the discharge end of said Venturi tube to provide a second aspirating air passage communicating with the discharge end of the air passage between the exterior of the discharge end of the outer casing and the spaced overlying portion of the third tube.

5. A muffler for the exhaust gases of explosive motors comprising an open ended tubular outer casing tapering from an intake end of a maximum diameter to a discharge end of reduced diameter, an elongated gas receiving tube supported in said casing in spaced relation thereto to provide an annular air passage therebetween and extending from the intake end of said casing toward its discharge end, a Venturi tube fitted within said casing adjacent its discharge end and engaging the walls thereof, the intake end of said Venturi tube being of greater internal diameter than the exterior of the discharge end of the gas receiving tube to provide an aspirating air passage therebetween communicating with the discharge end of the annular air passage between said casing and said receiving tube, and a third tube mounted externally of and spaced from the discharge end of the outer casing and tapered into substantial alinement with said discharge end to provide a second aspirating air passage communicating with the discharge end of the air passage between the exterior of the discharge end of the outer casing and the spaced overlying portion of the third tube.

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