

April 16, 1929.

J. F. WEBB, SR

1,709,332

EXHAUST MUFFLER

Filed Sept. 22, 1926

2 Sheets-Sheet 1

Fig. 1.

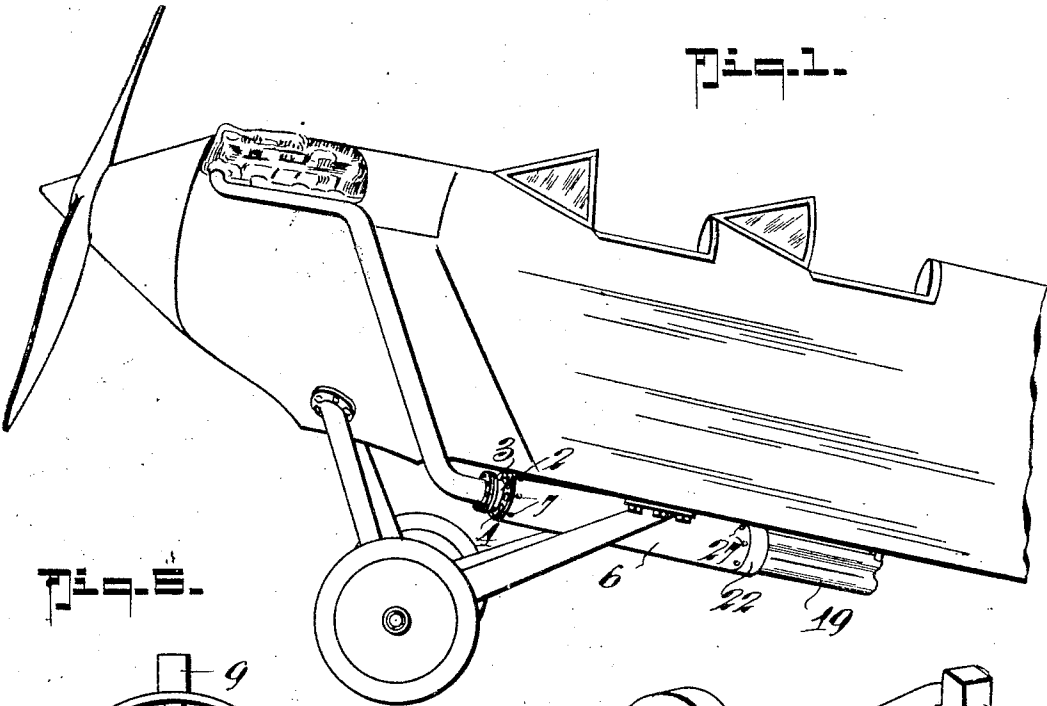


Fig. 2.

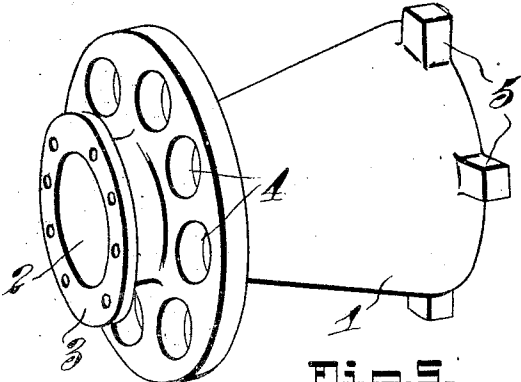
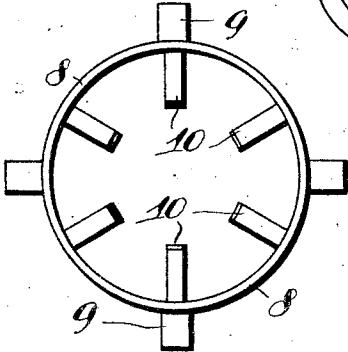


Fig. 4.

Fig. 5.

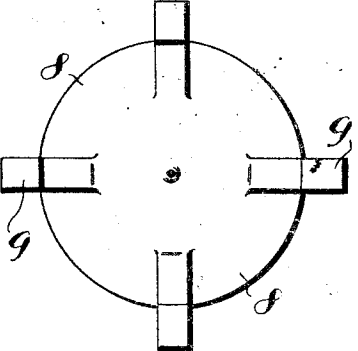
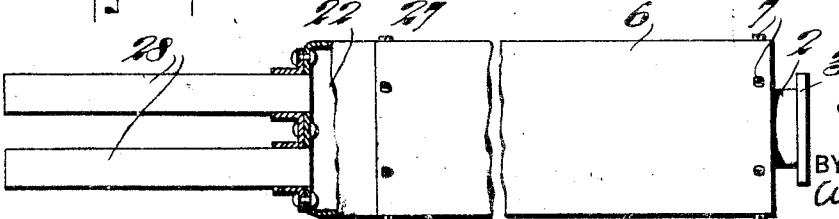


Fig. 7.

Fig. 8.



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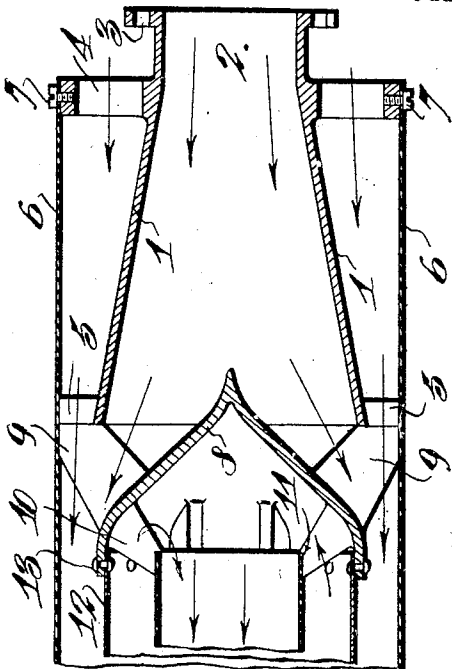


Fig. 1--

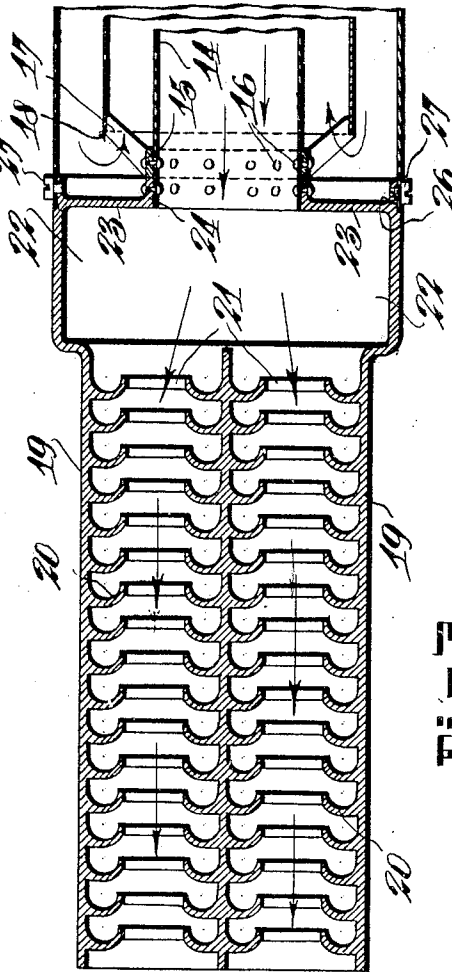
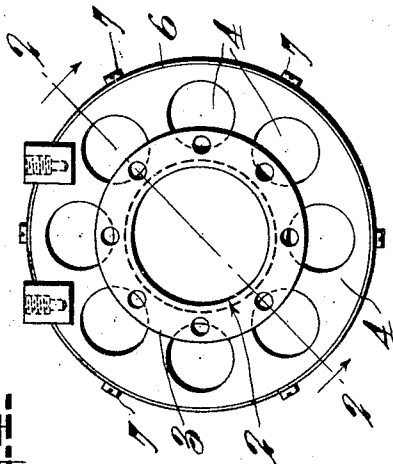


Fig. 3--

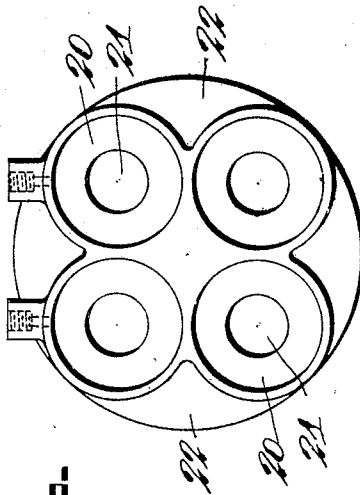


Fig. 4--

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EXHAUST MUFFLER.

Application filed September 22, 1926. Serial No. 137,088.

My invention is an improved apparatus for silencing or deadening the noise caused by the exhaust gases from internal combustion engines and it particularly has for an object the provision of an apparatus that may be effectively used on airplanes, especially those of the bomber type which employ motors of from two hundred to five hundred horse power, although the invention is also adapted for automobile and other motor vehicle engines.

The airplanes referred to are frequently equipped with a plurality of engines, the exhaust of which creates such a terrific roaring sound that they can be heard for miles around their position and prevent effective communication with the aviators; it is, therefore, an object of the present invention to provide means successfully to eliminate these objectionable noises. Numerous tests on large engines have shown that muffle boxes designed for use on the small engines of automobiles are utterly useless, when applied to the very large engines, as they create such a back pressure as to greatly reduce the power of the engines. These muffle boxes only provide for a slower expansion and diffusion of the hot exhaust gases; the only cooling or reduction of the heating effected by them is that which is absorbed by the metal casing through which the gases are passed, and, being closely confined in their exit, the gases cause a certain amount of back pressure.

Another object of my invention, therefore, is to provide means to reduce the heat and explosive force of the hot exhaust gases by expanding them and then cooling them by flooding and smothering them in an excessive volume (preferably more than double the volume of the gases) of cold air, which will so chill the gases that their heat will be quickly absorbed or dissipated by both the cold air and the metal through which the gases pass (cold air will keep the metal parts of the entire apparatus chilled to a certain extent, which will assist the metal parts in absorbing the heat in the gases, and this absorbed heat will be constantly carried away by the rush of cold air through and around the metal).

In those types of exhaust apparatus heretofore employed for muffling exhaust gases of internal combustion engines there is an

ever present danger of fire from the hot gases, the combustion of which not infrequently continues to the point of discharge to atmosphere; therefore it is an object of my invention to guard airplanes against danger of fire from the hot exhaust gases and so treating them that when they issue from the apparatus they will be cooled to a point where danger from fire is wholly eliminated.

A still further object is to provide an apparatus of such design as to include, in a single device, three sub-units consisting of an expansion tube and cold air intake to receive the exhaust gases from the engine and effect a primary expansion and cooling thereof without creating the back pressure, a chamber into which the gases and cold air are passed from the expansion tube and cold air intake and wherein the gases are further mixed with a large volume of cold air and their explosive efforts neutralized, the gases further expanded and cooled, and a silencer proper through which the mixed gases and air are passed from the chamber and from which they are silently discharged to atmosphere in a condition largely freed from carbon monoxide. This latter feature of my invention, namely, the freeing of the gases from carbon monoxide or the mixing of the monoxide gases with a large volume of air so as to render them harmless, is especially advantageous, when the invention is used on motor vehicles.

Yet another object of the invention is to provide an apparatus of its kind, the parts of which may be easily assembled and disassembled for repairs and replacement, and which is inexpensive to manufacture and will effectively serve its intended purposes.

I accomplish the above objects by the apparatus shown in the accompanying drawings, which disclose a preferred embodiment of the invention, especially designed for airplane use and in which:

Figure 1 is a perspective view of a portion of a fuselage of an airplane, with my invention in place.

Figure 2 is a longitudinal section on the line 2—2 of Figure 4.

Figure 3 is an end view of the apparatus, looking at the outlet end.

Figure 4 is an end view, looking at the inlet end of the apparatus.

Figure 5 is a perspective view of the expansion funnel or tube and air admission unit.

Figures 6 and 7 are end views of the cone-deflector.

Figure 8 is an enlarged detail of a portion of the apparatus.

Figure 9 is a detail elevation and part section of a modification.

In the drawings in which like numerals of reference indicate like parts in all of the figures, 1 represents the expansion funnel, preferably made of cast iron, and having the entrance duct 2 provided with a coupling flange 3, by means of which it may be coupled to the exhaust pipe of an airplane engine. 4 is an apertured web, the openings through which are in their aggregate of a considerably greater area than the area of the entrance duct 2 (preferably twice the area). The web 4 forms a closure (except for the apertures in it) for the entrant end of the outer shell 6, which shell is secured to the web 4 by suitable screws or other equivalent devices 7.

A conical baffle or spreader cone 8 cooperates with the funnel 1 to spread or diffuse the gaseous stream and deflect it toward the shell 6, where it will come into contact with the cold air that passes into the shell through the openings 4.

The expansion funnel 1 at its end adjacent the spreader-cone 8 is provided with a suitable number of spacing lugs 5 and the spreader-cone 8 is likewise provided on its outer surface with spacing lugs 9, by which the spreader-cone 8 is properly located within the shell 6, so that its axis may coincide with that of the expansion funnel 1. Secured at 13 to the larger end of the spreader-cone 8 is an intermediate shell 12, the other end of which rests in the recessed portions 18 of spacer lugs 17 that are a portion of the collar 15, which is riveted at 16 to the inner shell 14, the outer end of which shell 14 is riveted at 25 to the silencer receiving chamber web collar 24.

The front end of the inner shell 14 is sustained in the recessed ends 11 of spacer lugs 10 located on the inside of the spreader-cone.

19 represents the silencer housing in which is contained a series (of a suitable number) of baffles 20 with aligning ports 21 through which the combined exhaust gases and air, which are delivered to the silencer receiving chamber 22 from the inner shell 14, pass to atmosphere. The collar 24 projects from the web 23 at the front end of the receiving chamber 22 of the silencer proper.

The silencer housing has a recessed flange 26 providing a seat to receive the outer shell 6, to which flange that shell is secured by suitable devices 27, as shown.

Instead of providing a series of baffles within the silencer housing 19, separate tubes

28 may be employed, as indicated in the modification shown in Figure 9.

In operation, when my invention is in use, the hot exhaust gases follow the direction of the arrows in Figure 2. After passing through the intake duct 2, the gases are permitted to expand by reason of the diverging wall of the expansion funnel and at the same time air is passed into the apparatus through the openings in the web 4. The air also takes the direction of the arrows indicated in Figure 2 and its velocity is dependent, in a measure, on the speed with which the apparatus is being conveyed. This speed is considerable in the case of airplanes and a considerable flow of air into the outer shell can be effected. The action of this inflowing air not only is that of a cooling agent, but it serves, by reason of the restricted passage in the vicinity of the lugs 5, to aid in passing the exhaust gases from the larger end of the expansion funnel into the space between the shells 6 and 12; the function of this incoming air also is to supply oxygen to the carbon monoxide contained in the hot gases and assists in reducing such carbon monoxide to carbon dioxide, a harmless substance. The combined air and exhaust gases pass to the rear of the outer shell 6 and then move forwardly between the intermediate shell 12 and the inner shell 14 and then into the inner shell 14 through which they pass and are delivered into the receiving chamber 22, after which they pass through the silencer housing 19 and are discharged to atmosphere.

From the foregoing description, taken in connection with the accompanying drawings, it will be seen that I have provided an effective yet inexpensive apparatus for the purposes for which it was designed and I desire to call especial attention to the fact that, in my apparatus, the volume of air passed through the apparatus is greatly in excess of the volume of exhaust gases, thereby exerting a material cooling effect on the exhaust gases as well as to provide for an excess of oxygen to counteract the monoxide gas.

From the foregoing description, taken in connection with the accompanying drawings, it is thought that the complete construction and advantages of the invention will be clear to those skilled in the art to which it appertains and I wish it understood that slight changes in the details of construction and design of parts may be made without departing from the spirit of the invention, as set forth in the appended claims.

What I claim is:

1. In an exhaust treating apparatus, an outer shell, an expansion funnel having a restricted inlet duct surrounded by a ported web to which one end of said outer shell is

secured and through the ports of which cool air is admitted around the funnel, a web at the other end of said outer shell to which said outer shell is secured, said last named web having a port surrounded by a flange, an inner shell secured at one end to said last named flange and terminating short of said funnel, a collar with spacers mounted on said inner shell, an intermediate shell one end of which is supported by said spacers, a spreader-cone secured to the other end of said intermediate shell and located between it and the funnel, spacers on the outside of said spreader-cone to locate it within the outer shell, and spacers within said spreader-cone to support the adjacent end of said inner shell.

2. In an exhaust treating apparatus, an outer shell; a chambered head secured to one end of said shell and having a web with a central passage surrounded by a collar projecting into said shell, an inner shell secured to said collar and located within said outer shell and of less length than said outer shell, the ends of said inner shell being open; an intermediate shell located between said inner and outer shells and having one end spaced from the web of said chambered head; a spacing spider with collar carried on said inner shell to maintain said one end of said intermediate shell in position; a spreader cone capping the other end of said intermediate shell and having inner spacer lugs to engage the adjacent end of said intermediate shell and having outer spacing lugs to engage said outer shell; and an expansion funnel mounted in the end of said outer shell opposite that having the chambered head, said funnel having its larger end within the outer shell and partially over said spreader cone but spaced from both said shell and said cone and having its smaller end located outside said outer shell, said funnel having a coupling flange at its outer end and means, having passages, for mounting said funnel in and to said outer shell, said chambered head having an outlet passage.

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