

June 12, 1945.

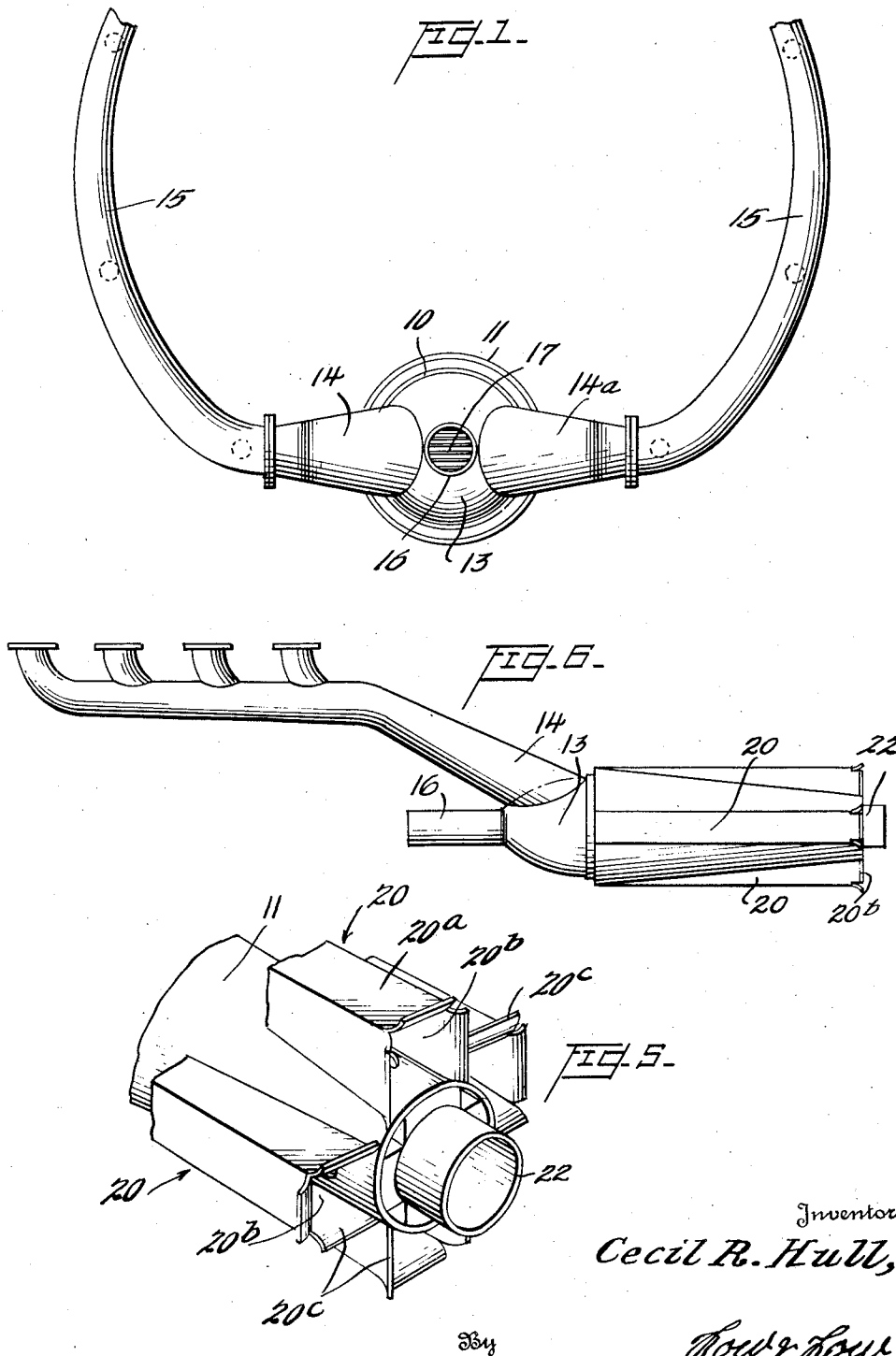
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2,378,083

VACUUM EXHAUST MUFFLER

Filed Nov. 2, 1943

2 Sheets-Sheet 1



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UNITED STATES PATENT OFFICE

2,378,083

VACUUM EXHAUST MUFFLER

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Application November 2, 1943, Serial No. 508,692

8 Claims. (Cl. 181—51)

The invention relates to exhaust mufflers particularly designed for airplane engines and has for its objects to provide new and useful improvements in devices of this character.

One of the principal objects of the invention is to provide a muffler device wherein provision is made to eliminate the flame ordinarily visible from the exhaust pipes of airplane engines, thereby rendering it more difficult to determine the exact whereabouts of the airplane at night.

A further object of the invention is to provide a muffler of new and improved construction wherein provision is made to greatly decrease the volume of noise created by the engine or engines.

A still further object is to provide a muffler having a stream-lined construction, thereby promoting the flow of air and exhaust gases therethrough with a minimum of congestion or back flow in the muffler.

A still further object is to provide a muffler device wherein the structure is such as to create a partial vacuum on the exhaust side, thereby increasing the engine power by virtue of an increase in the engine R. P. M. This has the further advantage of causing the engine to run much cooler. In the instance of Diesel engines the instant improved muffler device eliminates slush in the motor exhaust.

The invention further contemplates the instant improved muffler device on automobile engines wherein it has the advantage of neutralizing or eliminating the danger of carbon monoxide in the engine exhaust, particularly in automobiles operating on low grade gasoline, so prevalent at the present time due to war conditions.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

As a result of the instant improved muffler construction wherein flame is eliminated, the hazard of planes burning in flight or on the field as a consequence of exhaust flame is greatly minimized if not completely removed.

In said drawings:

Fig. 1 is a view in front elevation of the improved muffler device illustrated as connected on opposite sides to the outer ends of the exhaust collector ring of an airplane or other engine of the radial type.

Fig. 2 is an enlarged longitudinal horizontal section through the muffler per se, said view being taken substantially on line 2—2 of Fig. 1.

Fig. 3 designates a horizontal transverse sectional view taken substantially on line 3—3 of Fig. 2.

Fig. 4 is a similar view taken substantially on line 4—4 of Fig. 2.

Fig. 5 is a detail perspective view illustrating the rear or exhaust end of the muffler.

Fig. 6 is a view in side elevation of the improved muffler illustrated as attached to the exhaust pipe or conduit of an airplane or other engine of the straight line type.

Referring to the drawings the improved muffler device essentially comprises an inner tapered shell 10 and an outer tapered shell 11 spaced therefrom by means of a plurality of longitudinally extending circumferentially spaced and disposed spacer bars 10a, the latter being suitably secured as by welding or by other means to said inner and outer shells. This arrangement provides a plurality of spaced arcuate longitudinally extending chambers 12 between the said inner and outer shell elements. At the forward end of the muffler and secured thereto as by welding or other suitable means, is an enlarged hollow head 13, the latter having secured in open communication therewith by any suitable means, a pair of diametrically opposed tapered conduits or pipe connections 14, 14a. These latter mentioned conduits are reduced in area at their outer ends and are suitably secured respectively as by bolts or a welded connection, to the outer ends of the collector ring 15 (Fig. 1). The extreme forward end of the muffler is in turn communicably connected as by welding, to the inner end of a cylindrical air flow pipe 16, the outer open end 17 of which is freely exposed to the atmosphere.

A hollow plug 18 (Fig. 2) preferably of substantially partially truncated egg-shaped configuration, is illustrated as open but which may be closed at its rear end at 18a, is disposed at the inner end of the air flow pipe 16 at the point of its juncture with the outer open end of the hollow muffler head 13, also of substantially parabolic or semi-globular configuration. Said plug is spaced inwardly from the inner walls of the pipe and head by means of a plurality of radially arranged spaced supports 19 extending inwardly from the inner end of the air flow pipe 16 formed integrally with the pipe or plug, or secured thereto and/or to the plug by welding or by means of any other suitable connection. The purpose of this construction is to provide and promote a Venturi effect on the air flow into the

muffler as will be hereinafter more fully explained.

As best seen in Figs. 2, 4 and 5 the outer shell 11 of the muffler device is further provided with a plurality of integral or suitably secured radially disposed and extending hollow fins 20 of tapered and gradually increasing volume from the front to the rear of the muffler. These hollow fins are fully open and outwardly flared at their rear ends as illustrated and indicated at 20c in Figs. 2 and 5. Said fins are illustrated herein as preferably four in number and are rigidly and communicably secured to the outer shell 11. Obviously the number and disposition of these fins may be varied if desired.

The interior of the muffler inwardly of the spaced shells 10 and 11 constitutes an open air and exhaust chamber 21 of gradually decreasing area or volume from the front to the rear or exhaust end thereof, said exhaust end of the chamber being indicated by the reference character 22. The outer wall 20a of each of the hollow fins 20 is preferably of straight configuration and has at its inner or forward end a dimension substantially equal to that of the diameter of the forward end of the outer shell 11. By virtue of this construction a plurality of radially disposed tapered air and gas chambers 20b are provided within each hollow fin 20. Communication between said inner chamber 21 and each chamber 20b defined by the hollow fins 20 is afforded by means of a plurality of longitudinally spaced transverse ports, apertures or conduits 23 extending between said inner and outer otherwise imperforate shell members 10 and 11, said ports being disposed in the longitudinally extending spacer bars or elements 12 in turn disposed between the inner and outer shell members 10 and 11.

A hollow tubular baffle member 24 is mounted centrally of the hollow muffler head 13 by means of a pair of diametrically opposed supporting elements or webs 25 suitably secured as by welding to the inner wall of the head (Fig. 3). As illustrated said hollow baffle element is preferably square in cross section and is disposed substantially in axial alignment with the inner open end 18a of the plug member 18. The side walls of the tubular baffle element 24 are provided with a plurality of aligned and spaced apertures 26 to afford communication between the interior of the tubular baffle member and the interior of the hollow parabolic head 13.

The forward end of the muffler inwardly of the hollow baffle element 24 is preferably provided with a plurality of vertically disposed spaced baffle plates 27 rigidly held in place within the inner shell member 10 by means of an intermediate transversely or horizontally extending spacer and supporting plate 28 suitably secured as by spot welding to the shell 10 and to the baffle plates. If desired forward and rear ring elements 29 may be provided to aid in maintaining the baffle plates in spaced relation and to insure against longitudinal displacement thereof relative to the shell member 10. The said ring elements are also secured in place within the shell 10 in any approved manner, preferably by spot welding.

A similar set or plurality of vertically disposed spaced baffle plates 30 are mounted adjacent the rear end of the inner shell member 10 and are maintained in position by means of a horizontally disposed spacer plate 31 secured in any approved manner at its outer ends to the inner wall of

the inner shell 10, and by front and rear wire ring members 32 similar in all respects to the ring elements 29. The horizontally disposed spacer plates or elements 28 and 31 are provided with spaced slits within which the baffle plates 27 and 30 are inserted to maintain the latter in desirable uniformly spaced relation as best seen in Fig. 2 of the drawings. Each baffle plate 27 and 30 is provided with a plurality of spaced and aligned or staggered holes or apertures 33 thereby affording communication between the spaced open ended chambers 34 defined and set off by the baffle plate members 27 and 30.

The interior muffler chamber 21 between the described front and rear sets of rigidly mounted baffle plates 27 and 30 is preferably provided with a plurality of horizontally disposed vertically spaced baffle plates or elements 35 secured in any approved manner at their opposite ends to the inner wall of the shell member 10. These baffle plates 35 are similar to the plates 27 and 30 except in the plane of their right angular arrangement and are spaced between diametrically opposed inner shell walls by means of a centrally disposed imperforate spacer plate member 36 suitably secured at its opposite ends to said shell walls and provided with suitably spaced slots for receiving the various horizontally disposed vertically spaced baffle plate members 35. Said baffle members are also suitably perforated as indicated at 37 in staggered arrangement, to provide limited communication between the spaces 38 set off by the respective horizontally disposed plate elements 35.

In the operation of the device as is best seen in Figs. 1 and 2, the forward end of the muffler constitutes an air entrance pipe disposed between the inner adjacent ends of the collector ring arms 15 between the inner ends of the muffler conduits 14, 14a. The incoming air by-passes or moves inwardly circumferentially exteriorly of the centrally disposed hollow plug 18 with a Venturi effect and enters substantially centrally of the hollow apertured tubular baffle member 24. This locality immediately inwardly of the hollow plug 18 and at the front and rear of the member 20 of the incoming air mixes with exhaust gases from the engine cylinders entering the muffler through the ports 14, 14a from the collector ring 15.

A portion of these exhaust gases circulate through the enlarged hollow muffler head 13 and enter the tubular baffle member 24 through the perforations 26 in the side walls thereof. The combined air and gases thence enter between the spaced vertically disposed apertured plates 27 into the inner chamber 21 of gradually decreasing area and volume from front to rear thereof. From the forward end of said chamber the combined air and gases which are now of diminished pressure, enter between the intermediate horizontally spaced baffle plates 35 into the intermediate portion of the chamber 21. Thence said air and gases pass between the rearmost set of vertically disposed baffle plates 30, similar in all respects to the forward set of such plates indicated at 27. The air and exhaust gases thereafter pass into the rear reduced portion 21 of the inner shell chamber and are discharged at materially decreased pressure through the open rear end 22 of the muffler.

During the described passage of the air and gases through the interior of the muffler from front to rear thereof, a portion of the same pass laterally through the radially disposed longitudi-

nally spaced apertures or conduits 23 which are in spacer bars 10a, into the interior of the hollow longitudinally extending rearwardly flared or tapered radially disposed hollow fin 20 and are thence discharged into the atmosphere at the rear portion thereof as indicated at 20c in Fig. 2.

Fig. 6 shows the instant muffler arrangement when attached to the exhaust pipe of an in-line cylinder or Diesel motor.

From the above described manner of operation it will be obvious that the instant improved muffler is stream-lined to a great degree, the hollow fins 20 have a stabilizing effect on the muffler, thereby necessitating a minimum amount of bracing. The spaced communicating double shell structure 10, 11, 23 facilitates the air circulation between the shells as an incident to a materially increased cooling effect. The air and gases are materially reduced in pressure during their tortuous and baffled travel through the described longitudinally and transversely spaced parts of the muffler from the front to rear thereof as well as into the longitudinally disposed hollow fins which increase in volume and area as the same extend towards the rear exhaust end of the muffler. The three sections of perforated baffle plates alternately set at right angles to each other materially aid in breaking up and spreading of the force of the gases. Further a partial vacuum is promoted by the Venturi effect of the incoming air and exhaust gases mixing therewith from the conduits 14, 14a, at the locality of the hollow plug 18. The outward and rearward flaring of the laterally disposed hollow fins 20 causes and promotes additional suction on the exhaust gases. Additional air enters the forward ends of the longitudinally extending chambers 12 between the inner and outer shell members 10 and 11, escaping at the rear ends thereof, for the purpose of promoting cooling of said shell members.

Briefly and generally summarized the described novel and structural features of the instant improved muffler device constitutes in effect an exhaust system wherein large volumes of air enter and pass through the annular Venturi channel adjacent the hollow plug 11 spaced from the inner walls of the air flow pipe 16. This causes a partial vacuum which pulls upon the entering exhaust gases from the inwardly and outwardly flared conduits 14, 14a connected at their outer ends to the collector ring 15 of the airplane or other radial motor. After passing through the muffler the described air and exhaust gases are further sucked out by the outwardly flared ends of the hollow fins 20, as well as by means of the central opening 22 at the extreme rear and exhaust end of the device. This exhausting under materially reduced pressure has the desirable tendency to depart to the motor an increased R. P. M., causes the motor to operate at a cooler or reduced temperature, as well as more efficiently. The inner shell construction aids in cooling the exhaust gases quicker to a reduced temperature and hence reduces the volume of the gases in accordance with the recognized physical law and principles.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

What I claim is:

1. A muffler device comprising inner and outer continuous tapered shell members arranged in radially spaced relation throughout, a hollow fin element mounted on the outer of said shell members, said fin member being open at its rear end, a plurality of spaced baffle plates disposed within said inner shell member, means at the forward end of said muffler for admitting air therinto, means disposed at the rear portion of said air admitting means for connecting said muffler with the exhaust conduit of an internal combustion engine, and a plug member disposed in spaced relation to the inner wall of said air admitting means for admitting air circumferentially therearound to the muffler interior so as to mix with the engine gases admitted to the muffler by said exhaust conduit.

2. A muffler device comprising inner and outer cylindrical continuous tapered shell members arranged in radially spaced relation throughout, a plurality of radially disposed hollow fin elements mounted on the outer of said shell members, said fin members being open at their rear ends and being of gradually increasing area from front to rear of the muffler, a plurality of spaced baffle plates disposed within said inner shell member, said baffle plates being perforated to provide communication between the spaces between said plates, means at the forward end of said muffler for admitting air therinto, means disposed at the rear portion of said air admitting means for connecting said muffler with the exhaust conduit of an internal combustion engine, and a plug member disposed in spaced relation to the inner wall of the rear portion of said air admitting means for admitting air circumferentially therearound to the muffler interior so as to mix with the engine gases admitted to the muffler by said exhaust conduit.

3. A muffler device comprising inner and outer continuous cylindrical shell members arranged in equally radially spaced relation throughout and tapering inwardly from the front to the rear of the muffler, circumferentially disposed spacing means between said shell members, a plurality of radially disposed hollow fin elements mounted on the outer of said shell members, said fin members being open at their rear ends and being of gradually increasing area from front to rear of the muffler, a plurality of spaced sets of baffle plates disposed within said inner shell member, said sets of baffle plates being perforated to provide communication between the spaces between said plates, means at the forward end of said muffler for admitting air therinto, means disposed at the rear portion of said air admitting means for connecting said muffler with the exhaust conduit of an internal combustion engine, and a plug member disposed in spaced relation to the inner wall of the rear portion of said air admitting means for admitting air circumferentially therearound to the muffler interior so as to mix with the engine gases admitted to the muffler by said exhaust conduit.

4. A muffler device comprising inner and outer continuous cylindrical shell members tapering inwardly from the front to the rear of the muffler, said shell members being disposed in equal radially spaced relation throughout, circumferentially disposed spacing means between said shell members, a plurality of radially disposed hollow fin elements mounted on the outer of said shell members, said fin members being open at their rear ends and being of gradually

increasing area from front to rear of the muffler, a plurality of sets of longitudinally spaced baffle plates disposed within the inner of said shell members, said sets of baffle plates being perforated and arranged at right angles to the contiguous set, the perforations in said baffle plates providing for communication between the spaces between said plates, means at the forward end of said muffler for admitting air thereinto, means disposed at the rear portion of said air admitting means for connecting said muffler with the exhaust conduit of an internal combustion engine, and a plug member disposed in spaced relation to the inner wall of the rear portion of said air admitting means for admitting air circumferentially therearound to the muffler interior so as to mix with the engine gases admitted to the muffler by said exhaust conduit.

5. A muffler device comprising inner and outer continuous cylindrical shell members tapering inwardly from the front to the rear of the muffler, said shell members being disposed in equal radially spaced relation throughout, circumferentially disposed spacing means between said shell members, a plurality of radially disposed hollow fin elements mounted on the outer of said shell members, said fin members being open at their rear ends and being of gradually increasing area from front to rear of the muffler, a plurality of sets of longitudinally spaced baffle plates disposed within the inner shell member, said sets of baffle plates being perforated and arranged at right angles to the contiguous set, the perforations in said baffle plates providing for communication between the spaces between said plates, means at the forward end of said muffler for admitting air thereinto, laterally extending means disposed at the rear portion of said air admitting means for connecting said muffler with the exhaust conduits of an internal combustion engine, and a partially spherical plug member disposed in spaced relation to the inner wall of the rear portion of said air admitting means for admitting air circumferentially therearound to the muffler interior so as to mix with the engine gases admitted to the muffler by said exhaust conduit.

6. A muffler device comprising inner and outer continuous tapered shell members arranged in equal radially spaced relation throughout, a hollow fin element mounted on the outer of said shell members, said fin member being open at its rear end, a plurality of spaced baffle plates disposed within said inner shell member, means at the forward end of said muffler for admitting air thereinto, means disposed at the rear portion of said air admitting means for connecting said muffler with the exhaust conduit of an internal combustion engine, a plug member disposed in spaced relation to the inner wall of the rear portion of said air admitting means for admitting air circumferentially therearound to the muffler interior so as to mix with the engine gases admitted to the muffler by said exhaust conduit, and a hollow perforated tubular baffle member spaced inwardly from and also disposed in spaced relation to and between said hollow plug member and the foremost set of said perforated baffle plates.

7. A muffler device comprising inner and outer continuous cylindrical shell members tapering inwardly from the front to the rear of the muffler, said shell members being disposed in equal radially spaced relation throughout, circumferentially disposed spacing means between said shell members, a plurality of radially disposed hollow fin elements mounted on the outer of said shell members, said fin members being open at their rear ends and being of gradually increasing area from front to rear of the muffler, a plurality of sets of longitudinally spaced baffle plates disposed within the inner shell member, said sets of baffle plates being perforated and arranged at right angles to the contiguous set, the perforations in said baffle plates providing for communication between the spaces between said plates, means at the forward end of said muffler for admitting air thereinto, means disposed at the rear portion of said air admitting means for connecting said muffler with the exhaust conduits of an internal combustion engine, a plug member disposed in spaced relation to the inner wall of the rear portion of said air admitting means for admitting air circumferentially therearound to the muffler interior so as to mix with the engine gases admitted to the muffler by said exhaust conduits, and a hollow perforated tubular baffle member spaced inwardly from and also disposed in spaced relation to and between said hollow plug member and the foremost set of said perforated baffle plates.

8. A muffler device comprising inner and outer continuous cylindrical shell members tapering inwardly from the front to the rear of the muffler, said shell members being disposed in equal radially spaced relation throughout, circumferentially disposed spacing means between said shell members, a plurality of radially disposed hollow fin elements mounted on the outer of said shell members, said fin members being open at their rear ends and being of gradually increasing area from front to rear of the muffler, a plurality of sets of longitudinally spaced baffle plates disposed within the inner shell member, said sets of baffle plates being perforated and arranged at right angles to the contiguous set, the perforations in said baffle plates providing for communication between the spaces between said plates, means at the forward end of said muffler for admitting air thereinto, laterally extending means disposed at the rear portion of said air admitting means for connecting said muffler with the exhaust conduits of an internal combustion engine, a hollow plug member of substantially spherical configuration disposed in spaced relation to the inner wall of the rear portion of said air admitting means for admitting air circumferentially therearound to the muffler interior with a Venturi suction action so as to mix with the engine gases admitted to the muffler by said exhaust conduits, and a hollow perforated tubular baffle member of substantially square cross section spaced inwardly from and also disposed in spaced relation to and between said hollow plug member and the foremost set of said perforated baffle plates.

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