May 10, 1932. F. F. HAMILTON 1,857,845

EXHAUST GAS SILENCER

Filed May 24, 1930

Fig. 1.

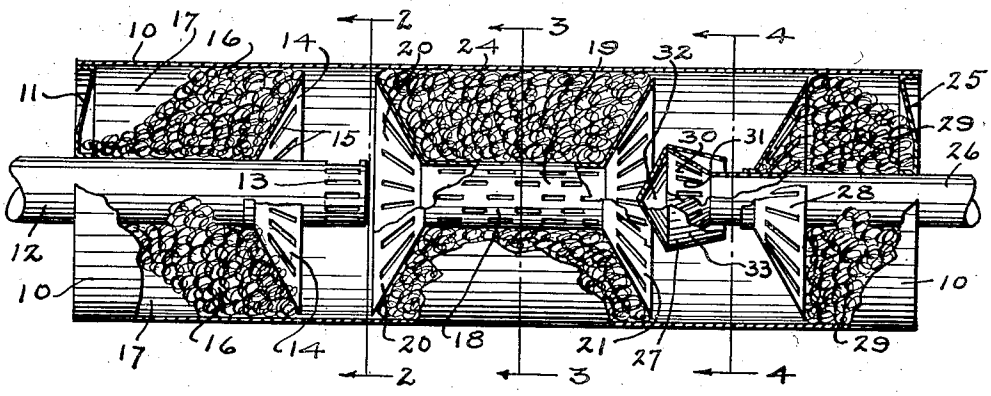


Fig. 2.

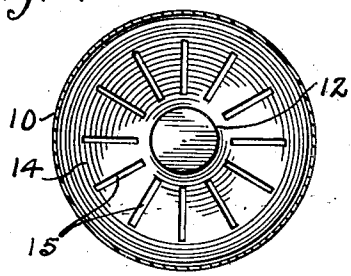


Fig. 3.

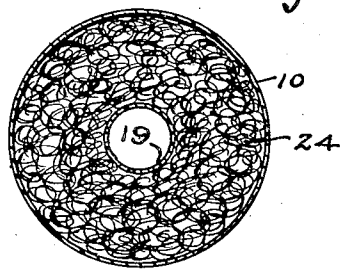
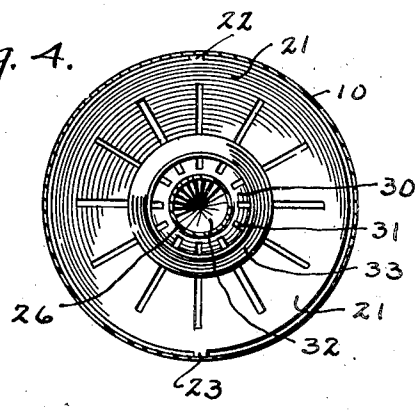


Fig. 4.



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UNITED STATES PATENT OFFICE

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EXHAUST GAS SILENCER

Application filed May 24, 1930. Serial No. 455,403.

This invention relates to the art of exhaust gas silencers as are commonly employed with gas engines, and relates particularly to a new and novel structure, the primary object of which is to eliminate all noise without creating undue back pressure of the stream of gases exhausting from such engines.

A further important object resides in the unique combination of the elements permitting a free flow of gases through the silencing device and at the same time causing the gases flowing therethrough to be slowed up in part and expanded and cooled at intervals so that the sound waves in the gas stream issuing from the engine are broken up to such an extent that there are no metallic pings or other noises audible.

A still further object resides in the means for resisting the flow of gases through parts of the silencer and at the same time serving to deaden and prevent vibration of various members embodied within the silencer.

These and other objects will become apparent in the following description of the invention as illustrated by the accompanying drawings, in which

Fig. 1 is a fragmentary side elevation of a silencer embodying my invention;

Fig. 2, a vertical transverse section on the line 2—2 of Fig. 1;

Fig. 3, a vertical transverse section on the line 3—3 of Fig. 1; and

Fig. 4, a vertical transverse section on the line 4—4 of Fig. 1.

Like characters of reference indicate like parts throughout the several views in the drawings.

I form a cylindrical shell 10 having the forward enclosing head 11 passed through which is an intake pipe 12 to extend for an appreciable distance axially within the shell. The inner end of the intake pipe 12 is closed and a plurality of openings 13 are spaced circumferentially around the pipe near the closed end. Spaced forwardly a slight distance from the openings 13 is a conical apron 14 which is fixed to and carried by the pipe 12. This apron 14 flares outwardly and rearwardly to terminate substantially against the inner side of the shell 10. A plurality of holes 15, here shown as radial slots, are provided in the apron and the length of the pipe 12 between the head 11 and the forward side of the apron 14 is wrapped with steel wool 16 preferably in such a manner that an annular space 17 is left immediately behind the head 11. The steel wool 16 compressively contacts the inner side of the shell 10 and the forward side of the apron 14.

I form a spool member 18 having a central hollow cylindrical barrel 19 and the forward and rear conical flanges 20 and 21, the barrel 19 and the flanges 20 and 21 being provided with a plurality of holes therethrough, here shown as slots. Both flanges 20 and 21 have their outer peripheries substantially in contact with the inner side of the shell 10 and the entire space between the two flanges is filled with the steel wool 24. The flange 21 is preferably fixed to the shell 10 by welding to form the attaching junctures 22 and 23, Fig. 4. The other flange 20 is not attached to the shell so that the barrel 19 may expand longitudinally from the flange 21 as the fixed member.

The spool 18 is positioned longitudinally within the shell 10 to have the plane of the forward edge of the flange 20 substantially at the plane of the end of the pipe 12 so that there is an appreciable space between the flange 20 and the apron 14 bounded thereby fore and aft and by the shell 10 circumferentially therearound.

The rear end of the shell 10 has a head 25 as a closure thereacross through which the tail pipe 26 is supported to project inwardly to carry the exhaust head 27 on its forward end toward the rear of the flange 21. The apron 28 is fixed to the pipe 26 behind the head 27 and flares outwardly and rearwardly toward and in substantial contact with the shell 10. The space between the head 25 and the rear of the apron 28 is filled with steel wool 29 with the exception of a small annular space around the inside of the shell 10 at its juncture with the head 25.

The head 27 is here shown as being comprised of a forwardly and outwardly flaring wall 30 on the end of the pipe 26 hav-

ing the slots 31 therethrough. A cap 32 encloses the forward opening to within the wall 30 and a frusto-conical apron 33 extends from the base of this cap rearwardly and spaced outwardly from the wall 30 to have an annular opening between it and the pipe 26. The exhaust head 27 is similar to the head as described in my previous application for patent, filed November 1, 1929, Serial No. 404,114.

In operation, gases flow from the pipe 12 out through the holes 13 where they may expand into the chamber there provided as above described. Some of this gas may escape forwardly through the holes 15 into the steel wool 16. Also gases may escape rearwardly through the holes in the flange 20 into the steel wool 24 and through the holes in the barrel 19 or on back through the holes in the flange 21. There is no restriction in the barrel 19 so that gases may flow freely from the chamber around the end of the pipe 12 therethrough. The gases discharging back of the flange 21 again may expand and come in contact with the cool wall 10 and may in part flow through the holes in the apron 28 into the steel wool therebehind. The main volume of the gases will however flow through the holes 31 in the wall 30 and turn and flow rearwardly out the tail pipe 26. While I have here described the material around the spool 18 and back of the aprons 14 and 28 as steel wool, it is entirely possible and practical to use other material such as asbestos, metal shavings, porous cinders, porous or sponge iron and the like. The essential feature of such material to be employed is that it be noncombustible and maintain a cellular-like condition to permit gas to flow therethrough but only by following devious paths.

Due to the close proximity of the holes 13 to the holes in the flange 20, gases will flow through the holes in the flange 20 and drift out slowly into the barrel 19 thus causing a high resistance path at low engine speeds. I find that by leaving the unfilled spaces at the forward and rear ends of the material 16 and 29 respectively that an additional absorption is obtained. It is to be noted that substantially all of the reflecting surfaces against which high velocity gases may hit are deadened by contact of steel wool. The parts of the shell which are shown as being packed with the steel wool are preferably designated as surge chambers since they tend to break up pressure waves within the shell itself and provide for a smooth resultant flow from the tail pipe.

While I have here shown and described my invention in the one form as now best known to me, it is obvious that structural variations may be made from that form without departing from the spirit of the invention and I, therefore, do not desire to be limited to that precise form, nor any more than may be required by the following claims.

I claim:

1. In an exhaust gas silencer, a shell, an intake pipe discharging into the shell, a tail pipe discharging from the shell, a surge chamber formed by filling a length of the shell with a material formed into a porous mass and a barrel through the material having openings through its side walls, said intake pipe extending within the shell toward and terminating near the forward end of said barrel, and said tail pipe projecting within the shell to have its forward end near the rear end of said barrel and surge chambers at each end of the shell formed by porous material around the intake and tail pipes.

2. In an exhaust gas silencer, a shell, an intake pipe discharging into the shell, a tail pipe discharging from the shell, a surge chamber formed by filling a length of the shell with a porous material, and a barrel through the material having openings through its side walls, said intake pipe extending within the shell toward and terminating near the forward end of said barrel, and said tail pipe projecting within the shell to have its forward end near the rear end of said barrel, said intake and tail pipes being closed across their inner ends and having holes through side walls near the closed ends and surge chambers at each end of the shell formed by porous material around the intake and tail pipes.

3. In an exhaust gas silencer, a shell, an intake pipe discharging into the shell, a tail pipe discharging from the shell, a surge chamber formed by filling a length of the shell with a porous material, and a barrel through the material having openings through its side walls, said intake pipe extending within the shell toward and terminating near the forward end of said barrel, and said tail pipe projecting within the shell to have its forward end near the rear end of said barrel, said intake and tail pipes being closed across their inner ends and having holes through side walls near the closed ends and surge chambers at each end of the shell formed by porous material around the intake and tail pipes and perforated flanges extending from each end of said barrel toward said shell confining said first-mentioned material therebetween.

4. In an exhaust gas silencer, a shell, an intake pipe discharging into the shell, a tail pipe discharging from the shell, a surge chamber formed by filling a length of the shell with a porous material, and a barrel through the material having openings through its side walls, both said intake and tail pipe having extensions within the shell directed toward said surge chamber, porous material between the intake pipe extension and the shell, and

porous material between the tail pipe extension and the shell.

5. In an exhaust gas silencer, a shell, an intake pipe discharging into the shell, a tail pipe discharging from the shell, a surge chamber formed by filling a length of the shell with a porous material, and a barrel through the material having openings through its side walls, said intake pipe extending within the shell toward and terminating near the forward end of said barrel, and said tail pipe extending within the shell to have its forward end near the rear end of said barrel, a filling of porous material between a part of the length of both of the extensions and the shell, and perforate aprons extending from the pipes toward the shell to confine said material and define expansion chambers at each end of said barrel.

6. In an exhaust gas silencer, a shell, an intake pipe discharging into the shell, a tail pipe discharging from the shell, a surge chamber formed by filling a length of the shell with a porous material, and a barrel through the material having openings through its side walls, said intake pipe extending within the shell toward and terminating near the forward end of said barrel, and said tail pipe extending within the shell to have its forward end near the rear end of said barrel, a filling of porous material between a part of the length of both extensions and the shell, and perforate aprons extending from the pipes toward the shell to confine said material and define expansion chambers at each end of said barrel, the inner ends of both the intake and tail pipes being closed, said pipes having holes through side walls near said inner ends.

7. In an exhaust gas silencer, a shell, an intake pipe discharging into the shell, a tail pipe discharging from the shell, a surge chamber formed by filling a length of the shell with a porous material, and a barrel through the material having openings through its side walls, said intake pipe extending within the shell toward and terminating near the forward end of said barrel, and said tail pipe extending within the shell to have its forward end near the rear end of said barrel, a filling of porous material between a part of the length of both extensions and the shell, and perforate aprons extending from the pipes toward the shell to confine said material and define expansion chambers at each end of said barrel, a head in each end of said shell, said last mentioned filling of porous material terminating to leave an annular open space therearound adjacent the juncture of said heads and said shell.

8. In an exhaust gas silencer, a shell, a head in each end of the shell, an intake pipe extended through one head, a tail pipe extended through the other head, a spool fixed in the central part of the shell spaced between the inner ends of said pipes, said spool having a central perforate barrel and steel wool wrapped around said barrel, means on the inner end of the tail pipe to deflect the gas and steel wool around the tail pipe.

9. In an exhaust gas silencer, a shell, a head in each end of the shell, an intake pipe extended through one head, a tail pipe extended through the other head, a spool fixed in the central part of the shell spaced between the inner ends of said pipes, said spool having a central perforate barrel and steel wool wrapped around said barrel, said intake pipe having its inner end closed and having holes through its side wall near the end, an apron carried on the intake pipe spaced forwardly from its inner end, and steel wool wrapped around said intake pipe between said apron and said one head.

10. In an exhaust gas silencer, a shell, a head in each end of the shell, an intake pipe extended through one head, a tail pipe extended through the other head, a spool fixed in the central part of the shell spaced between the inner ends of said pipes, said spool having a central perforate barrel and steel wool wrapped around said barrel, said tail pipe having a cap over its inner end and holes through a side wall near the end, an apron fixed on the tail pipe, and steel wool wrapped around the tail pipe between said apron and said other head.

11. In an exhaust gas silencer, a shell, a head in each end of the shell, an intake pipe extended through one head, a tail pipe extended through the other head, a spool fixed in the central part of the shell spaced between the inner ends of said pipes, said spool having a central perforate barrel and steel wool wrapped around said barrel, and a perforate flange at each end of the barrel extending toward said shell and confining said steel wool therebetween, said tail pipe having a cap over its inner end and steel wool wrapped around the tail pipe between the cap and other head.

In testimony whereof I affix my signature.

FRANCIS F. HAMILTON.