

H. P. MAXIM.
SILENCER FOR GAS ENGINES, &c.
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1,060,925.

Patented May 6, 1913

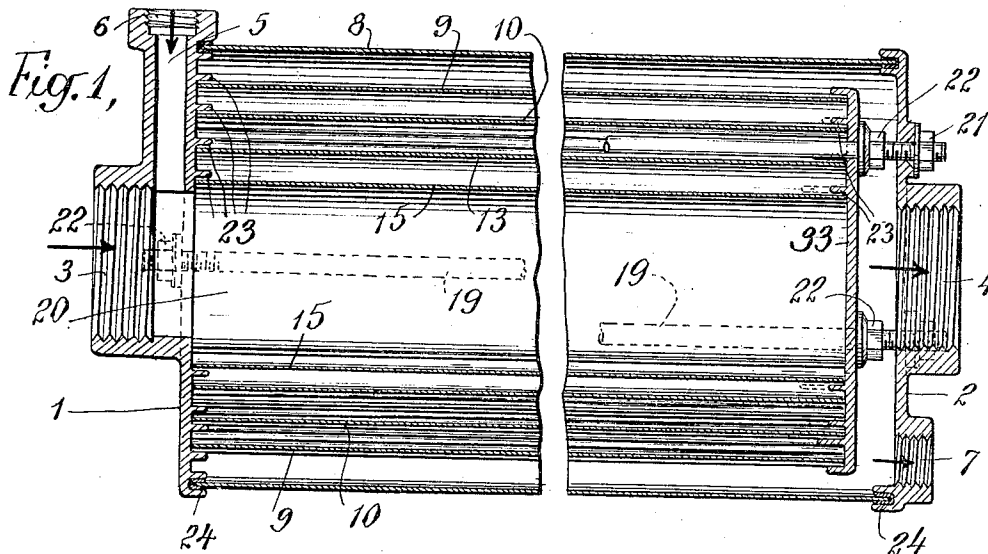


Fig. 2,

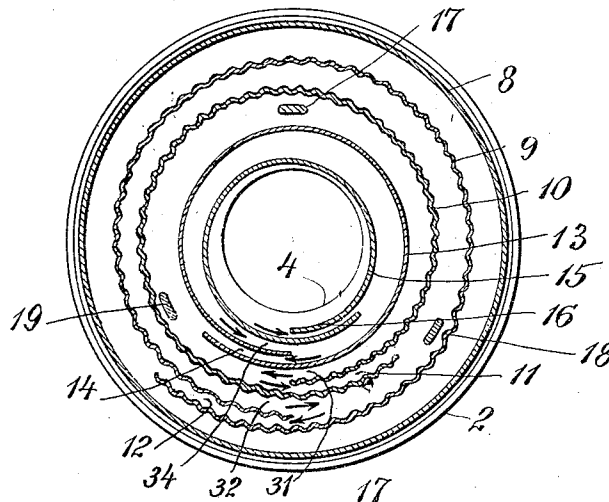
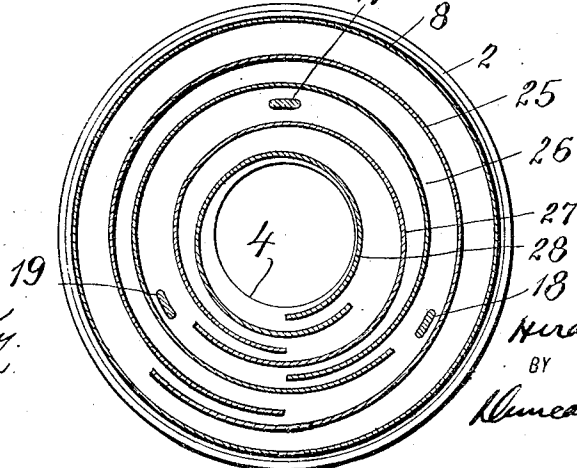


Fig. 3,



WITNESSES

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SILENCER FOR GAS-ENGINES, &c.

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To all whom it may concern:

Be it known that I, HIRAM PERCY MAXIM, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have made a certain new and useful Invention Relating to Silencers for Gas-Engines, &c., of which the following is a specification, taken in connection with the accompanying drawing, forming part of the same.

This invention relates to silencers for gas engines and the like to muffle or deaden the noise of the exhaust and to smooth out the sharp gaseous impulses, and may comprise an eccentrically arranged nested series of spiral shells having slightly lapping ends forming a compounded series of wide nested spiral whirl chambers, each contracting toward its constricted discharge throat, said shells being preferably mounted within an outer casing by suitable grooved supports which may conveniently comprise an independently adjustable intermediate support within the casing to engage one end of each of said shells.

In the accompanying drawing showing in a somewhat diagrammatic way several illustrative embodiments of this invention, Figure 1 is a longitudinal sectional view. Figure 2 is a transverse section thereof; and Fig. 3 is a similar section through another construction.

This silencer preferably comprises a nested series of spiral shells of any suitable metal or material, such as steel or of galvanized iron, or even brass, for salt water boat silencers and these wide shells which preferably have slightly lapping spiral ends, may be preferably but not necessarily given a cylindro-spiral form such as shell 15 shown in Figs. 1 and 2. The series of spiral shells of any desired form may be nested together, that is, fitted more or less one inside another, so as to form a nested series of whirl chambers for the exhaust gaseous material, and direct it around the spiral passages or whirl chambers formed between the shells. In order to increase the silencing and equalizing action it is desirable to have some of these spiral whirl chambers reversed in direction from the others so as to cause the gases which have been whirling in a right-handed direction, for instance, to reverse

in another whirl chamber and whirl in a left-handed direction. An effective silencing and equalizing action can be secured with an alternately reversing series of such spiral whirl chambers, that is, a series in which every alternate whirl chamber reverses the direction of movement of the exhaust gases or similar material which may of course be admitted to either end of this series of whirl chambers, although in some cases it is desirable to have the shells arranged so as to give the final whirl chambers a greater cross-section than the preceding chambers.

As indicated in Fig. 2, the inner shell 15 has slightly lapping spiral ends which form the constricted discharge throat 16 when the exhaust gases are admitted to the inner chamber formed by this cylindro-spiral shell. One or more outer shells may be provided, such as 13, which has similarly lapped spiral ends forming a constricted admission passage 14 to the succeeding whirl chamber while the spiral whirl chamber formed between the shells 13 and 15 is thus provided with a discharge throat 34. Another shell, such as 10, having corrugated or otherwise roughened walls, may be used having its lapping ends arranged to form an admission end 11 of the succeeding whirl chamber while the constricted discharge throat 31 of the preceding chamber is simultaneously formed. Any desired number of these nested shells may be employed to secure the desired silencing action, the capacity of the silencer being of course dependent upon the width or axial extent of these shells and as shown in Fig. 2 the outer shell 9 may be formed of corrugated or otherwise roughened material and provided with lapping spiral ends which form the admission passage 12 to the succeeding whirl chamber and also the discharge throat 32 from the whirl chamber preceding. These shells are preferably mounted eccentrically as indicated by which means spiral whirl chambers are secured which expand radially more or less gradually from their constricted admission ends and then more or less contract radially or change the effective radial height or dimension of the whirl chamber passages toward their constricted discharge throats. A reverse megaphone action is thus secured

which is valuable in deadening through cross reflection, interference action and so forth the noise of the exhaust generated within the gas engine and adjacent parts.

5 The shells are also preferably so arranged that each discharge throat is angularly advanced in its discharging direction beyond the admission end of the succeeding whirl chamber as indicated and it is also usually

10 desirable to give the final whirl chambers a progressively greater cross-section than the preceding chambers for best results, the decreased centrifugal effects in the outer larger radius chambers acting on the slower moving

15 gases being also beneficial where the exhaust gases are admitted to the inner chambers as in the illustrative form of silencer shown in the drawing. The desired number of these nested spiral shells may be conveniently ar-

20 ranged within a suitable inclosing casing, such as 8, which may be conveniently made cylindrical and as indicated in the drawings the shells and casing may be mounted within suitable supports so as to be firmly

25 held in position. These supports may be formed with recesses, grooves or lugs to properly support the shells and casing and it is desirable to have an intermediate support for one end of each of the shells so as

30 to allow them to be independently adjusted and secured in position before the inclosing casing is applied and secured in position by suitably connecting bolts or other means holding in position the supports which may

35 comprise any desired admission and discharge connections for the exhaust gases and also for cooling fluid in some cases.

The support 1 may as indicated be formed with a suitable annular recess or groove 24

40 for the casing which may be tightly held therein in connection with any desired form of packing, and the guiding grooves or ribs 23 serve to hold the inner shells in proper alinement. The other ends of the shells may

45 be conveniently supported in a grooved or ribbed intermediate support 33 having the ribs or projections 23 formed thereon for coöperation with the shells. This intermediate support may be securely held in

50 position by tightening up the nuts 22 on the connecting bolts 17, 18, 19, which as shown in Fig. 2 are preferably flattened more or less to minimize their interference with the gases in the whirl chambers. When

55 the shells have been thus assembled the casing 8 may be placed in position and firmly secured by tightening up the nuts 21 at the outer ends of these connecting bolts, thus leaving free the cylindrical outer surface

60 of the casing. The supports may be formed with suitable admission connections such as the threaded connection 3 used in this instance for conducting into the silencer the exhaust gases from the gas engine and so

forth and a suitable fluid admission connection 6 may be provided through which cooling water or the like may be admitted into the first silencer whirl chamber through the radial passage 5. A suitably threaded discharge connection 4 may be provided in the other support for the discharge gases and a threaded drip connection 7 may also be formed for the discharge of the cooling fluid from the silencer. Fig. 3 shows a somewhat similar arrangement in which the nested

7 spiral shells within the casing are shown as smooth and do not have the same progressive radial expansion between the different whirl chambers. The outer spiral shell 25 may have slightly lapping ends and this is

8 also the case with the inner shells 26, 27 and 28 which may be more or less eccentrically arranged as indicated.

The sharp intermittent puffs or gas impulses of the gas engine exhaust are received

8 into the silencer and given a rapid whirling motion in the whirl chambers, the inertia of the rapidly moving gases being in this way utilized to momentarily retard their

9 progressive movement through the different whirl chambers until they have been considerably slowed down. This action is also

9 promoted by the reverse arrangement of different chambers, so that with alternately reversing spiral whirl chambers the sharp

9 high velocity gas impulse is considerably smoothed out and prolonged so as to be converted into a much more continuous discharge before it is released from the silencer, thus rendering it incapable of producing

10 the sharp objectionable noise characteristic of the direct gas engine exhaust. Furthermore, the noise or sound waves caused by the exhaust within the engine and adjacent

10 parts are so muffled and deadened in the spiral passages which for this purpose are preferably given a more or less reverse megaphone shape so that by cross-reflection interference and other deadening effects

11 within the silencer the original objectionable noise can be practically eliminated.

This invention has been described in connection with a number of illustrative embodiments, forms, proportions, materials, constructions and arrangements of parts, to

11 the details of which disclosure the invention is not of course to be limited, since what is claimed as new and what is desired to be secured by Letters Patent is set forth in the

12 appended claims.

1. The silencer for gas engines and the like comprising a reversely directed, eccentrically arranged, nested series of wide cylindrical spiral shells having slightly lapping

12 ends and forming a compounded series of wide alternately reversing spiral whirl chambers, each gradually expanding radially from its admission end and gradually con-

tracting toward its constricted discharge throat, each discharge throat being angularly advanced in its discharging direction beyond the admission end of the succeeding outer chamber receiving material therefrom, the final outer whirl chambers having corrugated or roughened walls and having a progressively greater cross-section than the preceding chambers, a casing within which said shells are arranged, grooved supports in which said shells and casing are mounted and provided with admission and discharge connections suitable for exhaust gases and for cooling fluid, said supports comprising an independently adjustable intermediate support within said casing for one end of each of said shells and connecting means cooperating with said supports.

2. The silencer for gas engines and the like comprising a reversely directed, eccentrically arranged nested series of wide cylindro-spiral shells having slightly lapping ends and forming a compounded series of wide alternately reversing spiral whirl chambers, each gradually expanding radially from its admission end and gradually contracting toward its constricted discharge throat each discharge throat being angularly advanced in its discharging direction beyond the admission end of the succeeding outer chamber receiving material therefrom, a casing within which said shells are arranged, grooved supports in which said shells and casing are mounted and provided with admission and discharge connections suitable for exhaust gases and for fluid, and connecting means cooperating with said supports.

3. The silencer for gas engines and the like comprising a reversely directed, eccentrically arranged nested series of wide cylindro-spiral shells having lapping ends and forming a compounded series of wide alternately reversing spiral whirl chambers, each expanding radially from its admission end and gradually contracting toward its constricted discharge throat, each discharge throat being angularly advanced in its discharging direction beyond the admission end of the succeeding outer chamber receiving material therefrom, a casing within which said shells are arranged, grooved supports in which said shells and casing are mounted and provided with admission and discharge connections suitable for exhaust gases and for fluid, and connecting means cooperating with said supports.

4. The silencer for gas engines and the like comprising a reversely directed, nested series of wide cylindro-spiral shells having lapping ends and forming a compounded series of wide alternately reversing spiral whirl chambers, each expanding radially from its admission end and contracting toward its constricted discharge throat, each discharge

throat being angularly advanced in its discharging direction beyond the admission end of the succeeding outer chamber receiving material therefrom, a casing within which said shells are arranged, grooved supports in which said shells and casing are mounted and provided with admission and discharge connections suitable for exhaust gases.

5. The silencer for gas engines and the like comprising a reversely directed, nested series of spiral shells having lapping ends and forming a compounded series of wide alternately reversing spiral whirl chambers, each expanding radially from its admission end and contracting toward its constricted discharge throat, each discharge throat being angularly advanced in its discharging direction beyond the admission end of the succeeding chamber receiving material therefrom, a casing within which said shells are arranged, grooved supports in which said shells and casing are mounted and provided with admission and discharge connections suitable for exhaust gases.

6. The silencer for gas engines and the like comprising a reversely directed nested series of spiral shells forming a compounded series of wide alternately reversing spiral whirl chambers, each expanding radially from its admission end and contracting toward its constricted discharge throat, a casing within which said shells are arranged, grooved supports in which said shells and casing are mounted and provided with admission and discharge connections suitable for exhaust gases.

7. The silencer for gas engines and the like comprising a reversely directed, eccentrically arranged, nested series of wide cylindro-spiral shells having slightly lapping ends and forming a compounded series of wide reversing spiral whirl chambers, each expanding radially from its admission end and contracting toward its constricted discharge throat, each discharge throat being angularly advanced in its discharging direction beyond the admission end of the succeeding outer chamber receiving material therefrom, the final outer whirl chambers having corrugated or roughened walls and having a progressively greater cross-section than the preceding chambers, a casing within which said shells are arranged and grooved supports in which said shells and casing are mounted and provided with admission and discharge connections suitable for exhaust gases and for cooling fluid.

8. The silencer for gas engines and the like comprising a reversely directed, nested series of wide spiral shells having lapping ends and forming a compounded series of wide reversing spiral whirl chambers, each expanding radially from its admission end and

contracting toward its constricted discharge throat, each discharge throat being angularly advanced in its discharging direction beyond the admission end of the succeeding outer chamber receiving material therefrom, the final outer whirl chambers having a progressively greater cross-section than the preceding chambers, a casing within which said shells are arranged and supports in which said shells and casing are mounted and provided with admission and discharge connections suitable for exhaust gases.

9. The silencer for gas engines and the like comprising a reversely directed, nested series of spiral shells forming a compounded series of wide reversing spiral whirl chambers, each expanding radially from its admission end and contracting toward its constricted discharge throat, each discharge throat being angularly advanced in its discharging direction beyond the admission end of the succeeding chamber receiving material therefrom, the final whirl chambers having a progressively greater cross-section than the preceding chambers, a casing within which said shells are arranged and supports in which said shells and casing are mounted and provided with admission and discharge connections suitable for exhaust gases.

10. The silencer for gas engines and the like comprising a reversely directed, nested series of spiral shells forming a compounded series of wide reversing spiral whirl chambers, each expanding radially from its admission end and contracting toward its constricted discharge throat, each discharge throat being angularly advanced in its discharging direction beyond the admission end of the succeeding chamber receiving material therefrom, a casing within which said shells are arranged.

11. The silencer for gas engines and the like comprising a reversely directed, eccentrically arranged nested series of spiral shells having slightly lapping ends forming a compounded series of wide nested spiral whirl chambers each contracting toward its constricted discharge throat to smooth out sharp gaseous impulses and deaden noise and an admission connection communicating with the inner one of said shells.

12. The silencer for gas engines and the like comprising a reversely directed, nested series of spiral shells having lapping portions forming a compounded series of wide nested spiral whirl chambers contracting toward their constricted discharge throats to smooth out sharp gaseous impulses and deaden noise and an admission connection communicating with the inner one of said shells.

13. The silencer for gas engines and the like comprising a reversely directed, nested

series of spiral shells forming a compounded series of nested spiral whirl chambers each contracting toward its constricted discharge throat to smooth out sharp gaseous impulses and deaden noise and an admission connection communicating with one of said shells.

14. The silencer for gas engines and the like comprising a nested series of spiral shells forming a compounded series of nested spiral whirl chambers to smooth out sharp gaseous impulses and deaden noise and an admission connection communicating with one of said shells.

15. The silencer adapted for use with gas engines and the like comprising a reversely directed, nested series of spiral shells forming a compounded series of nested spiral whirl chambers to smooth out sharp gaseous impulses and deaden noise and an admission connection communicating with one of said shells.

16. The silencer adapted for use with gas engines and the like comprising a reversely directed, nested series of spiral shells forming a compounded series of wide reversing spiral whirl chambers, each contracting toward its constricted discharge throat, each discharge throat being angularly advanced in its discharging direction beyond the admission end of the succeeding chamber receiving material therefrom, and a casing within which said shells are arranged.

17. The silencer adapted for use with gas engines and the like comprising a nested series of spiral shells forming a compounded series of nested spiral whirl chambers, a casing within which said shells are arranged and grooved supports in which said shells and casing are mounted comprising an independently adjustable intermediate support within said casing for one end of each of said shells.

18. The silencer adapted for use with gas engines and the like comprising a series of shells forming passages, a casing within which said shells are arranged and supports in which said shells and casing are mounted comprising an independently adjustable intermediate support within said casing.

19. The silencer for gas engines and so forth, comprising a reversely directed nested series of spiral shells having lapping portions forming a compounded series of nested spiral whirl chambers, the discharge throats of said chambers being angularly advanced in their discharging direction beyond the admission portions of the succeeding chambers receiving material therefrom to smooth out gaseous impulses and deaden noise.

20. The silencer adapted for use with gas engines and so forth, comprising a reversely directed nested series of spiral shells each having lapping portions to form narrow

constricted discharge throats discharging a wide thin stream substantially circumferentially forming a compounded series of nested spiral whirl chambers to smooth out sharp gaseous impulses and deaden noise.

21. The silencer adapted for use with gas engines and so forth, comprising one or more spiral shells having lapping portions to form constricted discharge throats dis-

charging substantially circumferentially 10 and an outer inclosing spiral shell forming a compounded series of spiral whirl chambers to smooth out sharp gaseous impulses and deaden noise.

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Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."