

L. VAUGHAN.

MUFFLER.

APPLICATION FILED AUG. 14, 1911.

1,058,393.

Patented Apr. 8, 1913.

2 SHEETS-SHEET 1.

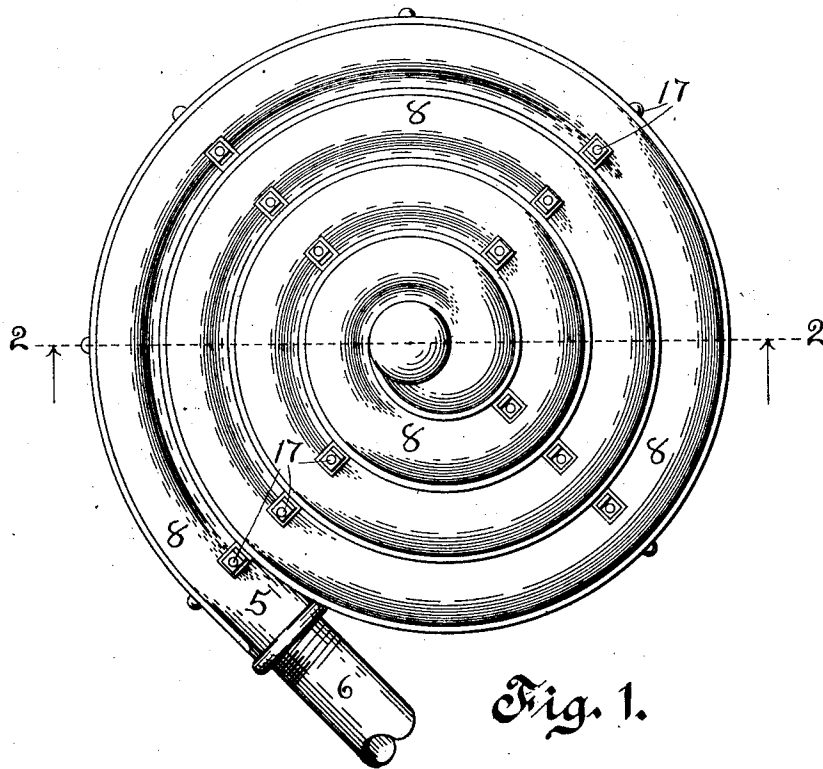
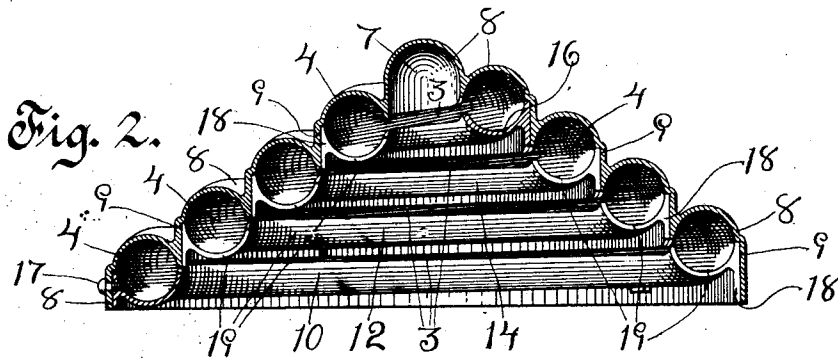


Fig. 1.

WITNESSES:

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INVENTOR:

Louis Vaughan.

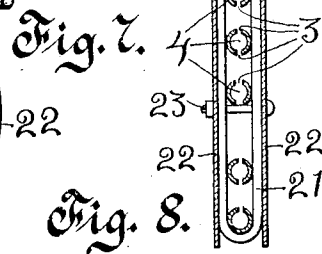
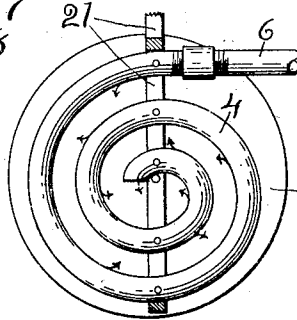
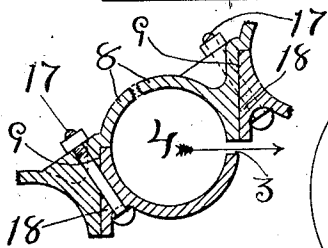
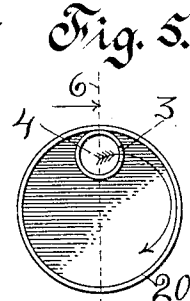
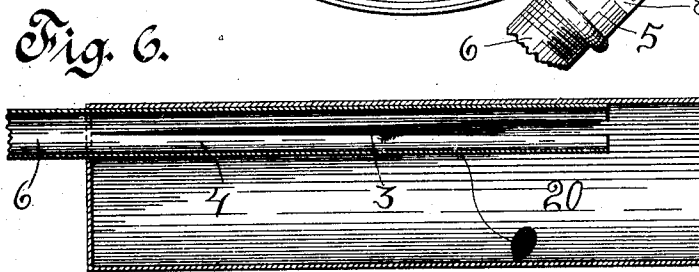
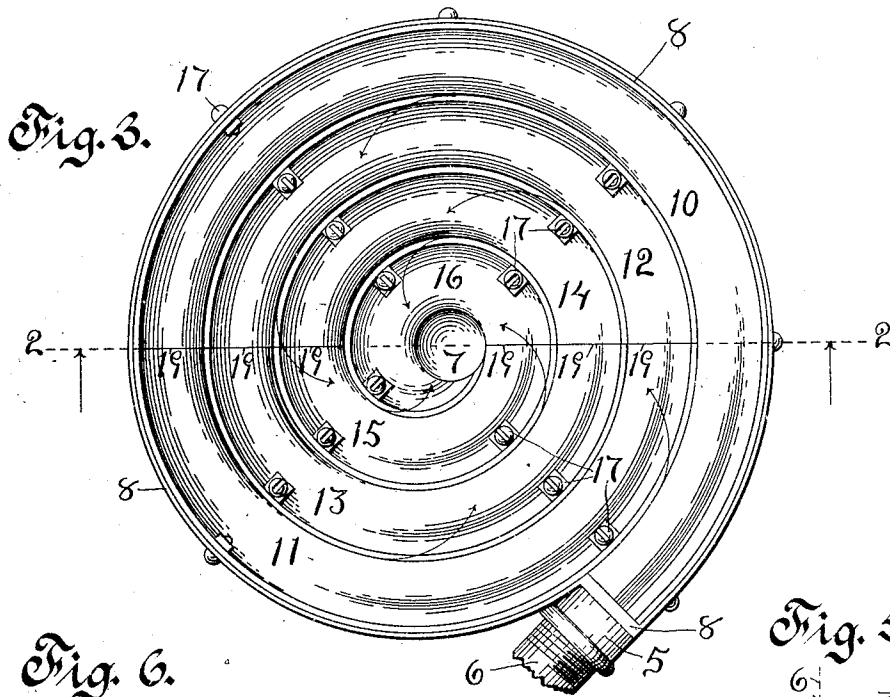
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INVENTOR:

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UNITED STATES PATENT OFFICE.

LOUIS VAUGHAN, OF BLAIR, NEBRASKA, ASSIGNOR OF ONE-HALF TO LITTLETON W. TURNER, OF LINCOLN, NEBRASKA.

MUFFLER.

1,058,393.

Specification of Letters Patent.

Patented Apr. 8, 1913.

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To all whom it may concern:

Be it known that I, LOUIS VAUGHAN, a citizen of the United States of America, residing at Blair, in the county of Washington and State of Nebraska, have invented certain new and useful Improvements in Mufflers, of which the following is a specification.

My invention relates to improvements in mufflers for the exhausts of power engines; and the objects of my improvement are, first, to gradually decrease the force or pressure of the discharge current in the exhaust duct without obstructing or restricting the free escape of the released exploded gas or steam; second, to primarily release a part of the discharge and so control and direct it that it will dissipate and muffle the later and final portions of said discharge; third, to gradually convert the intermittent discharge into an eddy in a discharging chamber of much larger diameter than the exhaust duct and thereby reduce the force of the pulsations too low to produce reports at the final ejection; fourth, to provide a muffler automatically adjustable to muffle exhausts of varying force and varying rapidity of pulsations; fifth, to build up a conical or trumpet-shaped discharging chamber of the exhaust duct itself; and, sixth, to construct that part of the exhaust duct forming the walls of the conical discharging chamber so that it may be made of cast metal parts assembled and bolted together. These and other minor objects hereinafter more particularly set forth, I attain by the structure illustrated in the accompanying drawings in which—

Figure 1 is a top, outside or back view of such a muffler designed and arranged for connection to an internal combustion engine and applicable to an automobile; Fig. 2, a vertical sectional view on the broken lines 2—2 of Figs. 1 and 3; Fig. 3, an underside, inside or front view; Fig. 4, an enlarged sectional detail illustrating the manner of joining and bolting the separable parts together; Fig. 5, a front elevation of a simplified modification for use where there is ample room for elongation; Fig. 6, a longitudinal section on the broken line 6 of Fig. 5; Fig. 7, a side elevation, with parts removed and cut away, of a modification designed laterally-thin for application to a motorcycle; and Fig. 8, a vertical cross sectional view of Fig. 7. In all of which views like parts are

designated by the same reference numerals and the arrow-heads indicate the direction of movement of the escaping exhaust current.

A generic feature, the tapered slit 3 disposed longitudinally along through the wall of the exhaust duct 4, is plainly shown in Figs. 2, 4, 5 and 6; said slit being continuously widened toward the discharging terminal of said duct. In the preferred form of my invention shown in Figs. 1, 2, 3 and 4, the exhaust duct 4 is conico-helically coiled upon itself into a helicoidal cone forming the walls of a conical or trumpet-shaped discharging chamber. The outer end 5 of the base whorl of the coiled exhaust duct is made whole and tapped to receive the threaded end of the engine exhaust pipe 6. The tapered slit 3 is disposed on the inside of the whorls of the coiled exhaust duct, on the inside of the helicoidal cone or trumpet-shaped discharging chamber; it is started close to the connected end 5 and continued throughout the length of the duct; it is started as narrow as possible and gradually increased in width until it and the discharging end of the duct opens into the dome-topped terminal or receiving chamber 7 at the apex of the cone. This receiving chamber is practically a terminal bend of the exhaust duct to direct its terminal discharge axially into the discharging chamber and is preferably of greater diameter than the exhaust duct; it is axially coincident with the conical discharging chamber and opens out full-sized thereinto, as shown in Figs. 2 and 3.

To avoid the difficulty of bending a slit-ted pipe into the desired conical coil or of cutting the slit after the coil is formed, the whole back or exterior wall 8 of the cone with the wall of the receiving chamber is cast integrally. A continuous helicoidal groove, of semi-circular transverse section, around the inside of the discharging chamber forms the upper or back wall of the exhaust duct. And a continuous vertically-broad rabbet 9 disposed between the convolutions or whorls of this upper semicircular groove serves as a seat to receive the bases 18 of the curved and reversely-grooved plates 10, 11, 12, 13, 14, 15 and 16, that form the under or front side of the exhaust duct. These plates are firmly secured in position by the bolts 17 disposed diagonally through their bases 18 and through the outer wall at the rabbet, 11c

as shown in Fig. 4. The plates are gradually narrowed at their inner edges from the base of the cone to its apex and said inner edges spaced away from the inner edge of the upper or back groove to form the continuously tapered slit therebetween. And the abutting ends 19 of these curved plates are close jointed together, as shown in Figs. 2 and 3.

In operation the exhaust at its full force enters the exhaust duct at the connection to the base whorl of the cone and is continuously and increasingly depleted in force by the inwardly lateral escape through the tapered slit into the discharging chamber until the receiving chamber at the apex is reached. If the exhaust is light the gradually increasing escape through the slit is sufficient to dissipate the pressure, obliterate the pulsations, whether slow or rapid, and prevent reports. The forcefully escaping gas from the slit entering the hollow of the cone or discharging chamber in the directions indicated by the arrow-heads is a resultant of the direction of the current in the duct and the lateral discharge therefrom through the tapered slit. This escaping gas first tends to form a helicoidal sheet from the mouth or base to the apex; but its tangential direction of movement produces a vortical effect while the lateral pressure from the slit crowds the whole toward the axis of the chamber against the centrifugal force of the vortex. The result is a rapidly revolving eddy of substantially uniform density filling the whole conical discharging chamber and also moving bodily in the direction of its axis toward the mouth thereof from which it is ejected in pulsations too light to produce reports. If the force of the exhaust is so great as to carry a portion thereof the entire length of the coiled exhaust duct into the receiving chamber at the apex, the discharge from the slit will accordingly be more forceful and the resulting eddy in the discharging chamber of greater velocity density and power. This final portion of the current enters the receiving chamber tangentially, producing instantly therein a strong vortical movement in the same direction as the eddy in the discharging chamber into which it is axially delivered assimilated and its pulsative power neutralized.

To coil the exhaust duct as shown, not alone provides a suitable inclosing wall for the discharging chamber, but, facilitates the use of ample length of duct to accommodate the required very long gradually-widened slit within the minimum of space; and disposes the slit to direct the discharge therefrom in the most suitable manner and direction to produce the dense rapidly revolving eddy in the final discharging chamber.

In the modification shown in Figs. 5 and

6, the action is similar. The exhaust duct is disposed in the large cylindrical casing 20 so that the discharge from the slit strikes the casing wall tangentially producing the forwardly moving eddy. If made of great length and the mouth of the casing far forward of the duct terminal, it is quite efficient.

In the modified arrangement for motor-cycles Fig. 7 shows the exhaust duct 4 disposed in an open helical coil in a vertical plane and supported by the centrally disposed yoke hanger 21. The outer coil has the slit on its inside only and the inner coils are slitted both sides, as shown in section in Fig. 8, and the open terminal is near the center of the helix. The side disks 22, supported a small distance away from the sides of the coil by the vertical members of the yoke hanger and secured by the central cross-bolt 23 completes the inclosing discharging chamber.

I claim:

1. An exhaust muffler, comprising an exhaust pipe coiled conico-helically to form the curved inclosing wall of a cone-shaped open based discharging chamber communicably connected at its apex with the discharging end of said coiled exhaust pipe.

2. An exhaust muffler, comprising a cone-shaped discharging chamber having the base of the cone open to form an ejecting mouth of greater area than the area of cross-section of the connected exhaust duct, an exhaust pipe bent conico-helically to form the curved inclosing wall of said chamber and communicably connected to discharge into the apex of said chamber.

3. An exhaust muffler, comprising a cone-shaped discharging chamber open at the base of the cone to form an ejecting mouth of greater area than the area of cross-section of the connected exhaust duct, an exhaust pipe having a conico-helical bend to form the curved inclosing wall of said discharging chamber, a receiving chamber axially communicable with the apex of said discharging chamber and communicably connected with said exhaust duct.

4. A muffler, comprising an exhaust pipe coiled conico-helically to form the curved wall of a cone-shaped discharging chamber, said chamber open at the base of the cone to form an ejecting mouth of greater area than the cross-section of the exhaust duct, and the whorls of the coiled exhaust pipe having a longitudinal slit opening laterally out of the exhaust duct into said discharging chamber.

5. An exhaust muffler, comprising a cone-shaped discharging chamber open at the base of the cone to form an ejecting mouth larger than the area of cross-section of the connected exhaust duct, a receiving chamber having an ejecting mouth opened axially into the apex of said discharging chamber,

an exhaust pipe coiled conico-helically to form the curved inclosing wall of said discharging chamber, and said exhaust duct communicably connected to discharge tangentially into said receiving chamber.

5 6. A muffler, comprising an exhaust pipe conico-helically coiled to form the curved wall of a cone-shaped discharging chamber and having at the inner curve of its whorls
10 a narrow slit opening laterally from the bent exhaust duct into said discharging chamber, the base of the cone open to form an ejecting mouth to the discharging chamber of greater area than the area of cross-
15 section of the exhaust duct, a receiving chamber having an ejecting mouth opened axially into the apex of the cone-shaped discharging chamber and communicably connected with the discharging end of said ex-
20 haust duct.

7. A muffler, comprising an exhaust pipe having a portion at its discharging end conico-helically coiled to form the inclosing wall of a cone-shaped discharging chamber,
25 the base of the cone open to form an ejecting mouth to the chamber of greater area than the area of cross-section of the exhaust duct, the discharging end of the exhaust duct communicably open into the apex of
30 said chamber, and the coiled portion of said pipe having a narrow slit throughout its length opening laterally from the duct into said chamber.

8. An exhaust muffler, comprising a cone-shaped discharging chamber having the whole base of the cone open to form an ejecting mouth of greater area than the area of cross-section of the connected exhaust duct,
35 a dome-shaped receiving chamber disposed with its base open as an ejecting mouth into the apex of said discharging chamber, an exhaust pipe conico-helically coiled to form the curved surrounding wall of said dis-
40 charging chamber, said exhaust pipe having a narrow slit along the inner curve of its coiled portion to form a lateral opening from the exhaust duct into said discharging chamber, and the terminal of said exhaust
45 duct communicably connected to discharge tangentially into said receiving chamber.

9. An exhaust muffler, comprising a cone-shaped discharging chamber open at the base to form an ejecting mouth of greater area than a cross-section of the connected exhaust
50 duct, an exhaust pipe conico-helically coiled to form the conical wall of said chamber, said pipe having a slit to form a lateral opening from the exhaust duct into said chamber and extended along the whorls of
55 the coiled pipe with increasing width from the base to the apex of said chamber.

10. A muffler, comprising a cone-shaped discharging chamber, the base of the cone open to form an ejecting mouth of greater
60 area than the area of cross-section of the

connected exhaust duct, an exhaust pipe conico-helically coiled to form the curved wall of said discharging chamber, a dome-shaped receiving chamber having an open base to form an ejecting mouth disposed to
70 open axially into the apex of said discharging chamber, the coiled exhaust pipe adapted to be communicably connected at the base of the cone with an exhaust source, its opposite end communicably connected to discharge tangentially into said receiving
75 chamber, and having a longitudinal slit opening laterally from the coiled exhaust duct into said discharging chamber and of increasing width from the base of the discharging chamber to the receiving chamber.

11. A muffler, comprising a back-plate of bend to form a conical discharging chamber having an open base to form an ejecting mouth and having an intermural conico-helical groove, an integral portion of said
80 back-plate at the base terminal of the groove made whole to form a short pipe coincident with the base end of the groove and having its outer end threaded for connection with
85 an exhaust pipe, and a front-plate seated against the back-plate to cover said groove and form a conico-helical duct throughout the curved wall of said chamber.

12. A muffler, comprising a back-plate bent to form a conical discharging chamber open at the base of the cone to form
90 an ejecting mouth of greater open area than the area of cross-section of the connected exhaust duct and having an intermural conico-helical groove, a bent front-plate seated between the whorls of the groove in the back-plate and grooved reversely there-
95 to to form an exhaust duct therebetween, and the plates at the inner edges of the grooves spaced apart to form a narrow slit opening laterally out of said exhaust duct into said discharging chamber.

13. A muffler, comprising a back-plate shaped to form a conical discharging chamber open at its base, a helicoidally disposed
100 groove around the inner wall of said chamber, a rabbet disposed in the inner wall of said chamber between the whorls of said groove, bent sectional front-plates each having
105 a base to seat in said rabbet and a groove disposed reversely to the groove in said back-plate to form therebetween an exhaust duct, and the inner edges of said front-plates spaced away from the inner
110 edge of the groove in said back-plate to form a narrow slit opening laterally out of said exhaust duct into said discharging chamber.

14. A muffler, comprising an integral back-plate shaped to form a conical dis-
115 charging chamber open at its base and a receiving chamber opening therinto at the apex of said discharging chamber, an intermural helicoidally disposed groove starting
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at the base of said back-plate and terminating openly in said receiving chamber, bent sectional front-plates seated between the whorls of the groove in said back-plate and
5 oppositely grooved to form with the groove in said back-plate an intervening exhaust duct, and the back-plate and front-plates spaced apart at the inner edges of the grooves to form a longitudinal slit opening
10 laterally from said exhaust duct into said discharging chamber.

15 15. A muffler, comprising a back-plate having an open groove, an oppositely grooved front-plate seated against said back-plate to form an exhaust duct therebetween, and said plates spaced apart along

corresponding edges of their grooves to form a narrow slit opening laterally out of said exhaust duct.

16. A muffler, comprising a grooved back- 20 plate, a front-plate seated against said back-plate to cover said groove and form an exhaust duct, and said plates spaced apart along an edge of said groove to form a narrow slit opening laterally out of said ex- 25 haust duct.

In testimony whereof I have affixed my signature in presence of two witnesses.

LOUIS VAUGHAN.

Witnesses:

M. K. DAVIES,

S. W. CHAMBERS.