

B. CARLEN.
 MUFFLER.
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1,366,632.

Patented Jan. 25, 1921.

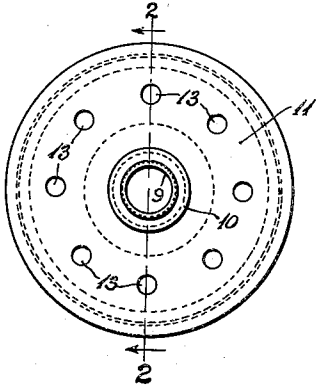


FIG. 1

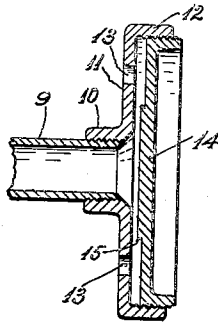


FIG. 2

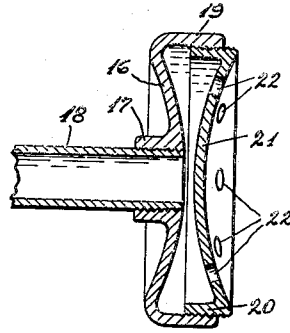


FIG. 3

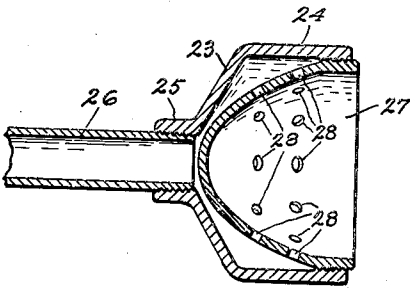


FIG. 4

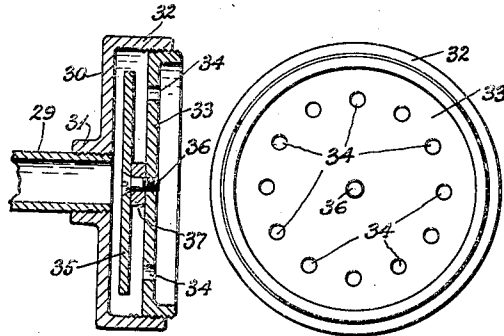


FIG. 5

FIG. 6

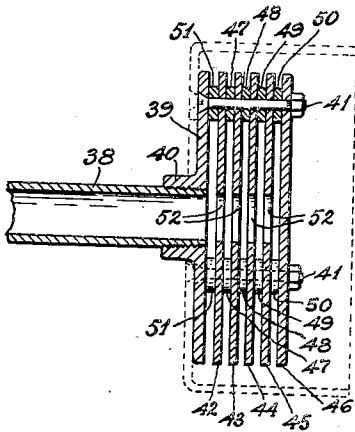


FIG. 7

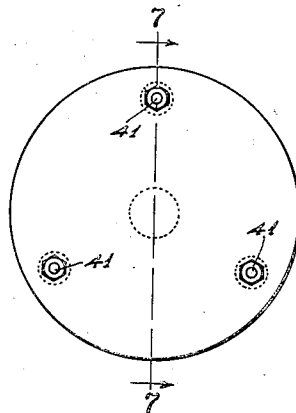


FIG. 8

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UNITED STATES PATENT OFFICE.

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MUFFLER.

1,366,632.

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To all whom it may concern:

Be it known that I, BJARNE CARLEN, a subject of the King of Norway, residing at Seattle, in the county of King and State of Washington, have invented a certain new and useful Improvement in Mufflers, of which the following is a specification.

My invention relates to improvements in mufflers, and the object of my invention is to provide a muffler which shall be adapted to be connected to the outlet end of the exhaust pipe of an internal combustion engine in such manner that all gases emitted from said exhaust pipe shall pass through said muffler; and which muffler shall be so constructed that, when it is so disposed, contiguous ones of successively discharged separate bodies of gaseous products of combustion that enter said muffler shall be emitted therefrom in the form of a silent current, without creating back-pressure to opposite movements of the engine's pistons, thus to prevent successive explosive sounds.

I accomplish this object by devices illustrated in the accompanying drawings, wherein—

Figure 1 is a view in elevation of one side of one form of muffler embodying my invention;

Fig. 2 is a sectional view of the same on broken line 2, 2 of Fig. 1;

Fig. 3, is a view in mid-section of a muffler embodying another form of my invention;

Fig. 4 is a view in mid-section of a muffler embodying my invention in a form slightly different from the form shown in Fig. 3;

Fig. 5 is a view in mid-section showing another form of my invention;

Fig. 6 is a view in elevation of one end of the same;

Fig. 7 is a view in mid-section on broken line 7, 7 of Fig. 8 showing a muffler embodying a preferred form of my invention; and

Fig. 8 is a view in elevation of one end of the same.

Referring to the drawings, throughout which like reference numerals indicate like parts, in Figs. 1 and 2, 9 designates the outlet end portion of an exhaust pipe of an internal combustion engine upon which is fixed a hub 10 which is integral with one side of a disk 11 whose other side is provided on its outer edge portion with an annular flange 12

of the form of a hollow cylinder which is provided with an internal screw-thread.

The disk 11 is provided with a plurality of air holes 13 extending therethrough, which are disposed at equi-distant points on a circular line intermediary of and concentric with the hub 10 and flange 12.

A flanged disk 14, which is provided with screw-threads on its periphery, is adjustably disposed to be encircled by the flange 12 with its screw-threads in operative engagement with the internal screw-threads of said flange 12, whereby the distance between the inner side surfaces of the disks 11 and 14 may be varied in response to relative rotative movements of the disk 14.

The inner side of the disk 14 is provided with a concentrically disposed integral boss 15, of greater diameter than the diameter of the passageway through the disk 11 and exhaust pipe 9, as shown in Fig. 2, whereby the space between said boss 15 and the inner side surface of the disk 11 will always be less than the space between other portions of the inner side surface of said disk 14 and the inner side surface of the disk 11.

The operation of that form of muffler shown in Figs. 1 and 2 is as follows: The disk 14 being adjusted to a position distant from the inner surface of the disk 11 where it will permit the emission of successive separate bodies of products of combustion from the exhaust pipe 9 without creating back-pressure, then such separate bodies of products of combustion will successively impinge against the surface of the boss 15 to be diverted and expanded radially through the narrower space between said boss 15 and the disk 11 into the wider space between the disks 14 and 11, and in passing through said narrower space all of said separate bodies of products of combustion will enter and expand in the axial direction of the device into said wider space and pass therefrom into the exterior atmosphere, through the holes 13, in the form of a noiseless constant current.

Fig. 3 shows a muffler which differs from the muffler of Figs. 1 and 2, in the particulars that instead of a disk like member 11, it embodies a plate 16 of concavo-convex form, whose concave side is integral with a hub 17 that is screwed on to the outlet end portion

of an exhaust pipe 18 and whose convex side is provided on its outer edge portion with an integral flange 19, corresponding to the flange 12 of Fig. 2.

Adjustably screwed into the flange 19 is a flange 20 that is integral with the convex side of a plate 21 also of concavo-convex form, which plate 21 corresponds to the disk 14.

Unlike the disk 11, the plate 16 is not provided with holes therethrough, but the plate 21 is provided with a plurality of holes 22, which correspond in function to the holes 13 of Figs. 1 and 2.

The convex sides of the plates 16 and 21 face each other whereby the space between the central portions of them will always be narrower than the space between other portions thereof, so that the gases will gradually expand simultaneously in two directions.

Obviously, the mode of operation of the modified form of muffler shown in Fig. 3 is similar to the mode of operation of the muffler shown in Figs. 1 and 2, since contiguous ones of separate bodies of products of combustion will be blended in their passage from the exhaust pipe 18 into and through the narrower space between the central portions of the convex sides of the plates 16 and 21 to flow into the wider space therebetween and thence to the exterior atmosphere through the holes 22.

Fig. 4 shows a muffler different in form of construction from the muffler of Fig. 3 in the particular that it embodies a flanged member 23 which corresponds in function to the plate 16 and whose flange 24 is of greater width, said flange 23 being provided with an integral hub 25 that is screwed on to the outlet end portion of an exhaust pipe 26, and, further, in the particular that within the flange 24 is adjustably disposed a member 27 which corresponds in function to the plate 21 of Fig. 3, but which is more nearly of the form of a parabolic lamp reflector, said member 27 being provided with a plurality of holes 28 which correspond in function to the holes 22 of the plate 21 of Fig. 3.

The modified form of muffler shown in Fig. 4 has exactly the same mode of operation as the muffler of the form shown in Figs. 1, 2 and 3, except that the rate and the direction of the expansion are modified by the form of the directing surfaces, 23 and 27.

In Figs. 5 and 6 I have shown another modified form of muffler attached to the outlet end of an exhaust pipe 29 which muffler is provided with a disk 30 having an integral hub 31 that projects from one of its sides and an internally screw-threaded flange 32 that projects from its other side integral therewith and which corresponds in

form to the disk 11 of Fig. 2, but which is not provided with holes corresponding with the holes 13 of said disk 11.

Within said flange 32 is adjustably disposed a flanged disk 33 provided with a screw-thread on its periphery which operatively engages with the internal screw-thread of the flange 32, said disk 33 corresponding to the disk 14 of Fig. 2, except in the particulars that said disk 33 is provided with air holes 34 and instead of the boss 15 it is provided with a deflector plate 35 secured to but spaced from the inner surface of said disk 33 by means of a screw 36 and washer 37, as more clearly shown in Fig. 5.

Obviously, the modified form of muffler shown in Figs. 5 and 6 is adapted to operate by similar mode of operation as the mufflers shown by Figs. 1, 2, 3 and 4, successive separate bodies of products of combustion being emitted from the exhaust pipe 29 to impinge against the inner surface of the deflector plate 35 to radiate and pass between said deflector plate 35 and the inner surface of the disk 30, thence around the periphery of said plate 35, thence to and through the holes 34 to the exterior atmosphere, said successive separate bodies of products of combustion passing through the muffler to issue from said holes 34 in the form of a silent current.

In Figs. 7 and 8, I have shown a muffler embodying a preferred form of my invention, which muffler is attached to the outlet end portion of an exhaust pipe 38, and which embodies a disk 39, from one side of which projects an integral hub 40 that is screwed on to said exhaust pipe 38 as shown in Fig. 7, and to the other side of said disk 39 is fastened, by equi-distantly disposed bolts, a plurality of plates 42, 43, 44, 45, and 46, adjacent ones of which are spaced from each other by washers 47, 48, 49 and 50, the plate 42 being also spaced from the disk 39 by washers 51.

Only the plates 42, 43, 44 and 45 are provided each with a hole 52 through its central portion concentric with the outlet end of the exhaust pipe 38.

While I have shown the holes 52 as being the same diameter and have shown the washers 47, 48, 49, 50 and 51 as being of the same thickness, said holes 52 and said washers may be varied in dimensions to suit different conditions of operation.

Under some conditions it is preferable that the space between the plates 45 and 46 be less than the space between the plates 44 and 45, and the space between the plates 43 and 44 be less than the space between the plates 42 and 43, and the space between the plates 42 and 43 be less than the space between the plate 42 and the disk 39; and also under most conditions it is preferable that the hole 52 of the plate 45 be smallest in diameter and

the hole 52 through the plate 42 be the largest in diameter, and the hole 52 through the plate 43 be larger than the hole 52 through the plate 44.

5 Thus, in the operation of a muffler embodying my invention in the manner illustrated in Figs. 7 and 8, the separate bodies of highly compressed gaseous products of
10 combustion from the outlet end of the exhaust pipe 38 will pass through the holes 52 to impinge against the inner surface of the central portion of the plate 46, and such gases in response to the pressure thereof will escape
15 from said cylindrical space through the spaces between adjacent ones of the plates 42, 43, 44, 45 and 46 and through the space between the disk 39 and the plate 42; which spaces being narrow and the walls thereof
20 being of great area, will tend to cause such flow to be constant, with the result that such gases will be emitted from said spaces into the outer atmosphere in the form of a constant silent current.

25 If it be desired that the several currents of gases be deflected upon their emission from the several spaces to cause them to flow all in a direction parallel with the axis of the exhaust pipe 38, then in such case, a deflector of the form indicated by dotted lines
30 in Fig. 7, may be attached to the muffler, which deflector in an obvious manner will cause all of said currents to flow in a direction at right angles to the plane of the
35 plate 46.

In all of the mufflers, of Figs. 1 to 8 inclusive, gases passing therethrough, first pass through a constricted passageway therein to a larger passageway, thence to the exterior
40 atmosphere through a plurality of smaller passageways.

In all of the figures of the drawings, the reduction of pressure is effected by expansion in a radial direction, but in order to reduce
45 the pressure as rapidly as possible it is pref-

erable that the expansion also takes place in an additional direction, transverse to its direction of flow.

In order to avoid all noise the expansion should be gradual until the gases have expanded, so that when they issue from the muffler there will be no noise due to sudden expansion into the open atmosphere.

In order to provide a proper operation sudden changes in the direction of flow are to
55 be avoided during expansion until the gases have been sufficiently reduced in pressure to avoid noise, after which the gases may be deflected in any direction.

The arrangements shown are such that in
60 the expanding channels of the muffler the velocity of the gases is greatly increased, enabling the engine to exhaust more completely and more rapidly. Use of this type of muffle shows decided beneficial results in
65 operation of the engines.

Obviously, changes may be made in the forms, dimensions, and arrangement of parts of my invention without departing from the spirit thereof.

70 What I claim is:

In a muffler for exhaust pipes, two elements, one of which is a circular flange for attachment on the end of said pipe, a circular
75 deflector plate opposite the ends of said pipe and having discharge orifices therein, said flange and plate having threaded flanged connections at their peripheries whereby said plate can be adjusted to and from said
80 flange, said plate forming a narrow passage with said flange sufficient to produce a diminished pressure between the flange and plate.

In witness whereof, I hereunto subscribe my name this 17th day of March, A. D. 1917.

BJARNE CARLEN.

Witness:

C. J. SMITH.