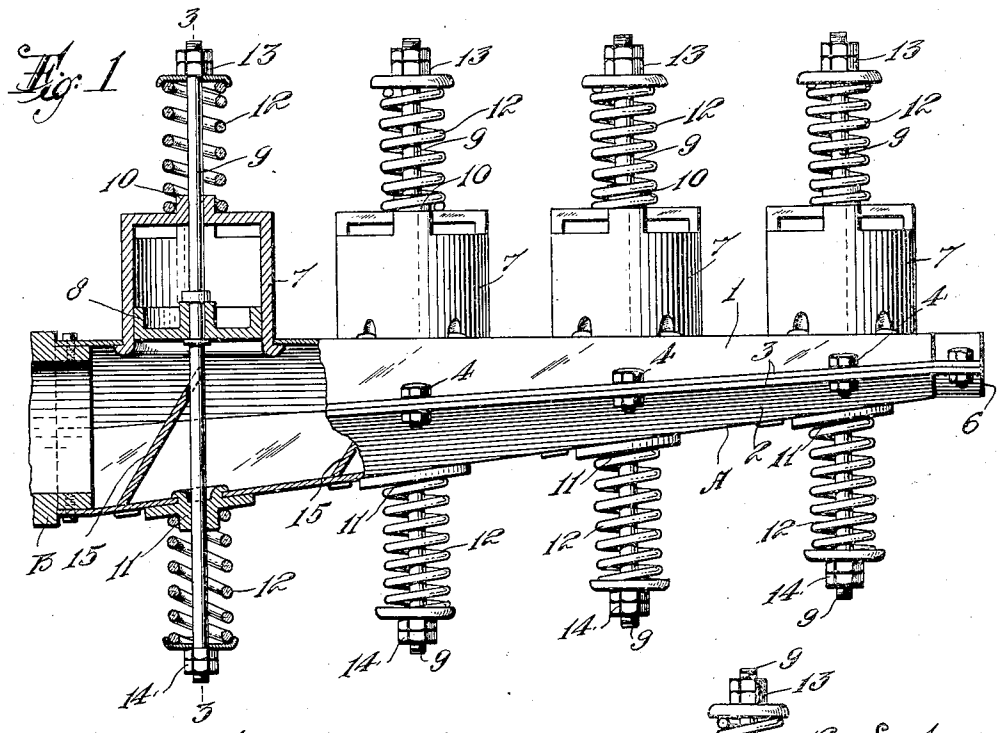
Oct. 2, 1934. S. S. SCOTT 1,975,483

MUFFLER

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Fig. 1



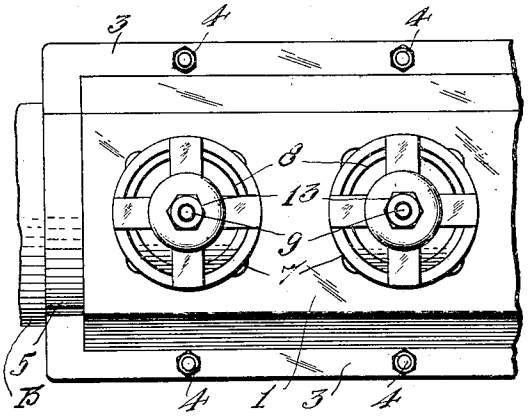
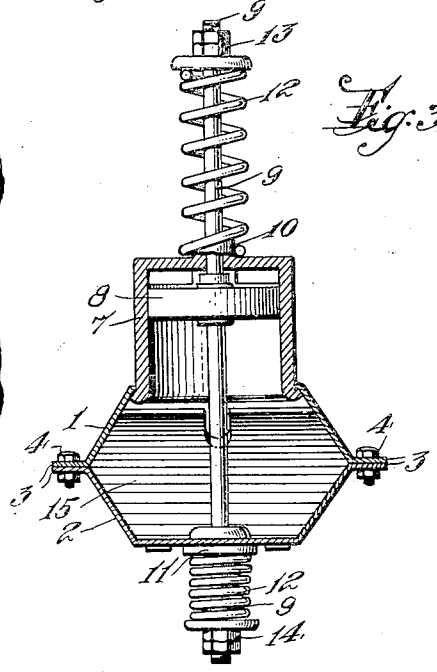


Fig. 2

Fig. 3



Semple S. Scott,
INVENTOR.
BY Everett H. Cook
ATTORNEYS.

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Fig. 4

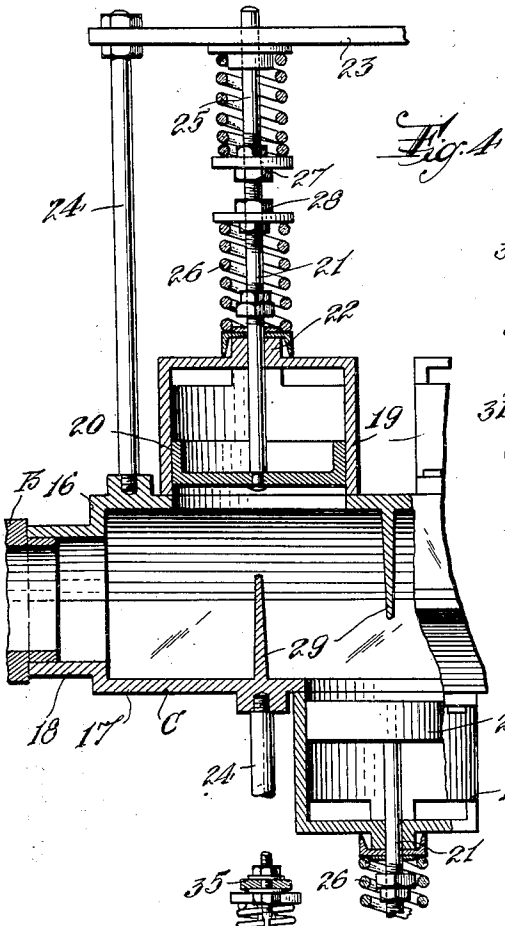


Fig. 5

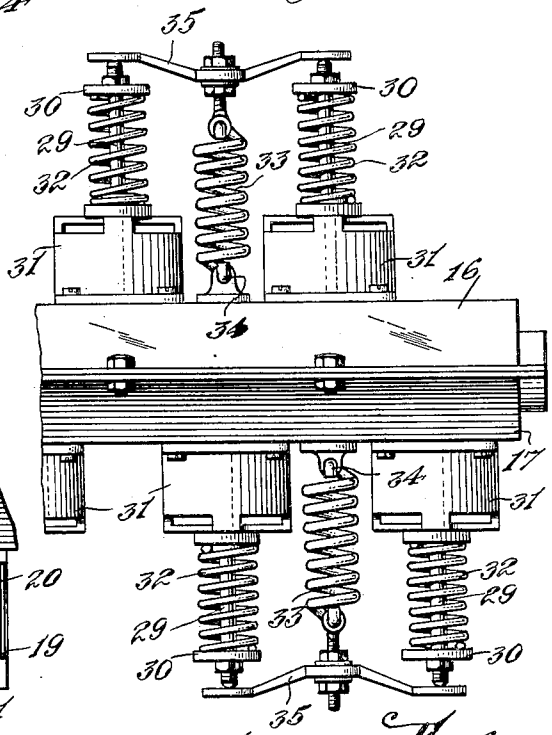


Fig. 7

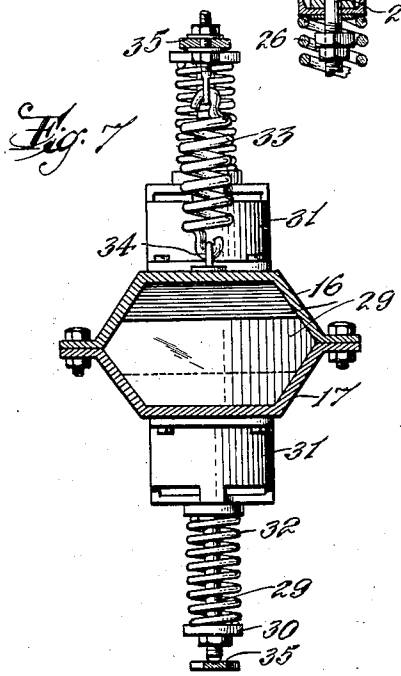
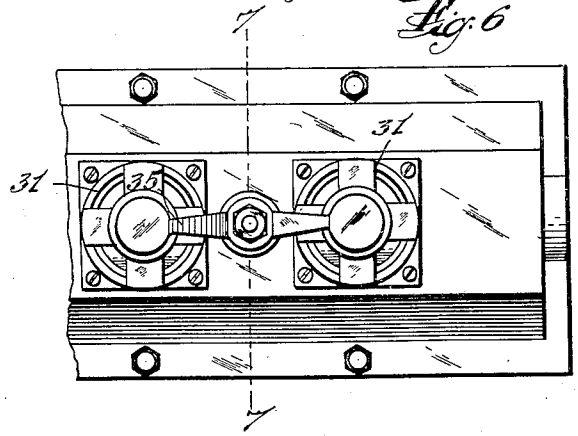


Fig. 6



INVENTOR.
Semple S. Scott,
BY
Cornell & Cook,
ATTORNEYS.

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UNITED STATES PATENT OFFICE

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MUFFLER

Semple S. Scott, Newark, N. J.

Application September 22, 1931, Serial No. 564,301

5 Claims. (Cl. 137—160)

This invention relates in general to mufflers, particularly mufflers for use with internal combustion engines, and especially the invention is directed toward the provision of a muffler suitable for use with aeroplane engines and motorcycles. It has always been desirable to reduce the noise incident to the exhaust of an internal combustion engine, and many types of mufflers have been provided for this purpose, but it is a well known fact that one great difficulty in the use of the mufflers is the production thereby of back pressure upon the engine which of course reduces the power obtainable from the engine unless the mufflers are made of an impractical size.

One object of my invention is to provide a muffler embodying novel and improved features of construction, which shall be relatively small and whereby the noise incident to the exhaust of an internal combustion engine or the like may be materially reduced without producing material back pressure on the engine.

Another object is to provide a muffler embodying novel and improved features of construction, whereby the pulsating exhaust gases as they leave the exhaust pipe shall be permitted to greatly expand and a portion thereof shall be momentarily stored before they reach the atmosphere and shall then gradually and continuously exhaust into the atmosphere at a reduced pressure.

Other objects are to provide such a muffler comprising a casing to be connected to the exhaust pipe of an internal combustion engine or the like and having an outlet, the casing being formed with a plurality of chambers between the end connected to the exhaust pipe and the outlet wherein the exhaust gases may expand and a portion thereof may be momentarily stored, each chamber communicating with the interior of said casing independently of the other chambers and being independently variable in volume and means for ejecting the exhaust gases from said chamber through the outlet; to make each said chamber in a muffler of this character as a cylinder in which is reciprocable a piston that is normally balanced or floated between two spring pressures so as to instantaneously and easily move under the influence of the exhaust gases and permit the gases to expand in said cylinder, the spring pressures returning the piston against the influence of the exhaust gases after expansion thereof and escape of a portion into the atmosphere so as to eject the gases from said chamber; and to obtain other advantages and results as may be brought out by the following description.

For the purpose of illustrating the principles of the invention, in the accompanying drawings I have shown it embodied in several forms, but it should be understood that this is primarily for the purpose of illustrating the invention, and that the details of construction of the muffler may be modified and changed by those skilled in the art without departing from the spirit or scope of the invention.

Referring to said drawings, in which corresponding and like parts are designated throughout the several views by the same reference characters,

Figure 1 is a sectional elevation of a muffler embodying my invention;

Figure 2 is a fragmentary top plan view of one end thereof;

Figure 3 is a transverse vertical sectional view, showing the movement of the piston in the cylinder to permit expansion of the exhaust gases;

Figure 4 is a fragmentary longitudinal sectional view through a modified form of the invention;

Figure 5 is a fragmentary side elevation of another modification;

Figure 6 is a top plan view of the construction shown in Figure 5, and

Figure 7 is a transverse vertical sectional view, on the line 7—7 of Figure 6.

Specifically describing the embodiment of the invention illustrated in Figures 1 to 3, inclusive, the muffler comprises a casing A which may be formed in any suitable manner and of any suitable material. As shown, this casing is formed of pressed steel and consists of two complemental sections 1 and 2 having flanges 3 which are secured together by bolts 4. One end of the casing has a circular portion 5 for connection to the exhaust pipe B of an internal combustion engine or the like, and the casing is shown as tapered or gradually reduced in cross-sectional area from said end 5 toward the outlet end 6, although the casing may be made straight or of the same cross-sectional area throughout its length, if desired.

At one side of the casing A and spaced longitudinally thereof are a plurality of cylinders 7 with their axes transverse to the axis of the casing and communicating at one end with the interior of the casing and open to the atmosphere at their other ends. Within each of these cylinders 7 is reciprocable a piston 8 mounted on a rod 9 slidable in a spider 10 at the open ends of the cylinders and also in a bearing 11 at the opposite side of the casing which is secured to the casing in any suitable manner. The pistons 8 are normally bal-

anced between two compression springs 12, one of which is interposed between the spider 10 and adjusting nuts 13, while the other is interposed between the bearing 11 and adjusting nuts 14, the springs serving to normally hold the pistons adjacent the inner ends of the respective cylinder 7, as clearly shown in Figure 1 of the drawings, and being of such strength as to yieldingly resist movement of the pistons under the influence of exhaust gases in the casing A.

In operation, when the exhaust gases enter the casing A from the exhaust pipe B, the pressure thereof forces the piston 8 in the first cylinder 7 outwardly of the cylinder against the influence of one of the springs 12, as clearly shown in Figure 3 of the drawings. This permits the gases to expand and a portion thereof to be momentarily stored in the cylinder between the pulsations. Simultaneously with this expansion some of the gases pass through the casing into the portion thereof adjacent the next cylinder 7, where a similar action takes place, and this continues throughout the length of the casing A. When the pressure of the gases has been reduced to less than the strength of the springs 12, said springs return the pistons inwardly of the cylinders to eject the gases from the cylinders into the casing, and of course the pressure of these ejected gases is less than the pressure of the gases when they entered the portion of the casing adjacent the respective cylinders. Accordingly, the irregular or pulsating pressure of the exhaust gases is gradually reduced as they pass through the casing A, and the gases are discharged from the casing A continuously with little or no noise and little back pressure is produced in the exhaust pipe B.

It may be desirable in some instances to insert baffles 15 in the casing A opposite each cylinder 7, to deflect the gases toward the cylinder.

Preferably the cylinders 7 and pistons 8 are formed of materials having different coefficients of expansion, so as to prevent binding of the piston in the cylinder; for example, the cylinders may be formed of brass, and the pistons of cast iron.

A modification of the invention is shown in Figure 4 of the drawings, where the casing C is formed of cast metal, consists of two sections 16 and 17 and is straight instead of tapered from the end 18 that is connected to the exhaust pipe B toward the outlet end, which is not shown. This form of the invention otherwise differs from the form shown in Figure 1, in that the cylinders are disposed at opposite sides of the casing in staggered relation, these cylinders being designated 19 and being bolted or otherwise secured to the casing. It will be obvious that the number and relative location of the cylinders 19 may be widely varied by those skilled in the art, for example, the cylinders might be arranged in a helical row surrounding the casing, with a portion of each cylinder opposite a portion of another cylinder.

In each cylinder is arranged a piston 20 having a rod 21 projecting outwardly from and slidable in a spider 22 at the open end of the cylinder. The extremity of the rod 21 may also be slidable in a bracket 23 secured to the casing in spaced relation thereto as by rods 24. Each piston 20 is normally balanced and held adjacent the inner end of its cylinder 19 by compression springs 25 and 26, one of which is interposed between the bracket 23 and an adjusting nut 27 on the rod 21, while the other is interposed between the spider 22 and an adjusting nut 28 on the rod.

The operation of this form of the invention is in general similar to that of the construction shown in Figures 1 to 3, inclusive, the gases being permitted to expand in the cylinders 19 and the pressure thereof being gradually reduced as the result of this expansion as they pass through the casing. If desired, baffles 29 may be arranged in the casing, corresponding to the baffles 15.

Obviously many different ways of mounting the springs for the pistons may be utilized, and one other manner of arranging the springs is shown in Figure 5 of the drawings. In this form of the invention, each piston rod 29 has an adjusting nut 30 between which and the corresponding cylinder 31 is interposed a compression spring 32 for influencing the corresponding piston outwardly of its cylinder. A pair of adjacent springs 32 are balanced by a tension spring 33 which is connected at one end to a bracket 34 on the casing of the muffler and at the other end to a yoke 35 which bears against the extremity of each rod 29, the spring 33 tending to move the pistons inwardly of their cylinders. This provides a more compact arrangement of the springs, and reduces the number of springs required, since one spring 33 serves for two pistons.

From the foregoing, it will be clear that the pistons 20 may rapidly reciprocate or vibrate to conform to rapid explosions and exhausts of, for example, aeroplane engines, so that the exhaust gases of each explosion may be expanded and their pressure reduced.

It will appear to those skilled in the art that the relative sizes of the cylinders 7, 19 or 31 and the muffler casings, the spacing and arrangement of the cylinders, and the strength of the cylinder springs, may be varied to suit different conditions, and therefore I do not desire to be understood as limiting myself to the specific sizes, proportions and arrangements of the parts shown in the drawings.

Having thus described the invention, what I claim is:

1. A muffler comprising a casing having a passage therethrough with an inlet at one end and an outlet at the other end, a plurality of cylinders spaced longitudinally of said casing and each communicating at one end with said passage and at its other end with the atmosphere, each cylinder having a piston therein, and spring means for normally holding said piston in one position when said cylinder contains a gas at a predetermined pressure and permitting said piston to move outwardly of said cylinder upon influx thereinto from said passage of gas at a higher pressure to permit expansion of said gas.

2. The muffler set forth in claim 1 with the addition of baffles in said passage between said cylinders.

3. A muffler comprising a casing having an inlet and an outlet, and a plurality of chambers in spaced and successive relation between said inlet and said outlet and each communicating with the interior of said casing independently of the others, the volume of each chamber being variable independently of variations in the volume of the other chambers and each chamber having a predetermined volume when containing gases at a predetermined pressure and a portion of its wall being yieldable under gas pressure to vary the volume of the chamber upon variations in the pressure of the gases in the chamber.

4. A muffler comprising a casing having an inlet and an outlet and a plurality of variable volume chambers in spaced and successive relation be-

tween said inlet and said outlet and each communicating with the interior of said casing independently of the other, each chamber having a movable wall and yielding means to cooperate with said wall to normally hold the same in position to make the said chamber of a predetermined capacity when the chamber contains gases at a predetermined pressure and to permit but yieldingly resist movement of said wall by variations in pressure of the gases to vary the volume of the chamber.

5. A muffler comprising a casing having a passage therethrough with an inlet at one end and an outlet at the other end, a plurality of cylinders spaced longitudinally of said casing, and each communicating at one end with said passage and at the other end with the atmosphere, each cylinder having a reciprocable piston and spring means for normally balancing said piston in one position when said cylinder contains a gas at a predetermined pressure and permitting but yieldingly resisting movement of said piston upon variations in pressure of the gases to vary the volume of the chamber.

SEMPLE S. SCOTT.