

Dec. 4, 1934.

J. OLSON

1,983,304

MUFFLER

Filed July 24, 1929

FIG. 1.

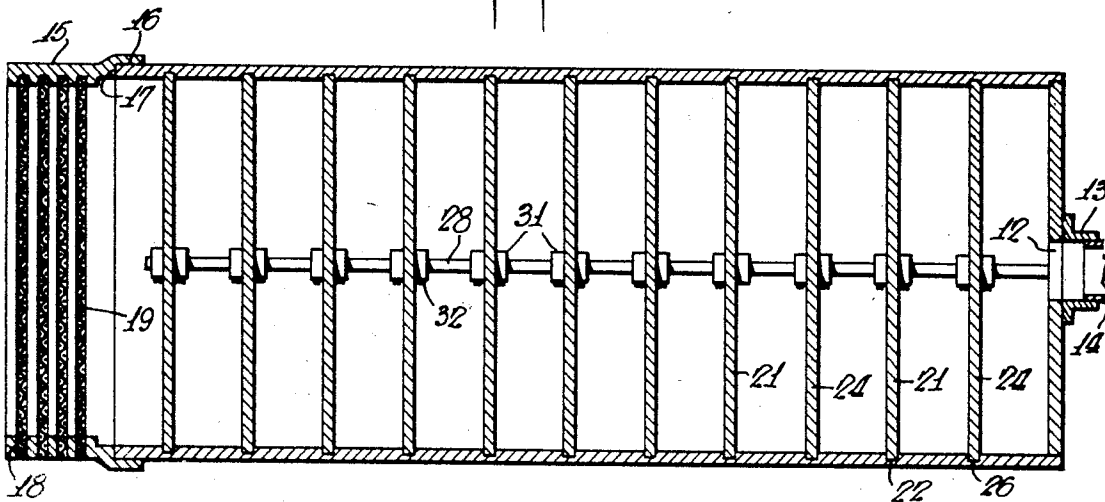


FIG. 2.

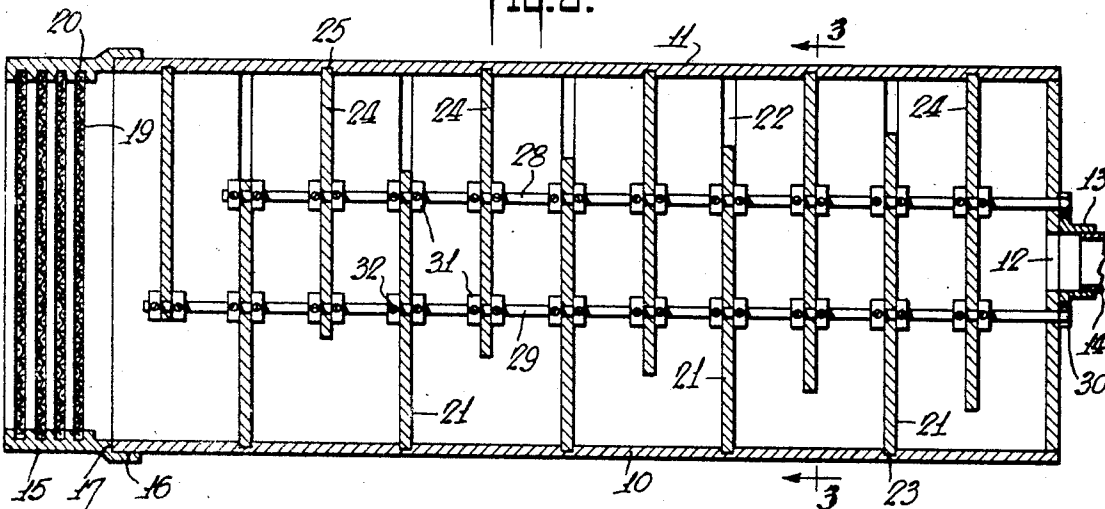


FIG. 3.

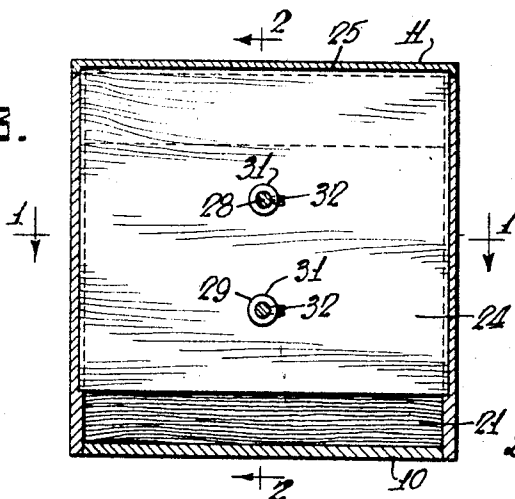
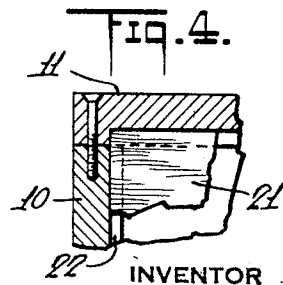


FIG. 4.



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UNITED STATES PATENT OFFICE

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MUFFLER

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4 Claims. (Cl. 137—160)

My present invention, while capable of a wide range of utility, finds its preferred embodiment in a muffler for motors or the like and is capable, for instance, of silencing the sound of a gas engine exhaust or a compressor intake.

An object of the invention is to provide a device of this type which not only shatters and dissipates the undesirable sound waves, but which cleanses and filters the aeroform fluid passing therethrough, these results being accomplished in every instance without the creation of back pressure in the muffler.

I have discovered that a muffler in order to be effective, particularly where the muffler is of relatively massive size, as on the intake of an air compressor, must be substantially self-sustaining against vibration and the baffle plates thereof must not only be leak proof but substantially non-responsive to vibrations in the current of air or gas which is moving through the muffler chamber.

In accordance with the preferred embodiment of the invention, therefore, I employ a staggered series of solid baffle plates arranged within a chamber having a restricted opening at one end and an air filter at the other end. The baffle plates, which cause the air current to take a tortuous, frequently diverted path through the chamber, are not only firmly secured to the walls of the muffler body but have their free edges effectively sustained against vibration, preferably by connective tie rods.

Preferably the baffles are of progressively increasing size from the filter end of the muffler to the end having the restricted opening through which the sound waves enter. The largest baffle plate provides an air clearance opening between its free edge and the muffler wall which is at least, as large as the sound wave inlet opening and this clearance becomes progressively greater at each baffle, whereby a charge of exhaust gas, for instance, entering one end of the muffler under pressure escapes from the other end of the muffler under no pressure and in fact there is a scarcely perceptible draft of air through the filtering screen.

By leading the sound waves during their expansion and breaking up through a gaseous medium of progressively decreasing density, I find that a material damping and absorption of sound occurs and that the total muffling effect is far greater than where the sound wave passage is of approximately uniform cross section throughout its length.

The invention may be more fully understood

from the following description in connection with the accompanying drawing wherein

Fig. 1 is a longitudinal sectional view of the muffler taken approximately on the line 1—1 of Fig. 3.

Fig. 2 is a similar view taken at right angles to Fig. 1 and on the line 2—2 of Fig. 3.

Fig. 3 is a transverse sectional view taken approximately on the line 3—3 of Fig. 2.

Fig. 4 is a transverse sectional detail through one corner of the muffler body.

The muffler casing designated generally at 10 is of boxlike form, preferably approximately square in cross section and is provided with a removable wall 11 which for purposes of descriptive convenience may be designated as the top or cover. One end of the box has a sound wave inlet opening 12 of relatively small size therein encircled by a collar 13 into which the pipe 14 is fitted, this pipe representing, for instance, the exhaust pipe of an internal combustion engine or the intake pipe of an air compressor.

The opposite end of the box is closed by a filter screen which may assume many forms, although the illustrated embodiment has proven highly satisfactory in use. This screen consists of a boxlike frame 15 of a cross sectional shape and size similar to that of the casing 10. Frame 15 is provided at one end with a socket 16 adapted to be telescoped over the end of the muffler case 10 and defining a shoulder 17 against which the end of this casing abuts. One side wall of the frame 15 is provided with a series of transverse slots 18 therein and screens 19 entered through these slots have their edges received in suitable grooves 20 in the inner faces of the other three walls of the frame. Preferably the series of parallel screens 19 are slightly spaced from each other and comprise wire mesh screen members carrying a coating or film of oil to which the impurities in the gas flowing through the filter are adapted to adhere.

Two series of baffles of progressively decreasing size are arranged in the muffler casing. The lower series of baffles 21 rests upon the bottom of the box 10. These baffles are inserted while the cover 11 is removed. Their side edges are received in grooves 22 in the side walls of the box 10 and their lower edges received in a groove 23 in the box bottom. These baffles are equi-distantly spaced from each other and are of progressively decreasing height from the sound wave inlet end of the box toward the screened end thereof.

A second set of baffles 24, having their upper edges received in grooves 25 in the box top 11,

project downwardly between the first baffle set 21. Baffles 24 are spaced equidistantly from each other and from the lower baffles 21 between which they extend.

5 The side walls of the box 10 are grooved for the proper distance as at 26 to accommodate the side edges of the upper series of baffles 24, the latter being supported at their bottoms on the bottoms of the grooves 26. The baffles 24 are also
10 of progressively decreasing size relative to each other and to the lower baffle set 21.

Considering Fig. 2 and the baffle 24 which is closest to the opening 12, it will be noted that the space between the lower edge of this baffle and the bottom wall of the box, should be of a cross sectional area which is approximately equivalent (in most cases at least equal) to the cross sectional area of the opening 12. The distance between the next baffle 21 and the top of the box is equal to approximately twice this area; the next baffle 23, three times the area, etc.

Thus when the muffler is in use, the sound waves entering the muffler casing through opening 12 and passing toward the screen are expanded and travel through a progressively less dense medium, and after traversing the tortuous pathway, are completely dissipated by the time they reach the atmospheric pressure region at the screen. The muffler thus provides in effect not only the mechanical sound interruption which is afforded by the shattering of the sound waves against the baffle walls and the repeated sharp change in direction of the waves but affords also a shock absorbing air or gas cushion of gradually decreasing density. I have discovered this air cushion to be unusually effective in its sound deadening action and experiments indicate that that the provision of a baffle arrangement which permits gradual expansion of the sound waves as well as rapid directional changes therein materially assists the impact of the waves against the baffle walls to kill the noise of the exhaust. The present arrangement is not to be confused with amplifier devices where columns of air are in vibration and sound waves are expanding toward the larger end of the column, since in such devices there is no continuous flow of air current tending to maintain progressively varying air density conditions throughout the length of the sound wave path.

I have found that it is highly desirable to provide some efficient means for firmly holding the baffles against vibration when they are assembled in the box. For illustrative purposes, I have shown the use of the tie rods 28 and 29, which are disposed in parallelism with the walls of the muffler casing and which extend from the free edge of the smallest baffle of each set through all of the other baffles of both sets and through the sound wave entrance wall of the muffler casing. These tie rods are secured at their ends by nuts 30 or equivalent devices and on each tie rod a pair of collars 31 are disposed at opposite sides of each baffle that the tie rod intersects. Preferably these collars are jammed tightly against opposite faces of the baffles and held in position by set screws 32.

In assembling the muffler, the lower set of baffles 21 are dropped into place, the upper set of baffles 24 are then dropped into position, the bottoms of the grooves 26 checking their downward movement and bringing all their upper ends flush. The tie rods 28 and 29 are then slipped into position, the collars 31 being applied as required while the ends of the tie rods are being pushed

through the successive baffle plates. Collars 31 are then moved against the baffles which they are to hold, the set screws 32 tightened, and the tie rods secured. Subsequently the cover 11 is screwed tightly home, the notches 25 therein snugly receiving the upwardly projecting edges of the upper baffle set 24. The assembly may now be completed by the application of the coupler collar 13 and the filter screen unit.

As suggested above, the flow of air or gas through the muffler may sometimes be in one direction and sometimes in the other, but the direction of sound wave movement is always through the opening 12 toward the filter end thereof and whether these sound waves are moving with the air current or counter-current thereto makes no material difference in the effectiveness of the muffling action.

In use the muffler combines all of the sound wave shattering qualities of an ordinary muffler with the unique air cushion action or what might be termed a sound wave shock absorbing action afforded by the progressively decreasing density of the air through which the waves must pass.

It will thus be seen that there is herein described a device in which the several features of this invention are embodied, and which device in its action attains the various objects of the invention and is well suited to meet the requirements of practical use.

As many changes could be made in the above construction, and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A muffler including an elongated casing of generally rectangular cross sectional shape having a sound wave inlet opening in one end and being open at its other end, a staggered series of generally rectangular sound wave shattering baffles extending transversely of the casing, said baffles being spaced alternately from opposite walls of said casing and providing passages of progressively increasing size toward the open end of said casing.

2. A muffler including an elongated casing of generally rectangular cross sectional shape having a sound wave inlet opening in one end and being open at its other end, a staggered series of generally rectangular sound wave shattering baffles extending transversely of the casing, each baffle being fixed at three edges to the casing walls and means to secure the free edges of the baffles against vibration, said baffles providing passages of progressively increasing size toward the open end of said casing.

3. A muffler including an elongated casing of generally rectangular cross sectional shape having a sound wave inlet opening in one end and being open at its other end, a staggered series of generally rectangular sound wave shattering baffles extending transversely of the casing, said baffles being spaced in alternation from opposite sides of said casing and of an extent to provide axial passages progressively larger toward the open end of said casing, the casing walls being grooved to receive the edges of the baffles and prevent leak therearound, and rods extending in parallelism from the inlet end of said casing through said baffles adjacent their free ends and having means clamping said baffles in rigid spaced

relation to prevent vibration of the free portions of the same.

4. A muffler comprising an elongate casing open at one end for the discharge and having a restricted inlet at the other end, a staggered series of baffles extending transversely of said casing, said baffles being spaced in alternation from dia-

metrically opposite parts of said casing and of an extent to provide axial passages progressively larger toward the open end of said casing, said casing having means for securely holding the free ends of said baffles against vibration and grooves receiving the other peripheral parts of said baffles.

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45	120
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65	140
70	145
75	150