Feb. 18, 1936. H. C. AUSTIN 2,031,451

EXHAUST SILENCER FOR INTERNAL COMBUSTION ENGINES

Filed March 17, 1933

Fig. 1.

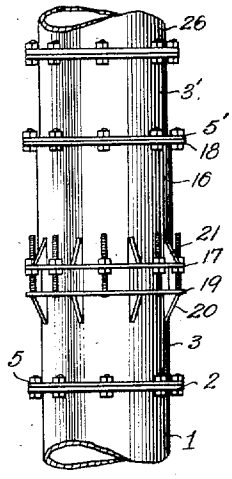


Fig. 2.

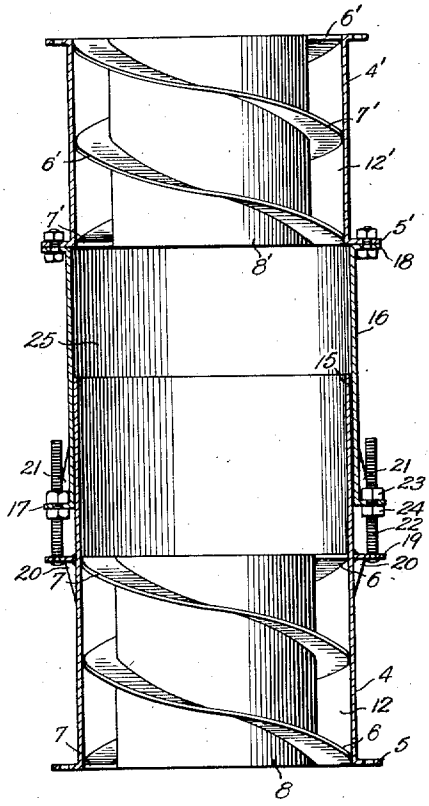


Fig. 3.

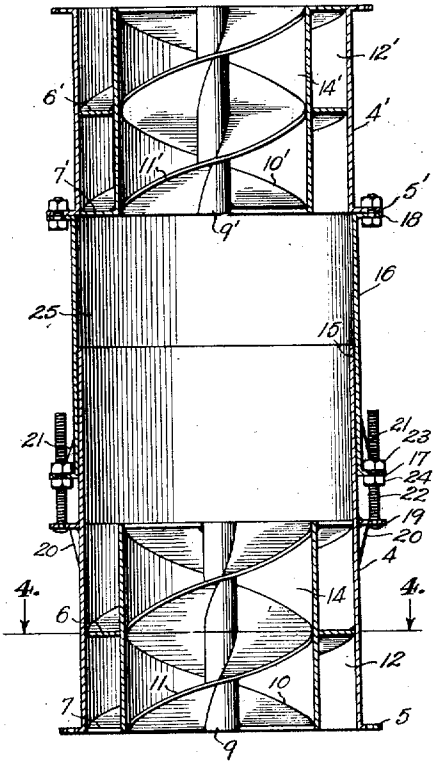
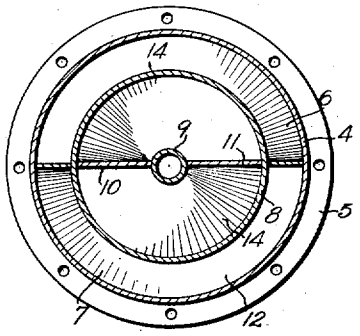


Fig. 4.



INVENTOR
Harry C. Austin
BY
Thomas E. Scofield
ATTORNEY

Patented Feb. 18, 1936

2,031,451

UNITED STATES PATENT OFFICE

2,031,451

EXHAUST SILENCER FOR INTERNAL COMBUSTION ENGINES

Harry C. Austin, Kansas City, Mo., assignor to Chester L. Austin, Kansas City, Mo.

Application March 17, 1933, Serial No. 661,314

2 Claims. (Cl. 137—160)

My invention relates to exhaust silencers for internal combustion engines and more particularly to a device adapted to eliminate the concussion from the exhaust of large Diesel engines.

The exhaust of large internal combustion engines of the Diesel type creates considerable noise. The use of Diesel engines to furnish power for industrial plants has necessitated the building of large muffler pits. The principle of all mufflers hitherto developed has been to slow down the exhaust gases to velocities below that of sound. The volume of the gases is generally from six to eight times that of the piston displacement which in the case of large Diesel engines is considerable. The building of concrete muffle pits involved considerable expense, inasmuch as the volume of the pit must be usually about twenty times the total piston displacement. Frequently, in the starting of engines, ignition does not take place immediately, with the result that the pit becomes filled with unburnt gases and air. This mixture is usually an explosive mixture with the result that, when ignition does take place and explosion follows, it frequently is of considerable violence resulting in injury to limb and property.

In two-cycle Diesel engines, it is essential for efficiency that the back pressure be not increased. Types of mufflers which depend upon baffling and giving the exhaust gases a circuitous path through baffles and apertures tend to increase the back pressure. A frequent source of difficulty is the clogging of the apertures by carbon depositions and resinous material which render the muffler inoperative after a period of use. These devices, too, are of considerable size and unless extremely strongly built, it is found that the baffles will vibrate and make considerable noise.

One object of my invention is to provide a strongly constructed, simple silencer for the exhaust of internal combustion engines.

Another object of my invention is to provide a silencer which will not increase the back pressure materially.

Another object of my invention is to build a muffler which is light and small in size so that it may be installed directly in the exhaust pipe from the engine at any convenient part thereof.

Still another object of my invention is to provide a construction in which the danger of damage due to explosions of unburnt fuel is eliminated.

In the accompanying drawing which forms part of the instant specification and is to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views;

Figure 1 is an elevation of my device installed in the exhaust pipe of a large Diesel engine.

Figure 2 is a sectional view of my silencer with the outer casing in section.

Figure 3 is a sectional view of my muffler with the outer and inner casings in section.

Figure 4 is a plan view taken on the line 4—4 of Figure 3.

In general, my invention contemplates providing a plurality of paths for the exhaust gases. Each path is of different length so that interference between the sound waves will be caused. The paths are adapted to give the exhaust gases a whirling motion and are substantially unobstructed to obviate the danger of clogging or of explosions. Likewise, unobstructed paths, I have found, will prevent the building up of back pressure. A pair of muffler sections are mounted in series separated by an adjustable tuning chamber. Frequently the principle of resonance amplifies the sound which remains after the gases pass through a muffler section. By adjusting the tuning chamber to the point of greatest dissonance, the sound is effectively muted with the result that the exhaust will be inaudible at the exit of the exhaust pipe.

More particularly referring now to the drawing, an exhaust pipe 1 leads the exhaust gases from the exhaust manifold of the internal combustion engine. Secured to the exhaust pipe 1 in any suitable manner, such as by a bolted flange 2, is a first section 3 of my muffler. This section comprises an outer casing 4 provided with a bolting flange 5. Within the casing 4 and in spaced relation thereto I provide a second casing 8. Between casings 4 and 8, I position a pair of helical baffles 6 and 7 which are welded to the inner surface of casing 4 and the outer surface of casing 8. It is to be understood, of course, that, while I have shown a pair of helical baffles, a single helical baffle or a plurality of helical baffles of any suitable number may be employed. The object in using more than a single helical baffle is to provide a spiral path of lesser pitch than would be required for a single helical baffle. The reduction of the pitch renders the component of back pressure created by the resistance of the baffles smaller than would be the case if a single baffle were used. Casings 4 and 8 are mounted in concentric relation. While I prefer to use cylindrical casings, it is to be understood that casings of any suitable cross sectional shape may be employed. I position a tube 9 with its axis coincident with

the axes of casings 4 and 8. Between tube 9 and casing 8 I provide a second pair of helical baffles 10 and 11. These baffles are welded to the exterior of tube 9 and to the interior of casing 8 and form an unobstructed path for the exhaust gases. It is to be noted that the gases passing through the passage 12 which is formed by casings 4 and 8 will have a much longer path of travel than the gases passing through the passage 14. A certain portion of the exhaust gases may pass directly through the tube 9 and, this being a straight path, will be the shortest path. Casing 4 has a skirted projection 15 extending beyond the baffle section. I provide a cylindrical member 16 adapted to telescope with skirt 15, as can be readily seen by reference to Figures 2 and 3. Member 16 is provided with a flange 17 and a flange 18. Flange 18 is adapted to be bolted to flange 5' of muffler section 3' which is identical to the muffler section described above. The reference numerals applied to muffler section 3' will be the same as those applied above, with primes to distinguish that they refer to the second muffler section. Around the exterior of casing 4 I weld a flange 19. Flange 19 is supported by triangular bracing members 20, welded thereto as can be readily seen by reference to Figure 1. Flange 17 is likewise provided with bracing members 21. Secured to flange 19 are bolts 22 which are provided with adjusting nuts 23 and 24 as can be readily seen by reference to Figures 2 and 3. It will be readily appreciated that, by the respective loosening of nuts 24 and the tightening of nuts 23 that the casing 16 will be moved to a greater depth of telescoping with skirt portion 15. This will result in a decrease of the size of the chamber 25, which as pointed out above, is the tuning chamber. By adjusting the chamber volume by the adjustment just described, a position of greatest dissonance may be reached, resulting in effective silencing. Very frequently a single muffler section and a tuning section are all that is required for silencing to an extent sufficiently great to render the exhaust innocuous as far as the nuisance effect of the exhaust noise is concerned. In zones where extreme silence is required, as for example in the vicinity of a thickly populated district, a second muffler section 3' may be installed outwardly of the first muffler section. If desired, a plurality of muffler sections as needed may be required, though I have found that in no event is it necessary for practical purposes to use more than two muffler sections. In event that only one muffler section is employed, casing 16 may be the terminal portion of the exhaust pipe. In event the two muffler sections are employed as shown in Figure 1, a length of eduction casing 26 may be bolted to the second muffler section.

In practice, I have installed a muffler made according to my invention on a commercial unit in which the exhaust of a Diesel engine having five cylinders 16 inches in diameter and employing a stroke of 20 inches was to be silenced. The engine exhaust pipe was 24 inches in diameter. The external diameter of my muffler was no greater than the diameter of the exhaust pipe, that is 24 inches. The entire length of my muffler was only 6 feet. The exhaust was effectively silenced so that it was substantially inaudible within a radius of 10 feet. No vibration was perceptible. The engine on which my muffler was installed, had been employing a commercial type of muffler. It measured 23 feet in length and 42 inches in diameter. The exhaust was not effectively silenced and the vibration occasioned by the muffler baffles made considerable noise in and of itself.

It will be obvious that I have accomplished the objects of my invention. Due to the fact there are no small openings for the dispersion of the exhaust gases, the danger of clogging, due to carbon deposition is obviated. Due to the fact that the passage for the exhaust gases is substantially unobstructed, not only is loss of efficiency due to back pressure prevented but the danger of explosion damage is obviated. It will be clear from the above description that in event unburnt gases do ignite, they will blow harmlessly out of the muffler pipe without doing damage. My muffler is of rigid construction and light in weight. There are no loose parts to vibrate and it may be conveniently installed at any desirable point. I have found that it is advisable in practice to install it near the terminal end of the exhaust stack.

It will be observed that, by creating three paths for the exhaust gases, of different length, that the exhaust gases will arrive at the outlet of the muffler section at different times causing an interference of the sound waves tending to reduce their intensity. Likewise, the imparting of a whirling motion to the gases will not only tend to cut down their forward velocity but will cause turbulence which will result in the destruction of the sound waves. It is to be noted that the spiral path in passage 12 is opposite in direction of rotation from the spiral path 14. If desired, the spiral paths 12 and 14 may be given the same direction.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, what I claim is:

1. An exhaust silencer comprising in combination a helical baffle structure providing a plurality of paths of different length, an enlarged chamber communicating directly with said baffle structure, means to vary the volume of said chamber to a predetermined point and a second baffle structure directly communicating with said chamber.

2. An exhaust silencer comprising in combination three imperforate casings having different cross sectional areas and disposed concentrically in spaced relation to each other and forming three passageways, said passageways having direct communication with the exhaust to be silenced whereby three paths are provided for the eduction of the exhaust gases, means constraining the exhaust gases to flow through the outer two passageways in respective helical paths of different length, the central casing being unobstructed and providing a direct path of flow for a portion of said gases.

HARRY C. AUSTIN.