April 29, 1930. H. E. VAN VOORHEES 1,756,711

MUFFLER FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 16, 1928

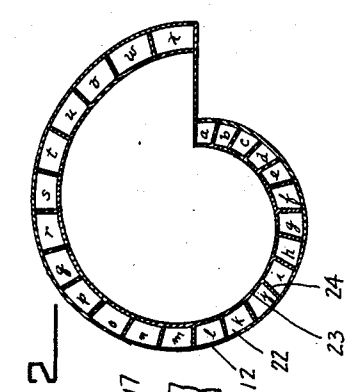


FIG. 2

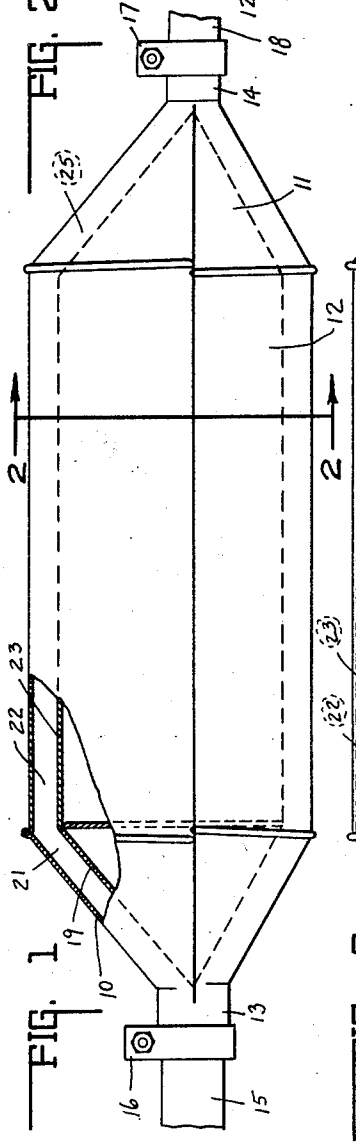


FIG. 1

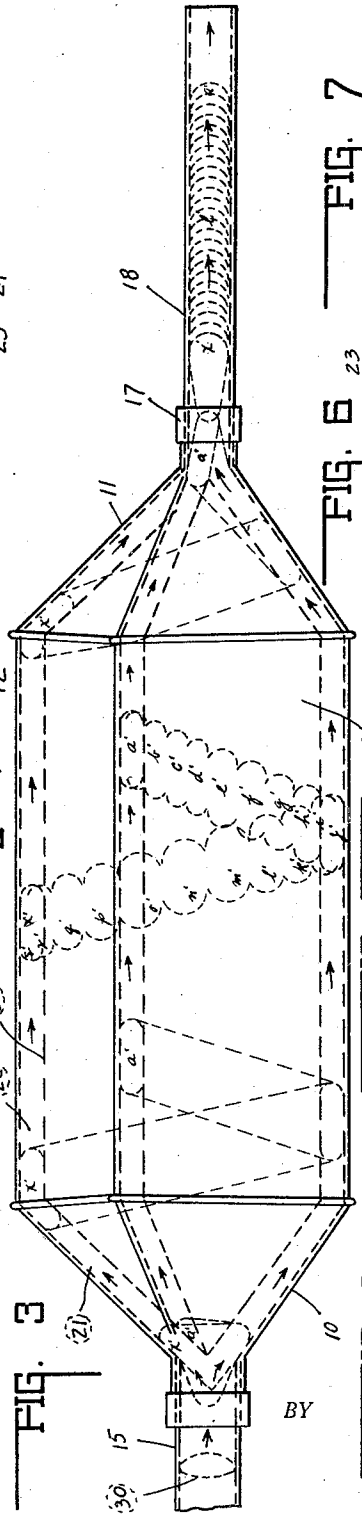


FIG. 3

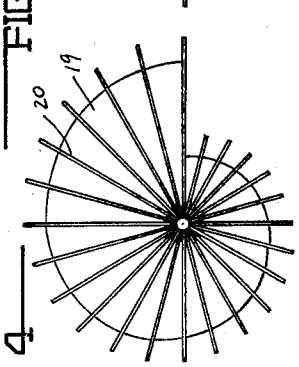


FIG. 4

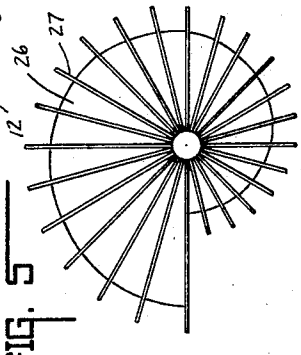


FIG. 5

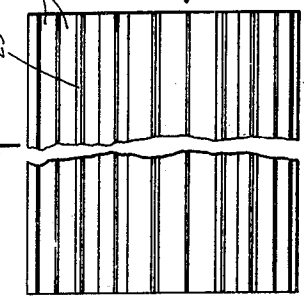


FIG. 6

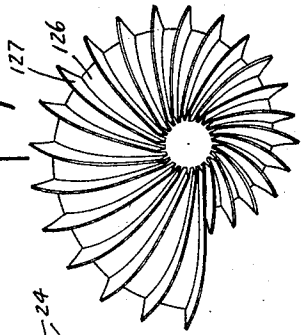


FIG. 7

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UNITED STATES PATENT OFFICE

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MUFFLER FOR INTERNAL-COMBUSTION ENGINES

Application filed January 16, 1928. Serial No. 246,925.

This invention relates to a muffler for use in connection with internal combustion engines, particularly adapted for silencing the explosions of the exhaust.

The principal object of the invention is to provide a muffler of this character wherein the normal impulses of the exhaust gases resulting from the explosions of the engine are caused to be broken up into a number of smaller impulses and conducted in individual paths of varying length through the muffler so that in issuing therefrom the normal impulses of exhaust gases will be changed to a constant stream. By means of this arrangement, the explosive sounds due to the impact of the impulses with the atmosphere are completely eliminated. One advantage of so discharging the impulses of exhaust in a constant stream is that no back pressure and consequent loss of power results, which occurs wherein the impulses are baffled. Another advantage resides in the elimination of any danger due to explosion in the muffler of accumulated exhaust gases due to the baffling thereof. In this muffler there is no baffling of the gases and their progress therethrough is in no way retarded.

Another feature of the invention resides in the variation in area of the conducting passages whereby certain impulses are permitted to expand in their respective passages more than others, whereby a variation in velocity cooperates with the variation in length of the passages. Other features of the invention to bring the divided impulses into the desired relative position for discharge will be hereinafter more specifically set forth and described.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims.

Fig. 1 is a side elevation of the muffler showing a portion thereof broken away in section. Fig. 2 is a section taken on the line 2—2 of Fig. 1. Fig. 3 is a diagrammatical illustration of the progress through the muffler of the impulses. Fig. 4 is an end view of the inlet unit before being mounted in the outer casing. Fig. 5 is an end view of the outlet unit before mounting in the outer casing. Fig. 6 is a side elevation of the intermediate unit before being mounted in the casing. Fig. 7 is a view similar to Fig. 5 showing a modified form with the vanes of the outlet unit given a spiral form for creating a swirling motion.

In the drawings there is shown a muffler comprising a casing having an inlet section 10, an outlet section 11 and an intermediate section 12. The inlet and outlet sections are tapered to form reduced end portions 13 and 14. The inlet portion 13 is adapted to be secured to the discharge end of an exhaust pipe 15 leading from an internal combustion engine, by means of the clamp 16. The outlet portion 14 is adapted to be connected by the clamp 17 to the discharge pipe 18. Mounted within the section 10 of the casing there is an inlet unit, as shown in Fig. 4. The outlet unit shown in Fig. 5 is mounted in the outlet end, and the intermediate unit shown in Fig. 6 is mounted in the intermediate section 12. The inlet end comprises a conical head 19 having its reduced end directed to the center of the inlet section 13 for receiving the impulses of the exhaust gas. Mounted on said head there are a plurality of radially extending vanes 20 forming passage-ways 21 through which the gas is conducted to the intermediate portion of the muffler. As shown in Fig. 4, said passage-ways are grouped together at the extreme inlet end, spreading apart toward their outer end so as to increase the area thereof, whereby the gas is divided into smaller impulses and conducted to the periphery of the muffler.

As shown herein, there are twenty-four such passages wherein the exhaust gases are broken up into twenty-four units or sections of each impulse. The passage-ways 21 communicate with the passage-ways 22 extending in parallel relation throughout the intermediate section of the muffler, said passage-ways 22 being formed by the inner drum 23 and the associated vanes 24 mounted thereon, as illustrated in Fig. 6. The passage-ways 23 communicate with the passage-ways 25 formed by the cone-like outlet head 26 provided with the radially extending vanes 27 which are brought together and reduced to

discharge the gas through the outlet portion 14, said head being illustrated in Fig. 5.

The formation of the muffler and the passage-ways contained therein are of an involute character, in cross section as shown in Figs. 2, 4 and 5, as well as Fig. 3. By reason of this arrangement the passages 21 and 25 are caused to vary in length. The twenty-fourth passage-way, as indicated by x, will be of maximum length while the first passage-way, as indicated by a, will be the shortest length. The intermediate passage-ways will vary, gradually increasing to the passage-way x. However, any number of passage-ways may be employed. The passage-ways are thus caused to vary in length, while in no way obstructing the flow of the gas therethrough by any substantial changes in direction. Each of them extend directly from one end of the muffler to the other.

As diagrammatically illustrated in Fig. 3, an impulse of gas, indicated at 30, in passing to the muffler from the exhaust pipe 15, is broken up into twenty-four smaller impulses or units of gas, as indicated in Fig. 2 by the letters a' to x' inclusive, corresponding with the a to x, indicating the passages in Fig. 2. It will be noted therein that the impulse a' has the shortest distance to travel and, therefore, it is ahead of each of the succeeding impulses as it passes through the intermediate passage-ways 22. It gains still further on the succeeding impulses as it goes through the passages 25 so that when the smaller impulses reach the discharge pipe 18, they are so timed that the sectional impulse x' of one of the impulses 30 just precedes the sectional impulse a' of the following impulse 30. Thus, a constant stream of smaller impulses, connected up with each other so that there will be no intermission between them, is caused to be discharged into the atmosphere and thus eliminate any detonation and consequent noise.

In the modified form shown in Fig. 7, the discharge unit having the cone-like head 26 is provided with spirally disposed vanes 127 wherein it may be desired to give a swirling motion to the smaller sectional impulses upon the discharge. A spiral-like action may further be obtained by causing the vanes 20 and 24 to be similarly formed in a spiral-like arrangement.

For the purpose of varying the pressure and velocity of the smaller sectional impulses, the area of the passage-ways vary, and, as shown herein, they increase from a to x inclusive. The velocity of the smaller or sectional impulses varies accordingly, whereby the impulse a' travels at a greater speed through its passage than each succeeding impulse. This variation in travel cooperates with the variation in distance to effect the timing of the impulses so that they are discharged in a constant stream, where a muffler of small diameter is desired, so as to permit more flexibility in the size of the muffler and the corresponding variation in length of the passage-ways.

The invention claimed is:

1. A muffler for exhaust gases of an internal combustion engine including an outer drum, an inner drum spaced therefrom, a plurality of partitions mounted between said drums for separating the space therebetween into a plurality of passage-ways, and means for connecting said passage-ways with the exhaust pipe of the engine, whereby an impulse of gas will be divided into a plurality of sectional impulses directed through their respective passage-ways, said drums being involute in cross section.

2. A muffler for exhaust gases including an outer drum, a plurality of partitions mounted therein for separating the space within said drum into a plurality of passage-ways, means connected with said passage-ways for separating each impulse of exhaust gases and causing the same to pass between said partitions and through said passage-ways so as to be divided into a plurality of sectional impulses, and a substantially involute head associated with said drum for transforming said separate impulses into a continuous stream of gas.

3. A muffler for exhaust gases including a plurality of separate continuous passage-ways extending longitudinally thereof, said passage-ways being so arranged with respect to each other as to form an involute closure in cross section, means associated with said passage-ways for separating each impulse of exhaust gas and causing the same to pass through their respective passage-ways, whereby said separate impulses will be discharged into said muffler in such relation as to form a constant stream of gases.

4. A muffler for exhaust gases including an outer drum, a plurality of partitions mounted therein for separating the space within said drum into a plurality of passage-ways, means connected with said passage-ways for separating each impulse of exhaust gases and causing the same to pass between said partitions and through said passage-ways so as to be divided into a plurality of sectional impulses, said drums and the asssociated partitions being formed involute in cross section, and said partitions extending helically with respect to said drum adjacent the discharge end thereof for creating a swirling motion in the discharge of said gases.

In witness whereof, I have hereunto affixed my signature.

HAROLD E. VAN VOORHEES.