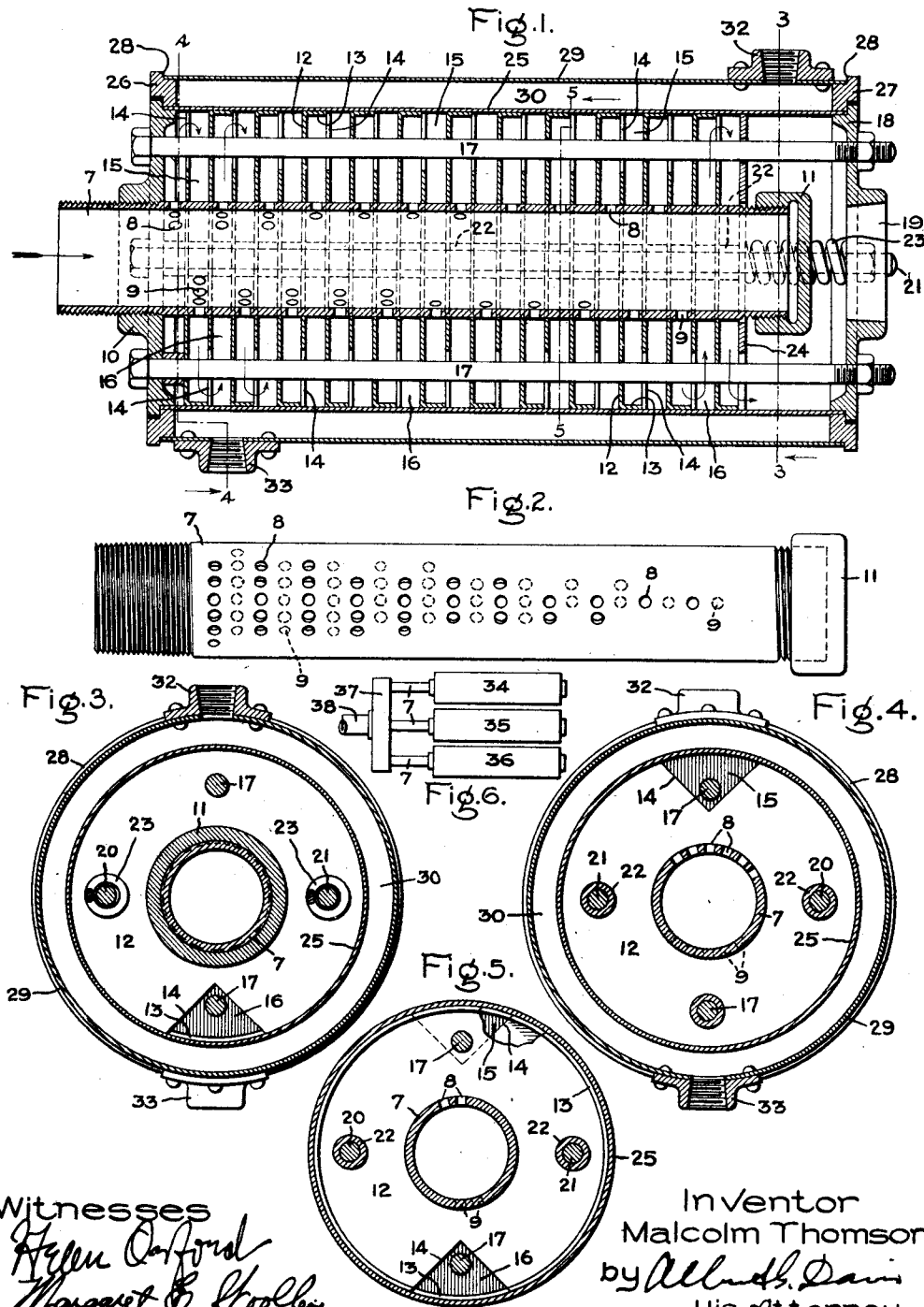


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MUFFLER.
APPLICATION FILED DEC. 30, 1912.

1,066,341.

Patented July 1, 1913.



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MUFFLER.

1,066,341.

Specification of Letters Patent.

Patented July 1, 1913.

Application filed December 30, 1912. Serial No. 739,213.

To all whom it may concern:

Be it known that I, MALCOLM THOMSON, a citizen of the United States, residing at Swampscott, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Mufflers, of which the following is a specification.

The present invention relates to mufflers or silencers for exhaust gases of internal combustion engines.

The muffler or silencer forming the subject matter of this application is based on the principle of lagging separated gas impulses, one behind the other, as set forth in the United States patent to Elihu Thomson, 854,778, dated May 28, 1907.

The object of the invention is to improve the construction and operation of such a muffler, particular reference being made to decreasing the size, weight and cost of constructing the same.

One of the distinctive features of the present muffler resides in the fact that the gases flow in a double zigzag path instead of following a spiral path as in the patent aforesaid.

Other features of the invention will be set forth more fully in the following description and claims appended thereto.

In the accompanying drawing which illustrates one of the embodiments of my invention, Figure 1 is a longitudinal section of my improved muffler; Fig. 2 is a plan view of the exhaust pipe showing the arrangement of the perforations; Fig. 3 is a cross-section taken on line 3—3 of Fig. 1; Fig. 4 is a cross-section taken on line 4—4 of Fig. 1; Fig. 5 is a section taken on the line 5—5 of Fig. 1, and Fig. 6 shows a number of mufflers connected in multiple to the same exhaust conduit.

7 indicates an exhaust conduit of suitable size that is connected to the exhaust chamber of the engine whose gases are to be muffled. This conduit should be of such cross sectional area as to permit the gases from the engine to freely enter and pass therefrom without undue friction. The conduit is provided with rows of perforations 8 and 9 arranged in sets, one set being at the top of the conduit and the other set at the bottom. The rows in said sets 8 and 9 are staggered so that they will discharge into different cells of the muffler. At the left hand end of the conduit the orifices or

holes are more numerous than at the right hand end. In other words, the exhaust gases are permitted to enter the first cell of the muffler more freely than to the subsequent cells, and the distance traveled by those entering the first cell will be considerably greater than those entering the later cells. This has the effect of lagging the exhaust gas impulses from the engine one behind the other, whereby a breathing or hissing sound is produced as distinguished from a series of short sharp impulses. This lagging action of the gas impulses is enhanced by the staggered arrangement of the sets of orifices. Although the conduit is provided with a number of holes arranged to communicate with each cell except the last few, those in each row may for convenience be regarded as one orifice. The main thing is to decrease the cross sectional area of the gas passages between the conduit and the cells step-by-step as the distance from the inlet increases. From a manufacturing point of view it is simpler to use the same size holes and vary their number than to change the diameter for each cell.

The ends of the conduit are screw threaded one to receive the head 10 and a coupling to connect it to the exhaust manifold, the other to receive a cap 11 which closes its right hand end. Mounted on the conduit is a plurality of diaphragms or partitions 12. Each diaphragm is provided with a central opening of substantially the same diameter as the conduit and through which the latter extends. The peripheral portion of each diaphragm is provided with an annular portion 13 formed integral therewith which acts as a spacing device to hold the same in position. These diaphragms are made out of relatively thin sheet metal and are pressed into cup-shaped form shown by any suitable and well known means. Each diaphragm is provided with one V-shaped opening or notch 14 to permit exhaust gases to flow from one cell or chamber to another cell or chamber on the opposite side of the diaphragm. The V-shaped openings or notches may be and preferably are formed by a stamping operation at the time the diaphragm is formed and previous to the formation of the annular spacing devices 13. In order to effectively break up the gas impulses and cause one part to lag behind another and to form a tortuous or zigzag path

therefor, the V-shaped openings 14 are angularly displaced. As shown an orifice 14 is located at the bottom of one diaphragm and a similar orifice 14 at the top of the adjacent diaphragm, so that exhaust gases passing from the holes 8 first flow upward into cell 15; then downward on both sides of the conduit 7 and through the orifice 14 into the cell 16, and so on. It will be noted, that each cell, in addition to conveying exhaust gases from one cell to another, also receives exhaust gases through one row or the other of the orifices in the conduit 7.

In order to secure the diaphragms in place, two or more rods 17 are provided, which are made in the form of bolts, the heads being mounted in the head or flange 10. The right hand ends of the rods, extend through a head 18, and are held in place by nuts. This head is provided with a suitable discharge opening 19, that is of sufficient size to permit the gases issuing from the final cell to freely escape.

In order to prevent the diaphragms from moving bodily along the rods 17, and also to permit the parts to expand and contract under temperature changes, two of the rods, such as 20 and 21, are provided with small spacing devices 22, made in the form of rings. These rings are slipped into place between the diaphragms when the latter are assembled. Near the right hand end of each of these rods, is a coiled compression spring 23, which permits the parts to expand and contract under temperature changes, said spring bearing at one end on the head 18 and on the end disk 24 at the other. The disk 24 acts as a diaphragm, and is preferably made a little thicker than the other diaphragms on account of the fact that it is pressed by the spring 23 against the annular flange or spacing device 13 of the adjacent diaphragm.

Surrounding the diaphragms and seated in annular shoulders in the heads 10 and 18 is a cylindrical casing 25 that is made of thin sheet metal, said casing preferably making a close fit with the peripheral surfaces of the several diaphragms so as to prevent leakage spaces and cause the exhaust gases to flow through the cells in the zigzag fashion hereinbefore referred to.

I have shown the muffler as being provided with a water jacket which may be used or not as the conditions of service dictate. For automobiles or power plants it will not be needed. For marine purposes it is sometimes necessary and desirable. To this end I provide it with a water jacket. This jacket comprises two end rings 26 and 27 that are internally shouldered to fit the heads 10 and 18, and also serve to secure the casing 25 in place. They are also provided with peripheral shoulders 28 to receive the casing 29, the two casings 25 and

29 being concentric thereby forming a chamber 30 to which water may be admitted by the connection 32 and discharged by the connection 33.

By making the diaphragms and the casings out of sheet metal as before described, the muffler as a whole will be relatively light without, however, sacrificing any of its features as a muffler.

Actual experience has demonstrated that a muffler built in accordance with my invention is capable of use with engines of quite different outputs either two or four cycle and this without creating any substantial back pressure thereon. By changing the number of cells, the length of conduit 7 and the number of sets of orifices therein the muffler can be used on engines having widely different outputs. As will be readily appreciated it is of material advantage to be able to use low cost punchings, that can be made up in quantities and afterward assembled to form a muffler having a greater or less number of cells, depending upon the size and character of the engine to be muffled.

Instead of changing the dimensions of the parts for use with larger engines I prefer to so construct the muffler that it will satisfactorily muffle exhaust gases of say a 25 kw., and when it is desired to muffle the exhaust gases of a larger engine to arrange two or more of these mufflers in multiple as regards the discharge of gases. Such an arrangement is shown in Fig. 6 wherein 34, 35 and 36 indicate mufflers of the character previously described. To each of these mufflers is connected a short conduit 7 that is connected to a distributing device or header 37, the latter being connected by a pipe 38 to the exhaust manifold of the engine. With this arrangement a supply of mufflers can be kept in stock and one or more sent out with each engine, depending upon the output of the latter.

One of the very important features of my improved muffler resides in the fact that the whole volume of gas does not pass through all of the cells. A small portion of the gas passes through all of the cells. Another small portion passes through less than the total number of cells, while a third small portion passes through a still less number of cells and so on, the number of cells being successively decreased, and hence the lengths of the gas passages for the different impulses successively decrease. This results in breaking up the total amount of gas from a given exhaust or discharge into a large number of parts which are retarded in their final exit one behind the other.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I

desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In a muffler, the combination of a conduit having gas discharging orifices which decrease in cross sectional area toward the point of final discharge, a casing, diaphragms which surround the conduit and divide the casing into cells that communicate with the orifices to afford gas passages of different lengths, said diaphragms having openings forming passages, the opening in one diaphragm being angularly displaced with respect to those of the adjacent diaphragms to cause the gases to follow a zigzag path, means for closing the ends of the casing, and means for holding the parts together.

2. In a muffler, the combination of a conduit having suitably spaced gas discharge orifices, a casing, diaphragms surrounding the conduit for dividing the casing into cells that receive gas in multiple from the orifices to afford gas passages of different lengths, each of said diaphragms being provided with an opening, said openings being displaced angularly so that the gas follows a double zigzag path in flowing from one cell to its adjacent cell, the volume of gas in the several cells increasing from the initial toward the final cell.

3. In a muffler, the combination of a conduit having staggered discharge orifices that open into alternate cells, a casing, partitions each having an opening near its periphery forming a passage for gas, said partitions dividing the casing perpendicularly into cells through which the gas flows from the passages in a double zigzag path, the volume of the gas in the several cells increasing step-by-step, heads for the casing, retaining means for the partitions which are seated in the heads, one of said heads being supported by the conduit, and the other by the means.

4. In a muffler, the combination of a conduit which is closed at one end and receives exhaust gases at the other, said conduit having sets of discharge orifices that decrease in area toward said closed end to deliver different amounts of gas to the cells, a casing, perforated diaphragms that divide the casing into cells, alternate cells communicating with the same set of orifices, the perforations in adjacent diaphragms being angularly displaced to cause the gases to flow in a double zigzag path.

5. In a muffler, the combination of a perforated exhaust conduit whose perforations decrease in cross-sectional area toward the outer end, a casing, a pair of heads that support the casing one of which is mounted on the conduit, cup shaped sheet metal diaphragms which divide the casing into cells that communicate with the perforations, said diaphragms having peripheral notches that are angularly displaced, means preventing the diaphragms from moving with respect to the conduit, and springs located between one of the heads and a diaphragm to compensate for expansion and contraction.

6. In a muffler, the combination of a perforated exhaust conduit whose perforations decrease in cross-sectional area toward the outer end, a casing, a pair of heads that support the casing, one of which is mounted on the conduit, cup shaped sheet metal diaphragms which divide the casing into cells that communicate with the perforations, said diaphragms having peripheral notches that are angularly displaced, means that enter the heads and prevent the diaphragms from moving with respect to the conduit, and a water jacket which surrounds the casing and is supported by the heads thereof.

7. In a muffler, the combination of an exhaust conduit containing perforations that decrease in area toward one end, a head that is fixed in position on the conduit, rods mounted in the heads, thin metal diaphragms that are mounted on the conduit and rods and are spaced apart to form cells that communicate with the perforations, a second head, spring means located between the second head and one of the diaphragms to subject the latter to pressure, and a casing that surrounds the diaphragms and is supported by the heads.

8. In combination, an exhaust conduit, a plurality of separate mufflers connected thereto in multiple relation as regards the flow of gas and discharging individually, each of said mufflers comprising a cellular structure with angularly displaced passages between cells, a conduit, and orifices in the conduit arranged to simultaneously supply gas to the different cells in multiple whereby each gas impulse is broken up into parts and said parts are lagged one behind the other.

In witness whereof, I have hereunto set my hand this 27th day of December, 1912.

MALCOLM THOMSON

Witnesses:

ELIHU THOMSON,
JOHN A. McMANUS, Jr.