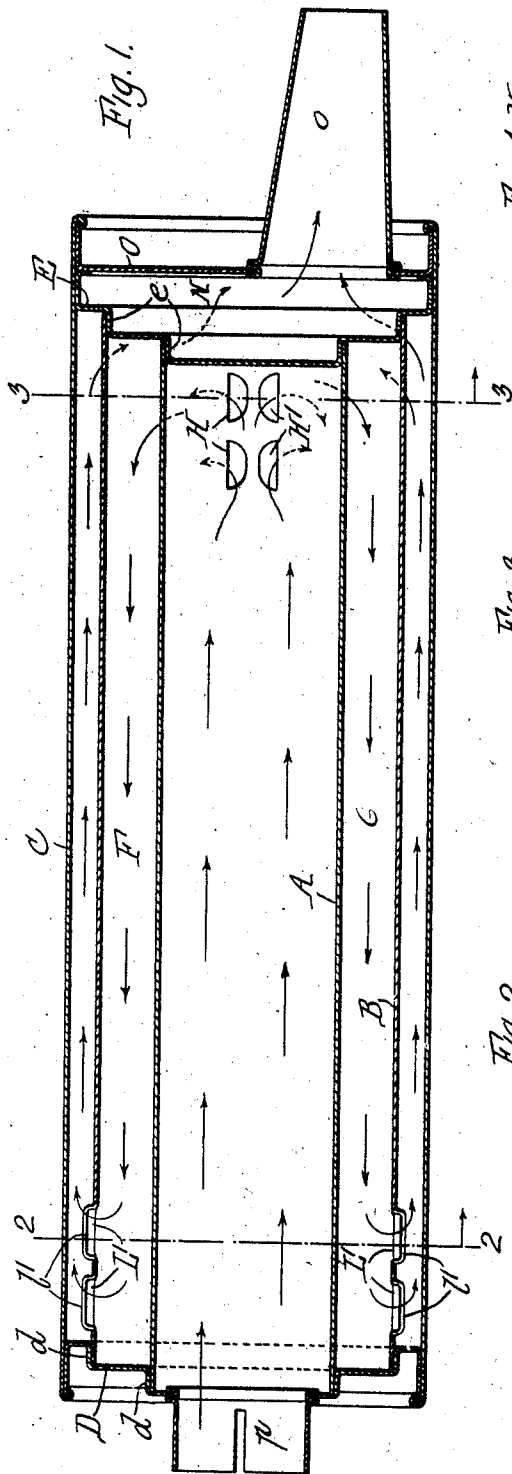
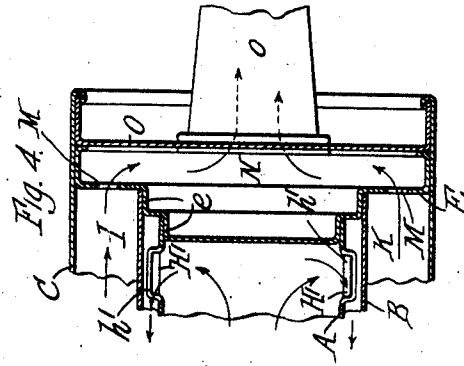
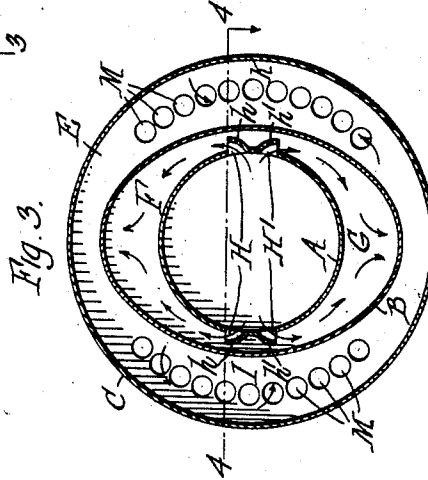
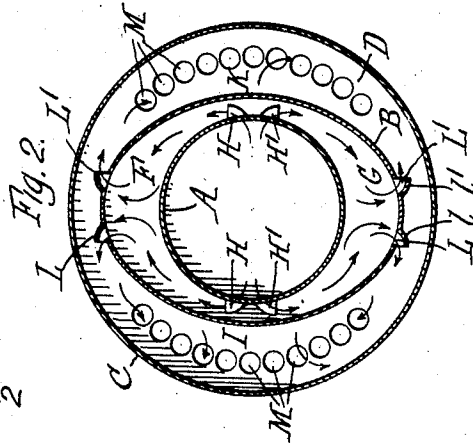


1,318,890.

Patented Oct. 14, 1919.



Inventor
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UNITED STATES PATENT OFFICE.

ROY J. MacKENZIE, OF BUFFALO, NEW YORK, ASSIGNOR TO BUFFALO PRESSED STEEL CO., OF NEW YORK, N. Y.

EXHAUST-MUFFLER.

1,318,890.

Specification of Letters Patent.

Patented Oct. 14, 1919.

Application filed March 16, 1917. Serial No. 155,332.

To all whom it may concern:

Be it known that I, ROY J. MacKENZIE, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Exhaust-Mufflers, of which the following is a specification.

This invention relates to improvements in mufflers or silencers of the kind commonly used in connection with internal combustion engines to reduce or eliminate the noise caused by the engine exhaust.

The objects of the invention are to produce a muffler or silencer of this kind of efficient and inexpensive construction which has a plurality of shells or tubes arranged to form expansion chambers having diametrically oppositely disposed portions into which the exhaust gases pass; also to provide means of improved construction for guiding the exhaust gases from one chamber to another; also to improve devices of this kind in other respects hereinafter specified.

In the accompanying drawings:

Figure 1 is a central longitudinal sectional elevation of a muffler embodying the invention.

Figs. 2 and 3 are transverse sectional elevations thereof on lines 2—2 and 3—3, respectively, Fig. 1.

Fig. 4 is a fragmentary longitudinal sectional elevation thereof on line 4—4, Fig. 3.

The muffler shown in the drawings includes an inner cylindrical tube or shell A of substantially circular cross-section, into which the exhaust gases pass from the engine, an intermediate tube or shell B of elliptical or analogous cross-section having its smallest diameter greater than the diameter of the shell A and arranged concentric with regard to the inner tube, and an outer tube or shell C, also of substantially circular cross-section and of greater diameter than the largest diameter of the elliptic shell B and arranged concentric with regard to the inner tube A. The tubes or shells are held in place with regard to each other by means of a head D at the inlet end of the muffler, and a head E at the discharge end thereof. The heads are preferably made of sheet metal and have shoulders or steps *d d* and *e e* by means of which the shells are held in place. The heads are preferably secured to and held in place by the outer shell C.

The shells A and B are so arranged with regard to each other as to form an inner expansion chamber having two expansion parts or halves F and G at diametrically opposite sides of the shell A. These half chambers join at opposite sides of the inner shell A, at the points of smallest diameter of the elliptic shell, and increase in sectional area from these points to the points of greatest diameter of the elliptic shell. The cross-section of each of these half chambers is therefore substantially crescent-shaped. The inner shell is provided with discharge openings H H' at the junctions of the two halves of the inner chamber, so that the gases from the inner shell enter the inner chamber at the portions thereof of smallest cross-sectional area and are divided and flow from opposite sides of the half chambers F and G to the portions thereof of largest cross-sectional area, at which portions the divided parts of the gases impinge and are again united.

A similar outer chamber comprising two half chambers I K is formed by the elliptic shell B and the outer shell C, these half chambers having their smallest cross-sectional areas at the greatest diameter of the elliptic shell, and their greatest cross-sectional areas at the smallest diameter of the elliptic shell. The elliptic shell has discharge openings L L' for the gases adjacent to the points of greatest diameter of the elliptic shell so that the gases enter the outer chamber at the smallest portions thereof and are sub-divided so as to pass toward the portions of the half chambers I K having the greatest cross-sectional area, at which portions the sub-divided parts of the gases impinge and are again united. The gases are discharged from the parts I K of the outer chamber through discharge openings M, in the head E of the muffler.

The discharge openings in the shells and in the muffler head E are preferably so arranged as to cause the gases to flow lengthwise of the chambers from one end of the muffler to the other end before being discharged. For this purpose, in the construction illustrated, the discharge openings H H' and L L' are arranged respectively adjacent to the discharge and inlet ends of the muffler. The gases are therefore not only divided and passed circumferentially in opposite directions in the two parts of each

chamber of the muffler to impinge and thereby deaden the noise of the exhaust, but also pass back and forth in the muffler to further diminish the sound.

- 5 The discharge openings H H' and L L' are formed by punching holes in the shells A and B respectively, and the metal adjacent to the holes or openings is preferably so shaped as to produce deflectors *h h'* and *l l'*, which cause the gases to flow toward the larger portions of the chambers. The deflectors shown in the drawings are formed by making cuts or slits in the shells and bending portions of the metal adjacent to the slits outwardly, as shown. The deflectors *h h'* are shaped to direct the portion of the gases passing through the openings H H' into the part F of the inner chamber and the deflectors *h' h'* direct the gases from the 20 openings H' H' into the part G of the inner chamber. In the same manner the deflectors *l l'* and *l' l'* direct the gases respectively into the parts I and K of the outer chamber.

- The gases after passing through the openings M in the head E of the muffler enter into a compartment N, formed in the discharge end of the muffler by the head E and an outer head O. The outer head is provided with a discharge nozzle or pipe *o* through which the exhaust gases pass out of the muffler. The head D also is provided with a short tube or pipe *p* which may be connected with the exhaust pipe of an engine (not shown) and through which the 35 exhaust gases enter the tube A. Other means may be employed, if desired, for admitting the gases to the shell A and for disposing of the gases after they have passed out of the parts I K of the outer chamber.

- 40 The parts F G and I K of the inner and outer chambers may if desired be separated from each other and form separate chambers, and it is understood that the words "parts of a chamber" as used in the specification and claims are intended to apply also to structures in which the parts are separated from each other.

- The muffler described has the advantages of being inexpensive to manufacture and thoroughly efficient. By dividing the gases and causing the divided portions to impinge in diametrically opposite parts of the expansion chambers and against diametrically opposite portions of a shell, the impact or momentum of the gases in one chamber is neutralized or counteracted by the momentum of the gases in the diametrically opposite chamber, thereby reducing the noise of the exhaust. The fact that the gases flow 60 lengthwise in the chambers as well as circumferentially also tends to silence the exhaust and cause the gases to flow from the discharge end of the muffler with very little noise.

- 65 Three shells are employed in the muffler

shown, but it is understood that as many shells as may be desired can be used, alternate shells being of elliptical cross-section.

I claim as my invention:

1. A muffler having an inner cylindrical 70 shell, an outer cylindrical shell, and an intermediate elliptical shell, said shells being arranged substantially concentrically and being provided with openings to permit gases to pass from one shell to another, said shells 75 forming chambers which vary in cross-section from the portions thereof at which the gases enter to the portions thereof at which the gases are discharged.

2. A muffler having a plurality of substantially concentrically arranged shells of circular and elliptical cross-section, said circular and elliptic shells being alternately arranged, and means for permitting gases to flow from one shell to another, said shells 85 forming chambers which vary in cross-section from the portions thereof at which the gases enter to the portions thereof at which the gases are discharged.

3. A muffler having two shells arranged to 90 form expansion chambers having diametrically opposite parts, and means for simultaneously discharging gas into said parts in opposite directions to cause the gas to impinge in said parts at diametrically opposite 95 sides of the said shells, whereby the impact of gas in one part of a chamber will be neutralized by the impact of gas in the other part of the chamber.

4. A muffler having a plurality of shells 100 forming an expansion chamber which has two diametrically oppositely arranged parts, means for admitting gases to said chamber at diametrically opposite sides thereof, the gases flowing in opposite directions in each 105 part of said chamber from the points of admission and impacting simultaneously in said diametrically oppositely arranged parts at points intermediate of the points of admission, whereby the impact in one of said 110 parts is neutralized by the impact in said other part.

5. A muffler having a plurality of shells arranged to form an expansion chamber for exhaust gas, said chamber having two oppositely arranged parts, means for admitting gas to said chamber at opposite sides of said chamber and causing currents of gas to flow in opposite directions in each part of said chamber from the points of admission, 120 the currents of gas impacting simultaneously in said oppositely arranged parts at points intermediate of the points of admission, whereby the impact in one of said parts is neutralized by the impact in said other part, 125 and means for discharging gas from said chamber at the portions thereof at which impact takes place.

6. A muffler having two shells arranged to form expansion chambers having diamet- 130

rically opposite parts of substantially crescent-shaped cross-section, and means for simultaneously admitting gas into portions of said chambers of small cross-section to cause the gas to flow in opposite directions in said parts to the portions of larger cross-section and to impinge in said last mentioned portions of the chambers.

7. A muffler having two shells arranged to form expansion chambers having diametrically opposite parts of substantially crescent-shaped cross-section, means for simultaneously admitting gas into portions of said chambers of small cross-section to cause the gas to flow in opposite directions in said parts to the portions of larger cross section and to impinge in said last mentioned portions of the chambers, and gas discharge openings in said chambers in the parts thereof of larger cross-section.

8. A muffler having a plurality of shells arranged to form a plurality of chambers having oppositely disposed parts of substantially crescent-shaped cross-section, means for simultaneously admitting gas into the portions of smallest cross-section of the chambers, and means for discharging gas from said chambers at the portions thereof of larger cross-section into portions of small cross-section of an adjacent chamber.

9. A muffler having a plurality of substantially concentrically arranged shells of circular and elliptical cross-section, said circular and elliptic shells being alternately arranged forming chambers of varying cross-section, and means for causing gas to flow from one chamber to another and to enter said chambers at the portions thereof of smaller cross-section.

10. A muffler having a plurality of substantially concentrically arranged shells of circular and elliptical cross-section, said circular and elliptic shells being alternately arranged, forming chambers of varying cross-section, and means for causing gas to flow into said chambers in opposite directions from the portions thereof of smaller cross-section to the portions of larger cross-section and to impinge in said last mentioned portions.

11. A muffler having a plurality of substantially concentrically arranged shells of circular and elliptical cross-section, said circular and elliptic shells being alternately arranged to form chambers having oppositely disposed parts of substantially crescent-shaped cross-section, and means for admitting gas to the portions of small cross-section of each of the parts of said chambers to cause said gas to flow in opposite directions in said parts and to impinge in the portions thereof of large cross-section.

12. A muffler having a plurality of substantially concentrically arranged shells of circular and elliptical cross-section, said cir-

cular and elliptic shells being alternately arranged to form chambers having oppositely disposed parts of substantially crescent-shaped cross-section, and means for simultaneously admitting gas to the portions of small cross-section of two oppositely disposed parts of a chamber to cause the gas to flow in opposite directions in each of said parts and to impinge in the portions thereof of greater cross-section, the impact of the gas in one part of a chamber being counteracted by the impact of the gas in the other part of the chamber.

13. A muffler having an inner cylindrical shell into which the gases of the exhaust enter, a second shell arranged about said cylindrical shell and forming therewith two chambers, each having diametrically opposed parts, four discharge openings in said inner shell through which four portions of the gas pass, two portions passing in opposite directions in each of the parts of a chamber, whereby the impact of the portions of the gas act in opposite directions on said second shell.

14. A muffler having an inner cylindrical shell into which the gases of the exhaust enter, and an elliptical shell arranged substantially concentric with and around said inner shell and forming therewith a chamber having two diametrically opposed parts of substantially crescent-shaped cross section, four discharge openings being provided in said inner shell, two openings being provided for each part of said chamber and admitting gas to the portions of the chambers of small cross-section and causing portions of gas to pass in opposite directions in each part of said chamber toward the larger portions thereof.

15. A muffler having an inner cylindrical shell into which the gases of the exhaust enter, an elliptical shell arranged substantially concentric with and around said inner shell and forming therewith a chamber having two diametrically opposed parts of substantially crescent-shaped cross-section, four discharge openings being provided in said inner shell, two openings being provided for each part of said chamber and admitting gas to the portions of the chambers of small cross-section and causing portions of gas to pass in opposite directions in each part of said chamber toward the larger portions thereof, and an outer cylindrical shell arranged about said elliptical shell and forming therewith a chamber having two substantially crescent-shaped parts into which the gases pass from said first mentioned chamber.

16. A muffler having an inner cylindrical shell into which the gases of the exhaust enter, an elliptical shell arranged substantially concentric with and around said inner shell and forming therewith a chamber hav-

ing two diametrically opposed parts of substantially crescent-shaped cross-section, four discharge openings being provided in said inner shell, two openings being provided for each part of said chamber and admitting gas to the portions of the chambers of small cross-section and causing portions of gas to pass in opposite directions in each part of said chamber toward the larger portions thereof, and an outer cylindrical shell arranged about said elliptical shell and forming therewith a chamber having two substantially crescent-shaped parts arranged substantially at right angles to the parts of said first mentioned chamber, said elliptical shell having openings to discharge gas from the portions of said first mentioned chamber of greater cross-section to parts of the second mentioned chamber of smaller cross-section.

17. A muffler having an inner cylindrical shell into which the gases of the exhaust enter, an elliptical shell arranged substantially concentric with and around said inner shell and forming therewith a chamber having two diametrically opposed parts of substantially crescent-shaped cross-section, four discharge openings being provided in said inner shell, two openings being provided for each part of said chamber and admitting gas to the portions of the chambers of small cross-section and causing portions of gas to pass in opposite directions in each part of said chamber toward the larger portions thereof, and an outer cylindrical shell arranged about said elliptical shell and forming therewith a chamber having two substantially crescent-shaped parts arranged substantially at right angles to the parts of said first mentioned chamber, said elliptical

shell having openings to discharge gas from the portions of said first mentioned chamber of greater cross-section to parts of the second mentioned chamber of smaller cross-section, the openings in said inner shell and in said elliptical shell being adjacent to the opposite ends of said muffler.

18. A muffler having an inner cylindrical shell, an outer cylindrical shell, and an intermediate elliptical shell, said shells being arranged substantially concentrically, said elliptical shell extending into proximity to said inner shell at the portions thereof of smallest diameter and extending into proximity to said outer shell at the portions thereof of greatest diameter, discharge openings for gas in said inner shell adjacent to the points of smallest diameter of the ellipse, and discharge openings in said elliptical shell adjacent to the points of largest diameter thereof.

19. A muffler having a plurality of shells arranged to form an expansion chamber for exhaust gas, said chamber having two oppositely arranged parts, means for admitting gas to said chamber at opposite sides of said chamber, and deflectors for causing currents of gas to flow in opposite directions from the points of admission to said oppositely arranged parts of the chamber, and causing currents of gas to impact simultaneously in said oppositely arranged parts, whereby the impact in one of said parts is neutralized by the impact in said other part.

Witness my hand, the 1st day of February, 1917.

ROY J. MacKENZIE.

Witnesses:

M. J. PITMAN,
A. L. McGEE.