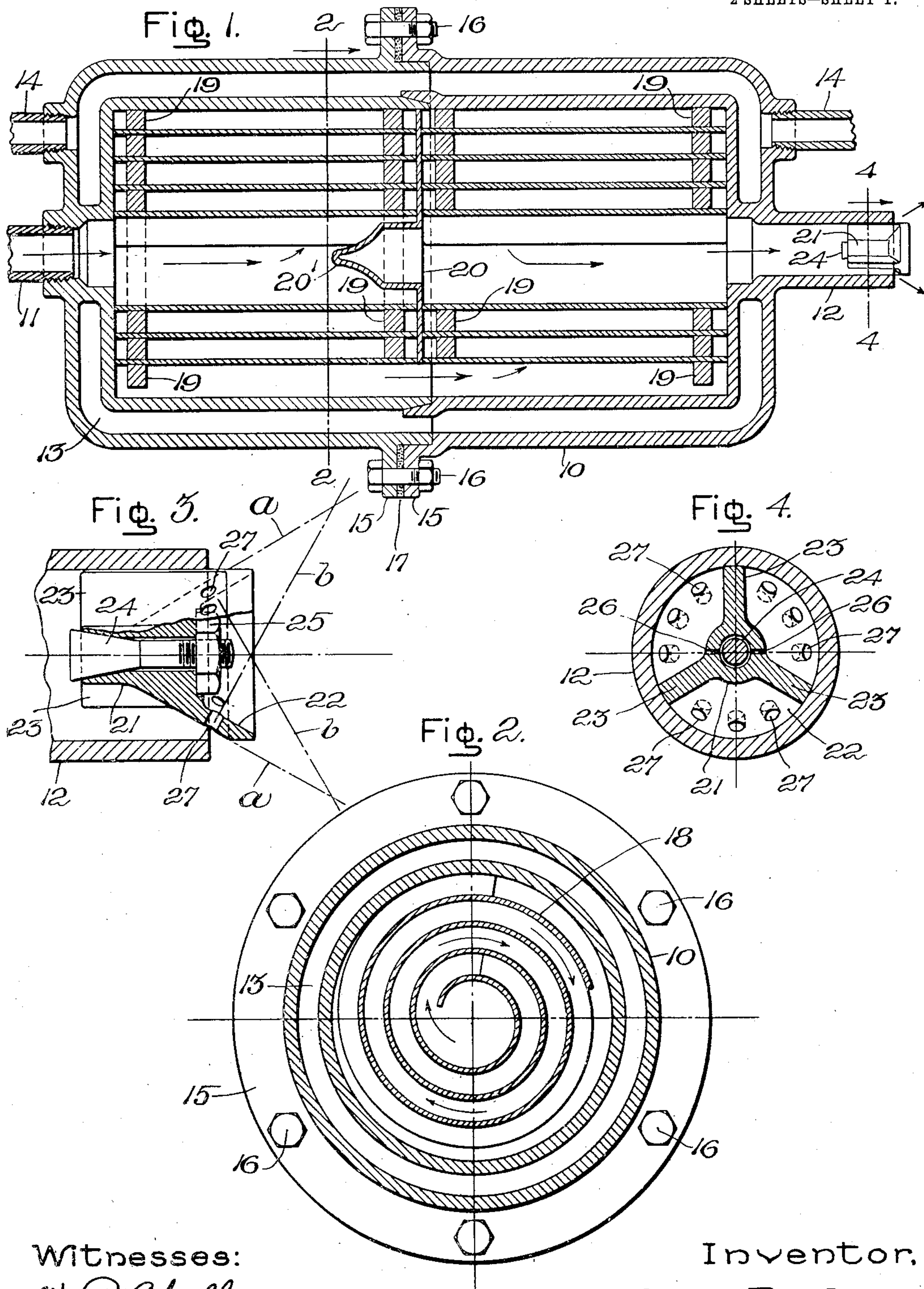


J. BOYLE.  
EXHAUST MUFFLER.  
APPLICATION FILED AUG. 28, 1909.

943,233.

Patented Dec. 14, 1909.

2 SHEETS—SHEET 1.



Witnesses:  
W. P. Abell  
A. C. Rust

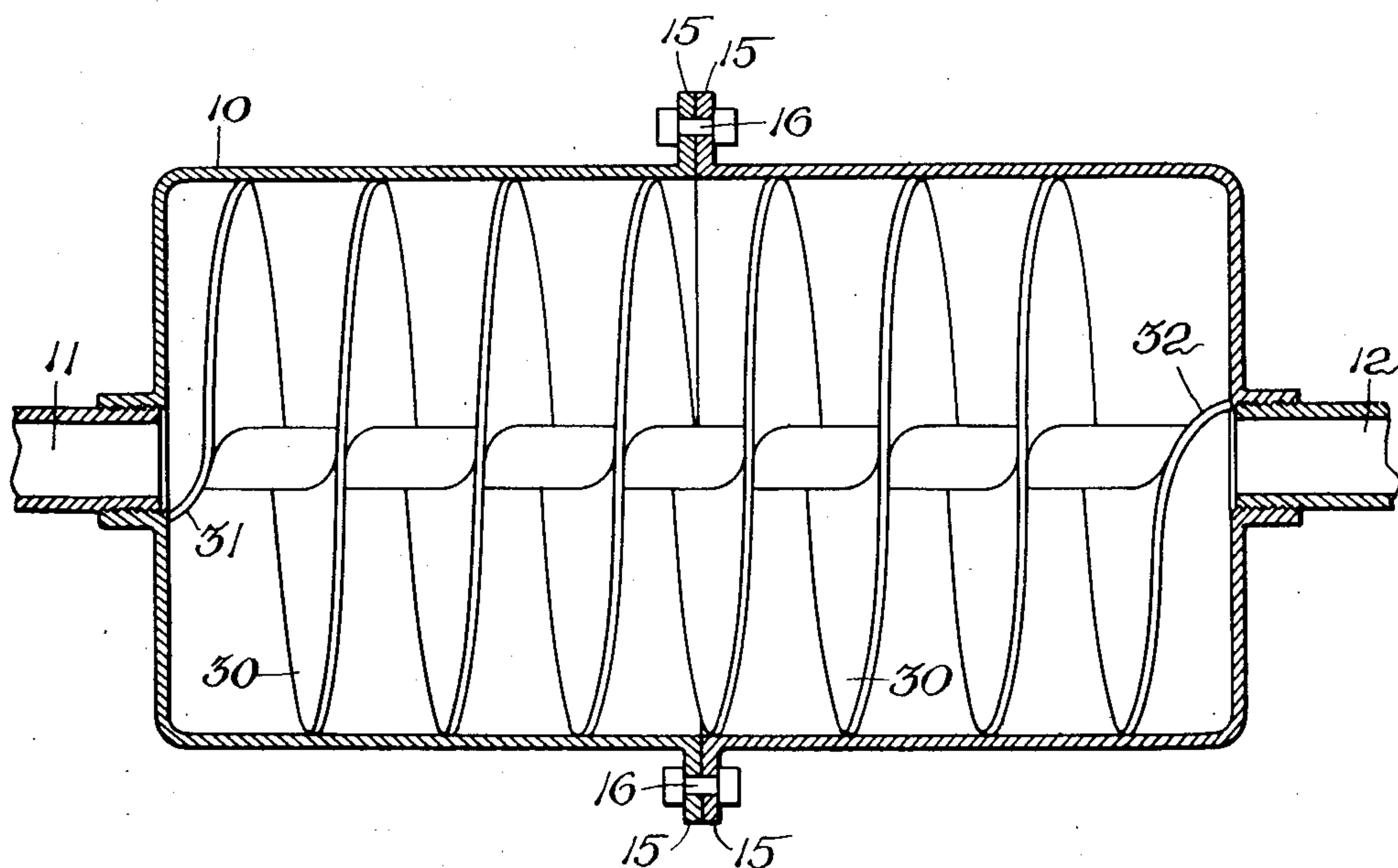
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Fig. 5.



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# UNITED STATES PATENT OFFICE.

JOHN BOYLE, OF PEABODY, MASSACHUSETTS.

## EXHAUST-MUFFLER.

943,233.

Specification of Letters Patent.

Patented Dec. 14, 1909.

Application filed August 28, 1909. Serial No. 515,032.

*To all whom it may concern:*

Be it known that I, JOHN BOYLE, of Peabody, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Exhaust-Mufflers, of which the following is a specification.

This invention relates to exhaust mufflers of the type employed for silencing the exhaust gases of internal combustion motors.

One of the objects of the invention is to provide a casing having an inlet and an outlet and a plurality of removable sections, each providing means for guiding the exhaust gas in a spiral course. The sections are arranged end to end and are separated by partitions which are formed to permit flow from one section to the next at a single point. The result of arranging the spiral sections successively is that the exhaust gas is conducted outwardly from the interior of one section and inwardly from the exterior of the next section, and so on according to the number of sections provided.

The flow passage for the exhaust is unitary and is preferably arranged with its inlet and outlet in alinement with the axis of the casing in which the spiral sections are inclosed.

Another object of the invention is to provide an outlet nozzle adapted to direct the exhaust in intersecting paths so that one body of gas may strike and disseminate another. The exhaust nozzle herewith shown is constructed to produce a conical sheet of exhaust gas and a plurality of relatively small jets directed outwardly at a greater angle than that of the conical sheet, said jets being adapted to cross each other and intersect the conical sheet. The nozzle may be adjusted with relation to the outlet so that the area for forming the conical sheet may be increased or diminished.

Referring to the drawings, which illustrate one form in which the invention may be embodied,—Figure 1 represents a longitudinal section of an exhaust muffler provided with two spiral sections. Fig. 2 represents a cross section on line 2—2 of Fig. 1. Fig. 3 represents a longitudinal section, on a larger scale, of the outlet nozzle. Fig. 4 represents a cross section of the nozzle on line 4—4 of Fig. 1. Fig. 5 represents a longitudinal section of another form of muffler in which the spiral guide has the form of a helix.

The same reference characters indicate the same parts wherever they occur.

On the drawings the muffler is represented as comprising a casing 10 which is preferably cylindrical in form.

11 indicates an inlet pipe, and 12 indicates an outlet, said inlet and outlet being preferably at opposite ends of the casing in alinement with the axis thereof. The casing may be provided with a water jacket 13 and means for connecting pipes 14 of a water-circulating system by which the muffler may be cooled. The casing may be formed of two sections, as illustrated, which may be connected in any preferred manner, such as by flanges 15 drawn together by bolts 16 and provided with packing 17.

In the interior of the casing are arranged a plurality of spiral sections each comprising a relatively broad sheet-metal strip 18 bent in the form of a spiral, and a pair of relatively narrow strips 19 for spacing the convolutions of the strip 18 and for closing the ends of the convolutions. The sections are arranged end to end, and a partition, such as a plate 20, is interposed between the abutting ends of two sections. The exhaust gas entering the casing through the pipe 11 enters the interior of the first spiral section and is prevented from immediately entering the second section by the intervening partition 20. It therefore flows outwardly from the center of the casing toward the periphery in a spiral course between the convolutions of the strip 18, and upon reaching the end of said strip it may pass to the exterior of the succeeding spiral section, passing around the outer edge of the partition 20, which is sufficiently cut away for this purpose. The gas is then conducted in the reverse direction through the second section, namely, from the exterior to the interior. There are two of such spiral sections illustrated on the drawings, but the number may be increased if desired. The gas upon reaching the interior of the last section may pass into the outlet 12, from which it is conducted to the atmosphere by a spraying nozzle, illustrated in detail by Figs. 3 and 4.

The nozzle indicated at 21 is formed with a conical wall 22 and a plurality of radial ribs 23. The smaller end of the cone is inserted in the outlet and is held centrally therein by the ribs 23. The nozzle is provided with means for clamping it in any desired position in the outlet, said means in-



cluding an expanding bolt 24 and nut 25. The nozzle is slotted at 26 in order to permit expansion when the bolt 24 is drawn up to enable the ribs to firmly engage the interior of the outlet 12. The exhaust gas passing between the mouth of the outlet and the conical wall 22 takes the form of a conical sheet, indicated by lines *a* in Fig. 3. The wall 22 is formed with a plurality of apertures 27 through which a portion of the exhaust gas is directed in cross currents along lines *b b* which intersect the continuous sheet of gas. In this way the greater portion of the exhaust gas is broken up by the jets flowing from the apertures 27 and the noise of the escaping gas is kept at the minimum degree. The nozzle may be adjusted longitudinally in the outlet so as to increase or diminish the volume of the continuous sheet of exhaust gas.

In the form shown by Fig. 5, the gas entering the muffler casing 10 at the inlet 11 engages a spiral deflector 30 of helical form whose continuous edge fits closely against the interior of the wall of the casing. The two ends of the deflector are curved as indicated at 31 and 32, for the purpose of gently changing the direction of the gas. For the same reason the central portion of the partition 20 in the form shown by Fig. 1 may be formed with a nose or projection 20' which is adapted to deflect the gas from a longitudinal course to a transverse course.

It will be noted that in both forms herewith included, the gas is conducted through a tortuous course, and that the course is marked by the absence of abutments extending transversely to the direction of the flow. The gas therefore does not impinge squarely

against any obstacles, but is guided from the inlet to the outlet by devices against which it strikes with glancing effect.

I claim:—

1. An exhaust muffler comprising a cylindrical casing having an inlet at one end, and an outlet at the other end, a series of flat strips of spiral form arranged edge to edge in said casing, said strips substantially filling the casing but being so curved as to provide spaces between their respective convolutions, and members engaging the adjacent edges of the spiral strips and constituting partitions closing the sides of the convolute spaces between said strips, said partition members, however, being cut away or omitted at such points as to leave a continuous unitary passage from said inlet to said outlet.

2. An exhaust muffler comprising a cylindrical casing having an inlet at one end and an outlet at the other end, and interengaged members so correlated with the interior of the casing as to form a closed unitary passage extending from said inlet to said outlet, said passage including a series of convolute portions and each portion including a series of convolutions.

3. An exhaust muffler comprising a casing having an inlet, an outlet, and means at the outlet for forming a continuous sheet of a portion of the exhaust, and for forming jets intersecting the continuous sheet.

In testimony whereof I have affixed my signature, in presence of two witnesses.

JOHN BOYLE.

Witnesses:

W. P. ABELL,

ARTHUR H. BROWN.