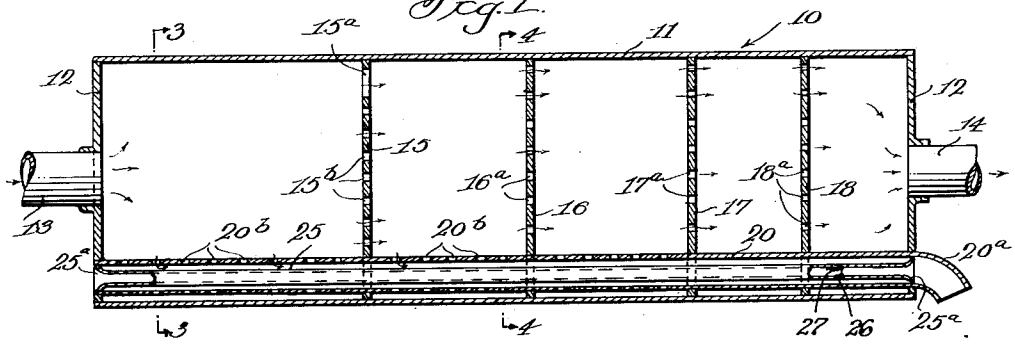
Jan. 21, 1941. B. C. KIRBY 2,229,576

MUFFLER

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Fig. 1.



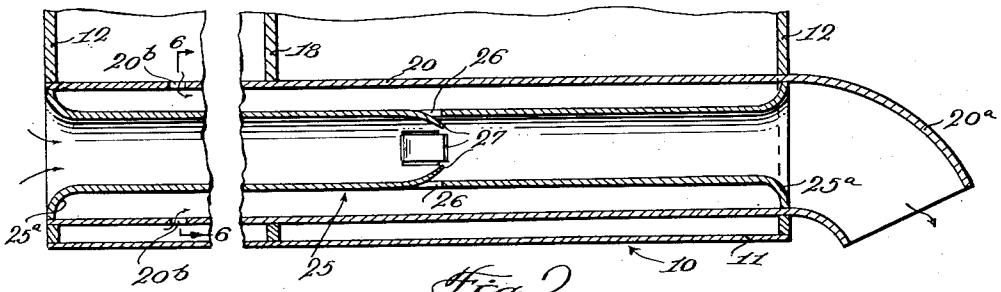
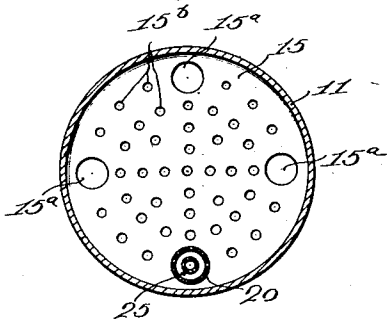




Fig. 2.

Fig. 3.



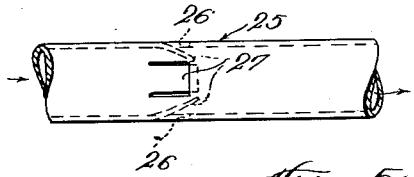




Fig. 5.

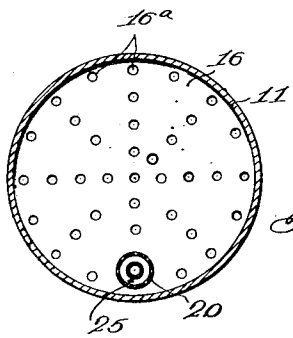



Fig. 4.

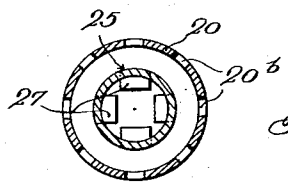



Fig. 6

Bernard C. Kirby
INVENTOR

BY Victor J. Evans & Co.
ATTORNEYS

Jan. 21, 1941. B. C. KIRBY 2,229,576

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Fig. 7

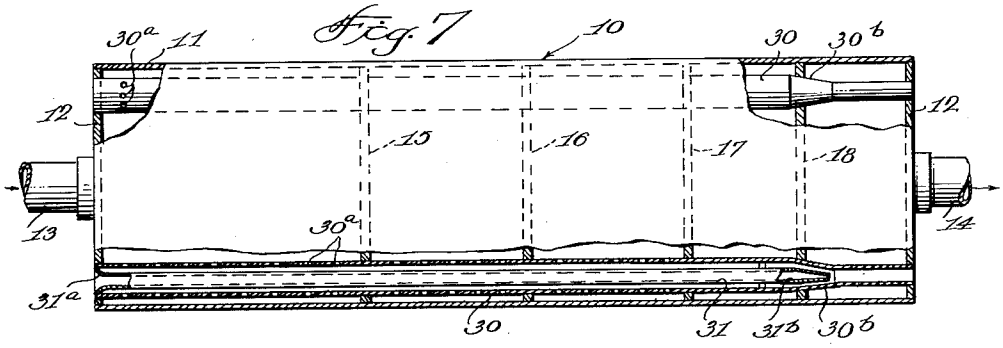



Fig. 8

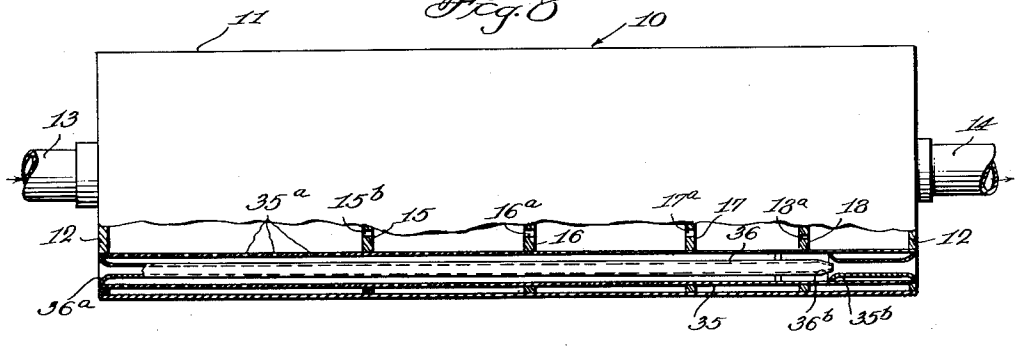
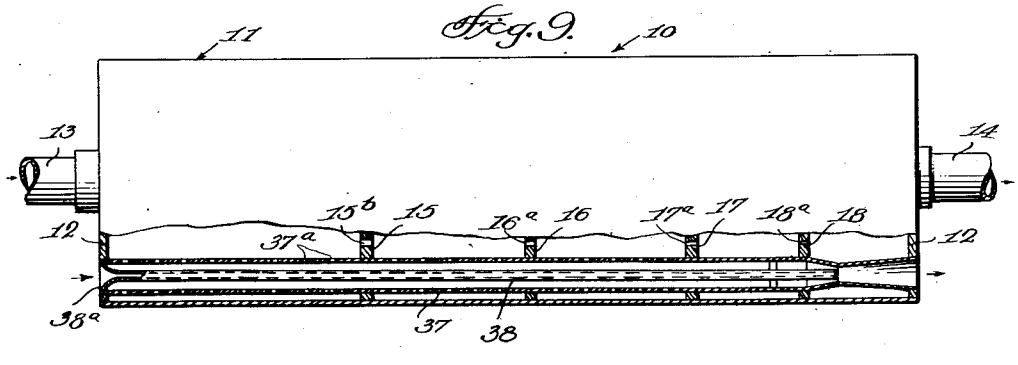



Fig. 9.




Bernard C. Kirby
INVENTOR

BY Victor J. Evans & Co.
ATTORNEYS

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# UNITED STATES PATENT OFFICE

2,229,576

## MUFFLER

Bernard C. Kirby, Monterey, Calif.

Application August 7, 1939, Serial No. 288,861

4 Claims. (Cl. 181—51)

This invention relates to improvements in mufflers for internal combustion engines and the like and especially is concerned with a novel muffler including means for withdrawing portions of exhaust gases from the muffler in a manner such that more facile operation of the muffler at least largely is promoted.

It is an object of the present invention to provide a novel muffler for use in treating exhaust gases from internal combustion engines and the like wherein means are provided for by-passing a portion of the exhaust gas effluent to promote the flow of exhaust gas through the muffler and also to facilitate the lowering of temperature of exhaust gases and the absorption of sound waves in the stream of exhaust gases resulting from explosion in the motor.

An advantage of the novel muffler according to this invention over existing types of mufflers is that in this novel muffler there is at least a tendency for exhaust gases to be withdrawn from the exhaust manifold even when the motor is idling.

A feature of the novel muffler according to this invention is its comparative simplicity of construction both from the standpoint of structure and of assembly whereby the device is well suited to requirements of mass production with concomitant lowering of manufacturing costs.

Other objects, advantages and features of the new and improved muffler according to the present invention will be apparent to those skilled in this art during the course of the following description.

Regarded in certain of its broader aspects, the novel muffler according to the instant invention comprises a casing having inlet and outlet pores traversed by exhaust gases; a pair of concentric tubes extending through said casing, the inner of said tubes being open at the ends whereby a stream of air can travel therethrough, the outer of said tubes communicating with the interior of said casing, and constricted formations behind openings in the innermost tube communicating with the outer tube whereby the stream of air passing through the inner tube draws exhaust gases from the chamber into the air stream.

In order to facilitate a fuller and more complete understanding of the present invention, a specific embodiment thereof herein illustrated will be hereinafter described, it being clearly understood, however, that the illustrated embodiment, although presently preferred, is provided solely by way of example of the practice of this invention and not by way of limitation thereof except insofar as the invention is recited in the subjoined claims.

Referring then to the drawings:

Figure 1 is substantially a vertical sectional view of the presently preferred embodiment of this invention,

Fig. 2 is essentially an enlarged view of a portion of the device shown in Fig. 1,

Fig. 3 is a vertical sectional view of Fig. 1, taken along the line 3—3 thereof,

Fig. 4 is substantially a vertical sectional view of Fig. 1 taken along the line 4—4 thereof,

Fig. 5 is a detail elevational view of a part of the device shown in Fig. 1,

Fig. 6 is essentially a vertical sectional view of Fig. 2 taken along the line 6—6 thereof, and

Figs. 7, 8 and 9 are side elevational views partially in vertical section illustrating modified forms of the device according to this invention.

Reference is now made especially to Figs. 1 to 6 inclusive wherein the presently preferred embodiment of this invention best is illustrated. It will be noted that the muffler generally designated by the numeral 10 comprises a hollow essentially cylindrical casing 11 provided with end panels 12 having openings wherein are received the inlet and outlet conduits 13 and 14 respectively. The interior of the casing is subdivided by a plurality of partitions 15, 16, 17 and 18 extending transversely within the casing essentially as shown. It is to be noted that each of the partitions is provided with openings 15*a*, 15*b*, 16*a*, 17*a* and 18*a* respectively. It is to be noted that the openings 15*a* in the partition 15 are relatively larger and fewer in number than the openings 15*b* likewise formed therein. Further it is to be noted that both the distance between the partitions and the size of the openings formed therein diminishes as the distance from the inlet end of the casing increases. That is to say, the distance between the partitions 15 and 16 is greater than the distance between the partitions 16 and 17, which in turn is greater than the distance between the partitions 17 and 18 and the openings 18*a* in the partition 18 are smaller than the openings 17*a* in the partition 17 which in turn are smaller than the openings 16*a* in the partitions 16 which likewise are smaller than the openings 15*a* and 15*b* in the partition 15.

A tube 20 mounted in registering openings in the casing ends 12 extends through the interior of the casing essentially parallel to the axis thereof substantially as shown and is provided with a series of openings 20*b* formed therein over ap-

proximately two-thirds the length thereof whereby exhaust gases can pass through said openings into the interior of the tube **20** from the chambers defined by the casing end **12** and the partitions **15**, **16** and **17**. It is to be noted that no openings are provided in the tube in the portion extending through the parts of the casing between the partitions **17**, **18** and the casing end **12**. It is to be noted that one end of the tube **20** designated by the numeral **20***a* projects outwardly from the casing end and is bent downwardly for reasons which hereinafter more clearly will be apparent. A second tube generally designated by the numeral **25** provided with flared ends **25***a* is positioned coaxially within the tube **20** and the flared ends sealed thereto holding the tube in the spaced relationship illustrated.

The tube **25** is provided in a portion thereof within the closed part of the tube **20** with a plurality of struck openings **26** arranged in a common plane perpendicular to the axis of the tube, the struck portions of the tube being bent inwardly to constrict the channel defined by the tube and provide the obstructing formations **27** essentially as is illustrated in the drawings, particularly Figs. 2 and 6. It is to be understood that a stream or current of air passes through the tube generally designated by the numeral **25** in a direction such that the formations **27** are, with respect thereto, bent forwardly and inwardly.

In operation of this embodiment of the instant invention exhaust gases are received in the muffler casing from the inlet tube **13** and disseminate into the chambers within the casing defined by the several partitions, the rate of travel of the exhaust gases of course being substantially diminished by the presence of the partitions and by the circuitous paths which they perforce must pursue. A portion of the exhaust gases entering the muffler will pass through the openings **20***b* in the tube **20** and into the space between the tubes **20** and **25**, thereafter passing through the openings **26** into the interior of the inner tube from which they discharge through the end portion **20***a* of the tube **20** as indicated by the arrows. The discharge of exhaust gases in this manner is possible irrespective of whether or not a stream or current of air is passing through the inner tube **25**. However, when a stream or current of air is so passing through the tube, a partially evacuated or low pressure air pocket is formed in front of the constricted portion of the tube provided by the inwardly and forwardly bent formations **27**. Accordingly, the exhaust gases are drawn through the openings **26** into the interior of the inner tube **25** and from thence pass in the discharge stream through the end part **20***a* of the tube **20**. It will be apparent from the foregoing that a portion of the exhaust gases normally discharged through the outlet **14** will be by-passed and will be discharged through the bent end part **20***a* of the tube **20**, thereby tending in a measure to draw gases from the exhaust manifold of the engine through the inlet tube **13**. Sound waves in the exhaust gases are deflected by the several partitions and, in at least a large measure thereby, absorb and dissipate whereby the discharge from the muffler is essentially silent in the sense that the term is used in this art. Moreover, a continuous stream of air passing through the inner tube **25** serves to a measure at least to cool the muffler acting in this respect as a heat exchanger, whereby the heat content of the muffler is diminished and the heat content of the air stream is increased.

Having thus described the preferred embodiment of the instant invention, reference is now made to Figs. 7, 8 and 9 wherein alternative or modified forms of the device according to this invention are illustrated. In Fig. 7 like reference numerals designate parts corresponding to those referred to in connection with the above described embodiment of this invention, it being noted that a casing internally subdivided by partitions and having an inlet and outlet conduit is provided with a tube **30** mounted therein and extending therethrough essentially as shown. The ends of the tube **30** are essentially fixedly mounted in registering openings in the casing ends **12**, it being noted that a major portion of the length of the tube is provided with openings **30***a* corresponding to the openings **20***b* formed in the tube **20** in the above described embodiment of this invention. The closed part of the tube **30** is constricted in the locality designated by the reference character **30***b* but the portion of the tube past the constricted part is of lesser diameter than of other parts of the tube. An inner tube **31** flared at the end **31***a* thereof and sealed to the end of the tube **30** and to the casing end **12** extends coaxially within the tube **30** and is constricted to form a jet-like end portion **31***b* extending through the constricted portion **30***b* of the tube **30** whereby an air stream passing through tube **31** and discharging through said jet-like end portion draws exhaust gases from the interior of the muffler to discharge same in substantially the manner described above in connection with the preferred embodiment of this invention. It is to be noted that a plurality of tubes **30** radially spaced are provided in the muffler for facilitating discharge of exhaust gases as above described.

In Fig. 8 similarly an outer tube **35** is provided having openings **35***a* formed therein and having, instead of the constricted portion **30***b* as in the tube **30** above described, an inner tube **35***b* mounted in end portions of the tube **35** and being of substantially lesser diameter than said tube substantially as shown. A tube **36** having a flared end portion **36***a* is coaxially mounted within the tube **35** and is provided with a jet-like end portion **36***b* pointing into the inner tube **35***b* above described. It will be apparent that an air stream traveling through the tube **36** and discharging from the jet-like end portion **36***b* thereof will draw exhaust gases from the interior of the muffler through the openings **35***a* of the outer tube **35** and will discharge same with the air stream through the inner tube **35***b*.

The embodiment of the instant invention illustrated in Fig. 9 is similar to the embodiment illustrated in Fig. 7 in that an outer tube **37** having openings **37***a* formed therein and constricted in a locality designated by the numeral **37***b* is mounted in the muffler ends **12**. However, it is to be noted that the end portion **37***c* of the tube **37** is flared outwardly and that the inner tube **38** flared at one end **38***a* thereof for attachment to the tube **37** extends coaxially therethrough but terminates within the constricted portion **37***b* of the tube **37**. It will be evident that an air stream traveling through the tube **38** will draw exhaust gases from the interior of the muffler through the openings **37***a* and discharge same mixed with the air stream through the flared end portion **37***c* of the tube **37**.

Having thus described the present invention, what it is desired to secure by Letters Patent is:

1. An internal combustion engine muffler, comprising a cylindrical body having an inlet at one end and an outlet at the opposite end, baffles in said body, a perforated tube extending longitudinally through the body and having open ends forming a tight joint with the heads of the body, and a smaller tube passing concentrically through the perforated tube and having its ends closing the space between the two tubes, the inner tube having openings communicating with the space between the tubes.

2. An internal combustion engine muffler, comprising a cylindrical body having an inlet at one end and an outlet at the opposite end, baffles in said body, a perforated tube extending longitudinally through the body and having open ends forming a tight joint with the heads of the body, a smaller tube passing concentrically through the perforated tube and having its ends closing the space between the two tubes, the inner tube having openings communicating with the space between the tubes, and inwardly and rearwardly extending shields opposite each opening in the inner tube.

3. An internal combustion engine muffler, comprising a cylindrical body having an inlet at one end and an outlet at the opposite end, baffles in said body, a perforated tube extending longitudinally through the body having open ends forming a tight joint with the heads of the body, a smaller tube passing concentrically through the perforated tube and having its ends reamed outwardly to form a tight joint with the perforated tube, the inner tube having struck-out portions forming openings and said struck-out portions extending rearwardly forming shields opposite each opening.

4. An internal combustion engine muffler, comprising a cylindrical body having an inlet at one end and an outlet at the opposite end, transverse perforated baffles in said body, a perforated tube extending longitudinally through the body and having open ends forming a tight joint with the heads of the body, a smaller tube passing concentrically through the perforated tube and having its ends reamed outwardly and forming a tight joint between the tubes, the inner tube having a circumferential struck-out portion forming openings and the struck-out portions extending rearwardly providing shields opposite each opening in the inner tube.

BERNARD C. KIRBY.