Aug. 8, 1961 V. SEIFERT 2,995,200

EXHAUST MUFFLER FOR ENGINES

Filed Oct. 23, 1959 2 Sheets-Sheet 1

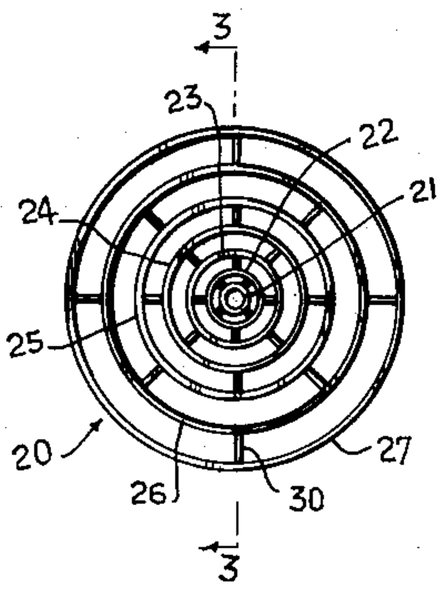

Fig. 2.

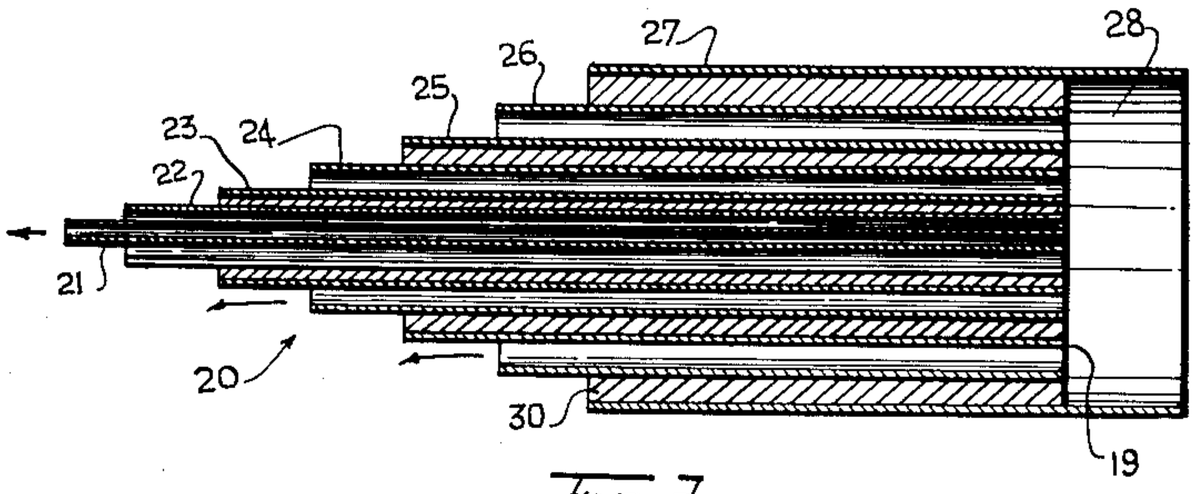

Fig. 3.

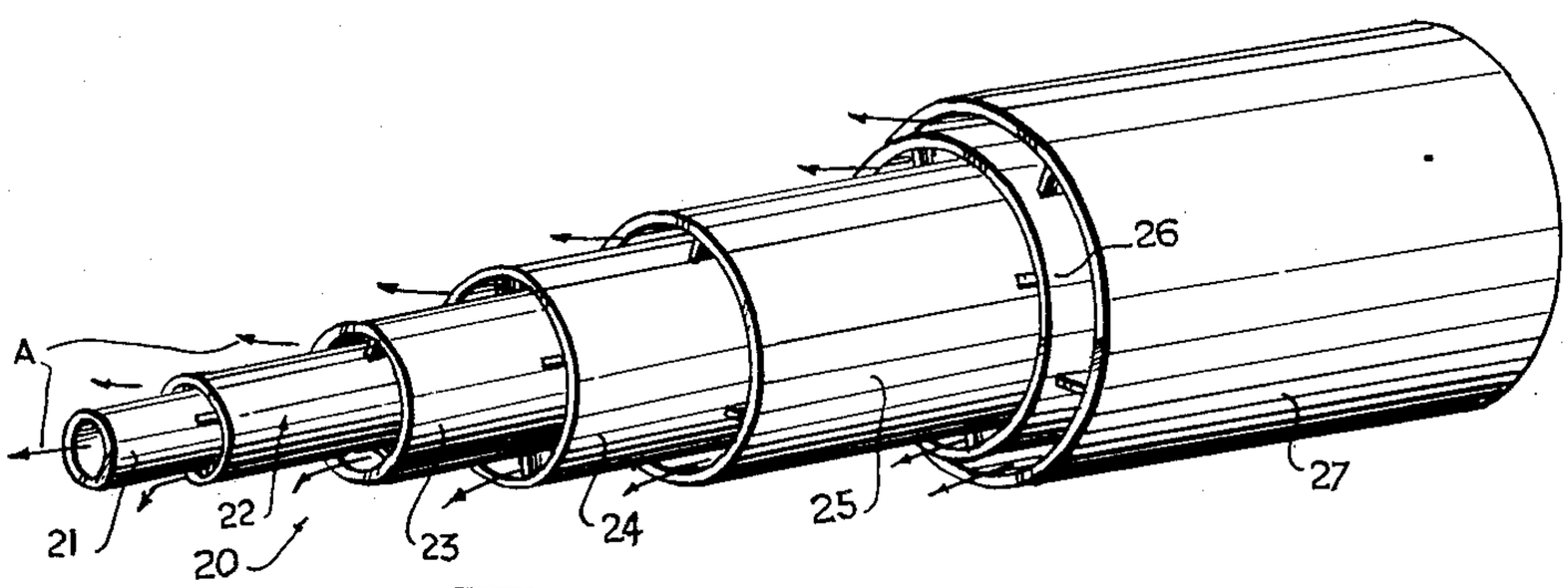

Fig. 1.

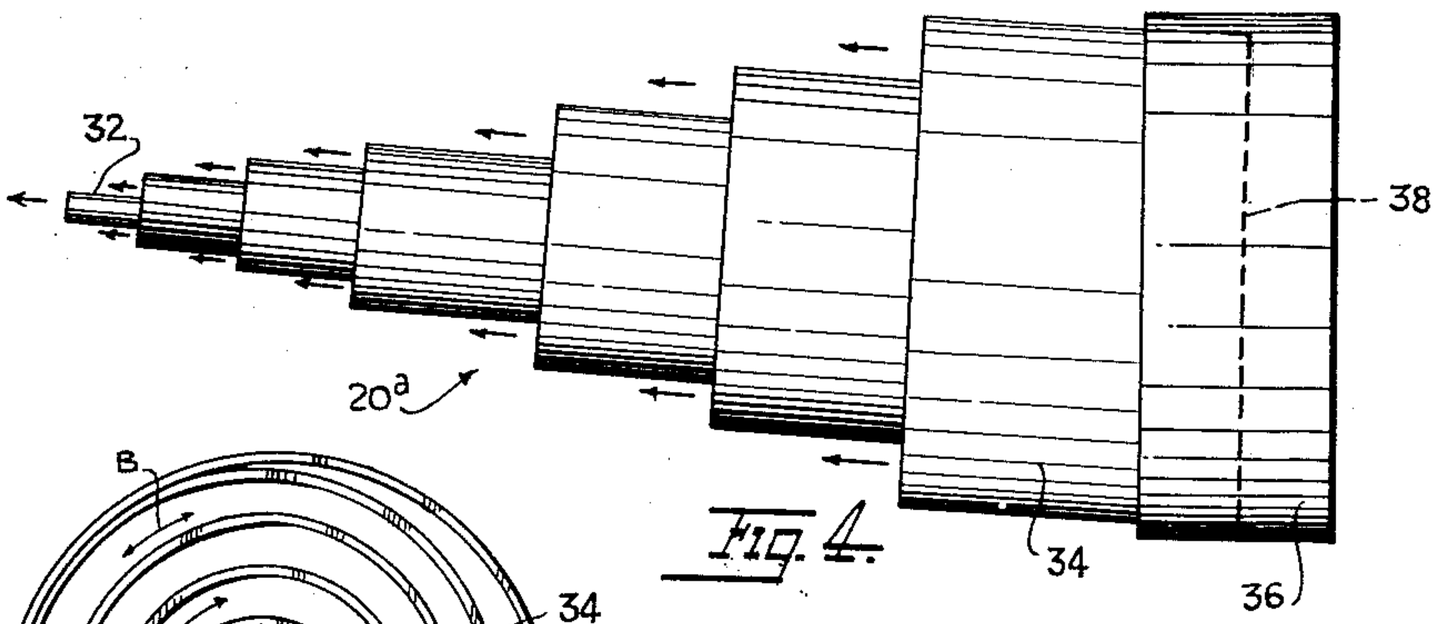

Fig. 4.

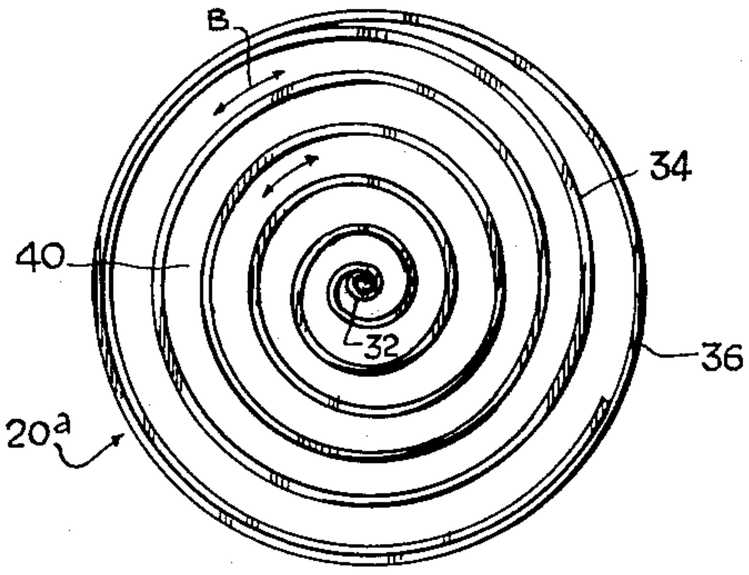

Fig. 5.

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Aug. 8, 1961 V. SEIFERT 2,995,200

EXHAUST MUFFLER FOR ENGINES

Filed Oct. 23, 1959 2 Sheets-Sheet 2

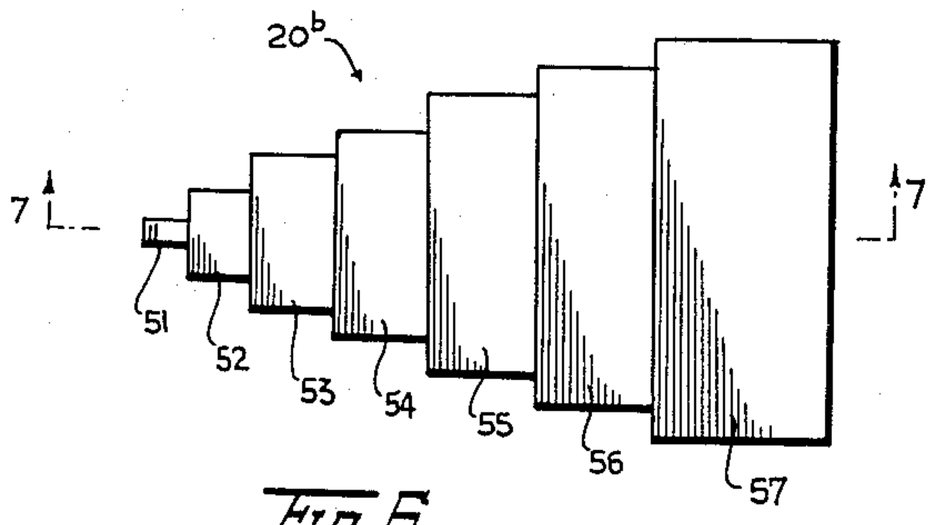

Fig. 6.

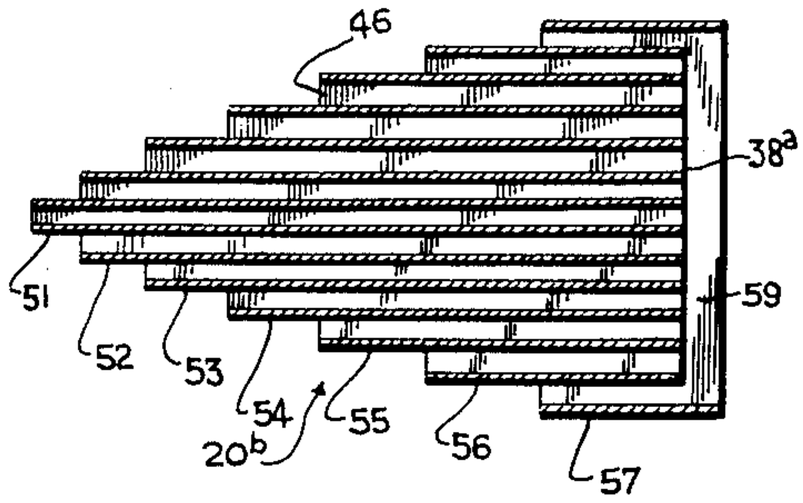

Fig. 7.

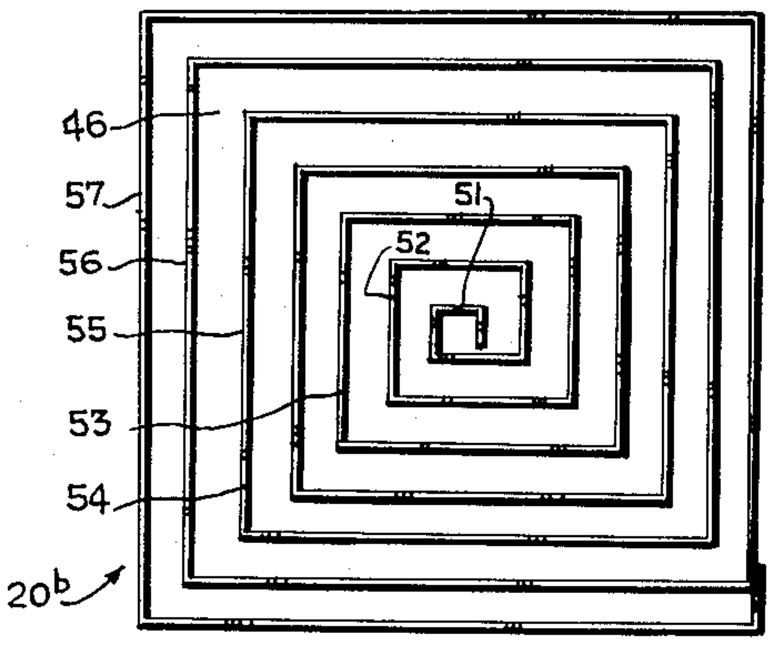

Fig. 8.

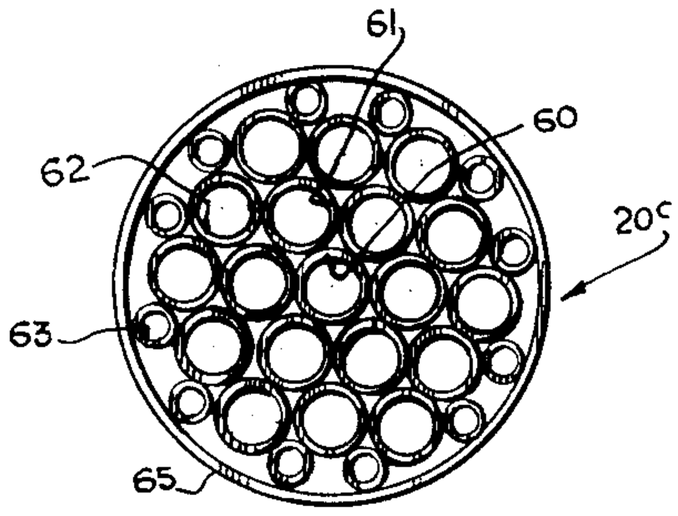

Fig. 9.

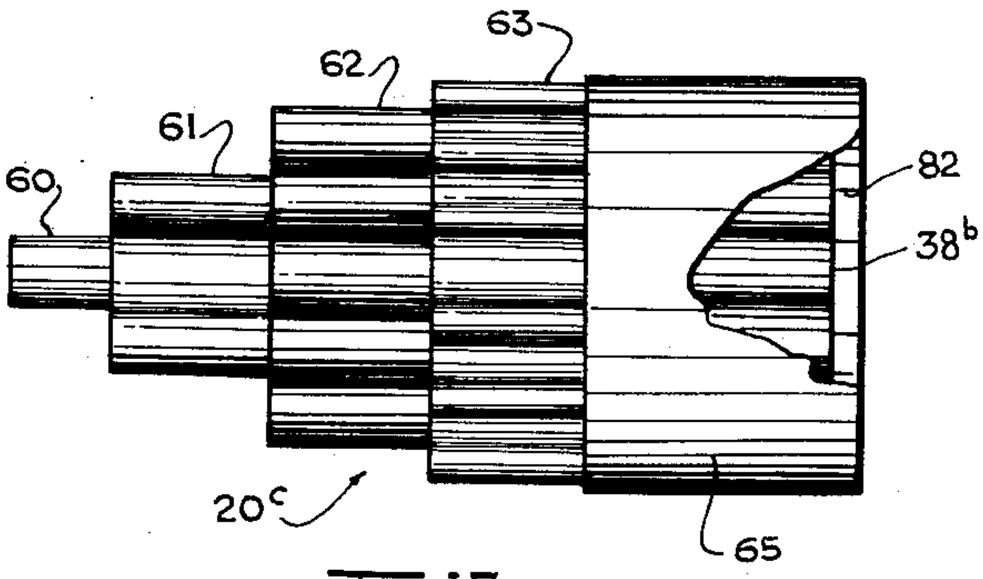

Fig 10.

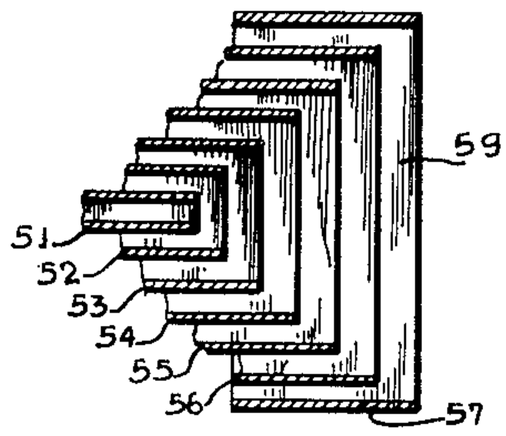

Fig. 11.

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EXHAUST MUFFLER FOR ENGINES

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2 Claims. (Cl. 181—46)

This invention relates to the art of engine exhaust mufflers and particularly concerns a through passage muffler especially adapted for jet engines, high powered reciprocating engines and the like.

One object of the invention is to provide a muffler including a plurality of tubes of different lengths disposed in a parallel and concentric array to provide unobstructed passages of different lengths for exhaust gases.

A further object is to provide a baffle-free muffler for an engine exhaust.

Another object is to provide a muffler having a helical configuration which is curved or straight-sided in cross section, the helical body of the muffler providing a divided expansible outlet for engine exhaust gases.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure.

FIG. 1 is a perspective view of one form of muffler according to the invention.

FIG. 2 is a front end elevational view of the muffler of FIG. 1.

FIG. 3 is a longitudinal sectional view taken on line 3—3 of FIG. 2.

FIG. 4 is a side elevational view of another form of muffler embodying the invention.

FIG. 5 is a front end elevational view of the muffler of FIG. 4.

FIG. 6 is a side elevational view of a further form of muffler according to the invention.

FIG. 7 is a longitudinal sectional view taken on line 7—7 of FIG. 6.

FIG. 8 is a front end elevational view of the muffler of FIGS. 6 and 7 taken on an enlarged scale.

FIG. 9 is a front end view of another muffler according to the invention.

FIG. 10 is a side elevational view of the muffler of FIG. 9 with an end portion broken away.

FIG. 11 is a fragmentary view similar to FIG. 7 of another modification.

Referring to FIGS. 1–3, there is shown a muffler **20** consisting of a plurality of concentrically disposed tubes **21—27**. The innermost centrally located tube **21** is longer than the others and extends forwardly furthest. All tubes except tube **27** are transversely aligned at their rear ends and terminate in a common plane **19** short of the rear end of tube **27** to define a free annular sleeve **28** adapted to engage on an exhaust outlet of an engine. Longitudinally extending ribs **30** divide the annular passages defined between the several tubes into sections and serve to hold the tubes in fixed radially spaced array. The muffler effectively divides a mass of exhaust gas expelled under pressure from an engine into a plurality of streams of different circumferential and axial lengths. This breaks up the sound producing capability of the single gaseous mass by converting it into a plurality of low pressure streams.

The tubes should preferably each have an axial length about one half wave length of the mean frequency of a range of sound frequencies to be attenuated, and each passage should have a circumferential length between ribs **30** of one quarter wave length. Then reflections and

standing waves will be set up in the tubes which will serve to cancel and silence the sounds of the exhaust gases leaving the several tubes in streams A.

In the form of the invention shown in FIGS. 4 and 5, the muffler **20a** is formed as a helical body. The body tapers to a tubular forward end **32**. The rear turn **34** which is the outermost and largest turn of the body is secured to a cylindrical sleeve **36** which serves to secure the muffler to an engine exhaust outlet. The turns of the muffler may terminate in a common transverse plane **38** or the ends may be staggered as shown in FIG. 11. A particular advantage of terminating in a common transverse plane is that the passage **40** for the exhaust gas is so divided that the gas is diverted to travel and expand spirally to follow the circumference of the passage while the gas also travels longitudinally through the muffler. Thus, the gas is divided into a plurality of streams as it enters the several turns of the muffler body and at the same time the gas in each turn can expand in the circumference of the passage as indicated by arrows B. The result is that the original sound pattern of the exhaust gas is disturbed, and the several streams of gas in the muffler turns tend to mix with each other. The resulting turbulence attenuates the sound waves. At the same time the gases are free to move longitudinally in the passage **40** and are discharged after traveling different distances since the several turns have progressively shorter axial lengths from the innermost turn **32** to the outer turn **34**.

If the ends are staggered, they peel off the exhaust and stagger the sound waves, straightening out any turbulence at the end. A further advantage of the muffler structure of FIGS. 4 and 5 is that the several turns are not attached to each other. This permits the walls to flex as the gas under pressure passes through. As a result, gas in one passage may tend to expand or separate the walls of a certain turn while the gas in an adjacent turn is tending to move the walls in an opposite direction. The energy in the several streams of gases is thus spent in opposing movements of the adjacent walls, and the gases leave the muffler in soundless streams.

FIGS. 6, 7 and 8 show a form of the invention similar to that of FIGS. 4 and 5. Muffler **20b** is helical but the several turns **51—57** are square in cross section. The passage **46** has the form of a rectangular spiral. The forward turn **51** is axially the longest and narrowest one and terminates with other turns **52—56** in transverse plane **38a** just inside of the end **50** of outer turn **57**. Turn **57** is the shortest axially of the turns. There is thus provided a square sleeve **59** at the rear end of the muffler for securing the same to an engine outlet. The flat walls of the several turns are flexible and can yield to absorb energy from the exhaust gases.

FIGS. 9 and 10 show another form of the invention in which a plurality of groups of tubes **60—63** are disposed parallel to each other and secured with a sleeve **65**. The center tube **60** is the longest one of the assembly. Around tube **60** is a circular ring of tubes **61** which are axially shorter than tube **60**. Around tubes **61** is another ring of shorter tubes **62** and this is surrounded by a further ring of shorter tubes **63**. Sleeve **65** is securely engaged around the outer ring and may be welded thereto. The tubes terminate on a plane **38b** which leaves a short cylindrical sleeve portion **82** for engaging the muffler on an engine outlet. This muffler **20c** operates like muffler **20** of FIGS. 1–3 since a plurality of unobstructed passages are provided at each radial step outward from the axis of the muffler.

While I have illustrated and described the preferred embodiments of my invention, it is to be understood that I do not limit myself to the precise constructions herein disclosed and that various changes and modifications may

be made within the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent is:

1. An exhaust muffler, comprising a plurality of concentric tubes secured to each other in radially spaced array, an axially disposed one of said tubes being longer than the others, said other tubes being successively shorter axially and having longer radii, and a plurality of axially extending ribs rectangular in cross section secured between adjacent walls of the tubes spacing the same, and dividing the spaces between the tubes into individual passages having arcuate cross sections, the axial lengths of said tubes each being substantially equal to a half wave length of the mean frequency of a range of sound wave frequencies to be attenuated by the tube.

2. An exhaust muffler, comprising a plurality of concentric tubes secured to each other in radially spaced array, an axially disposed one of said tubes being longer than the others, said other tubes being successively shorter axially and having longer radii, and a plurality of axially extending ribs rectangular in cross section secured between adjacent walls of the tubes spacing the same, and dividing the spaces between the tubes into individual passages having arcuate cross sections, the axial lengths of said tubes each being substantially equal to a half wave length of the mean frequency of a range of sound wave

frequencies to be attenuated by the tube, and the circumferential lengths of the passages defined between the several tubes and adjacent ribs therebetween being substantially equal to a quarter wave length of the mean frequency of sound wave frequencies to be attenuated in the passage.

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