March 16, 1937. N. H. SERVAIS 2,073,951

SILENCER FOR GASEOUS CURRENTS

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Fig. 1.

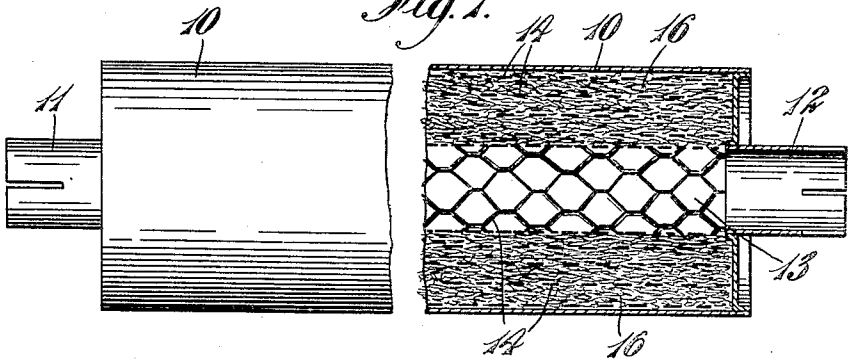


Fig. 2.

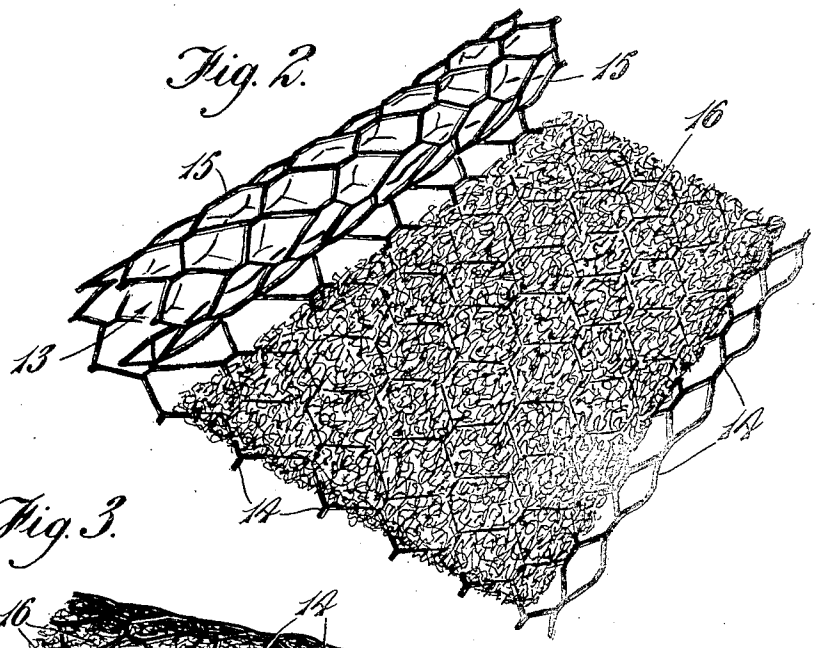
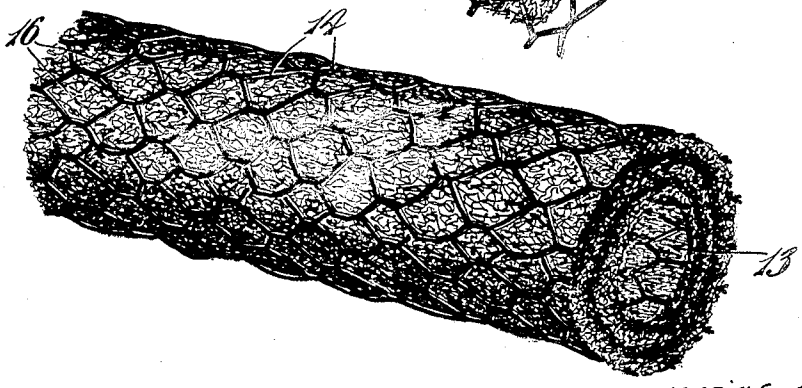


Fig. 3.



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Fig. 4.

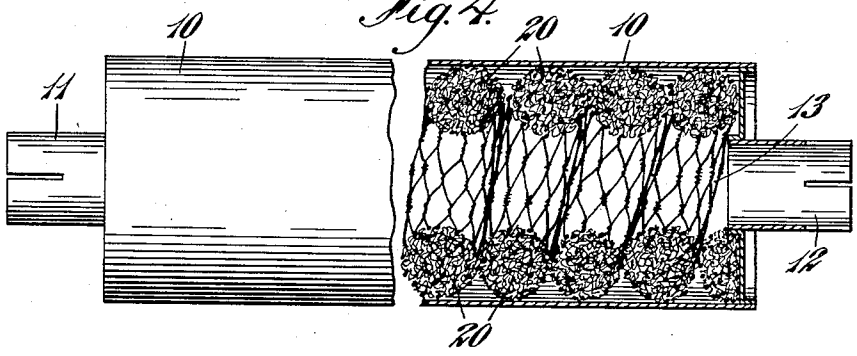


Fig. 5.

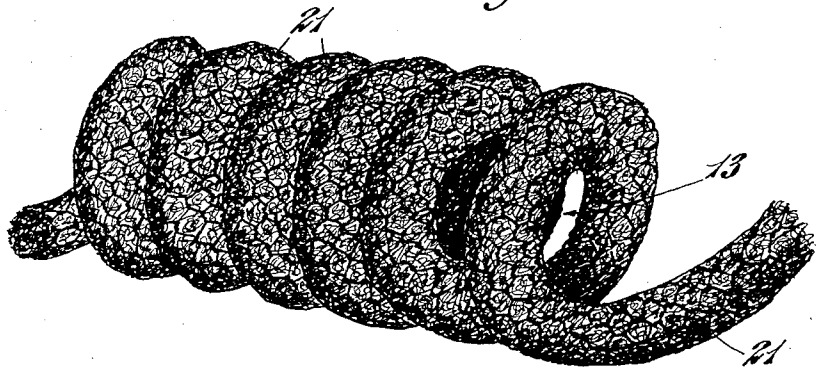
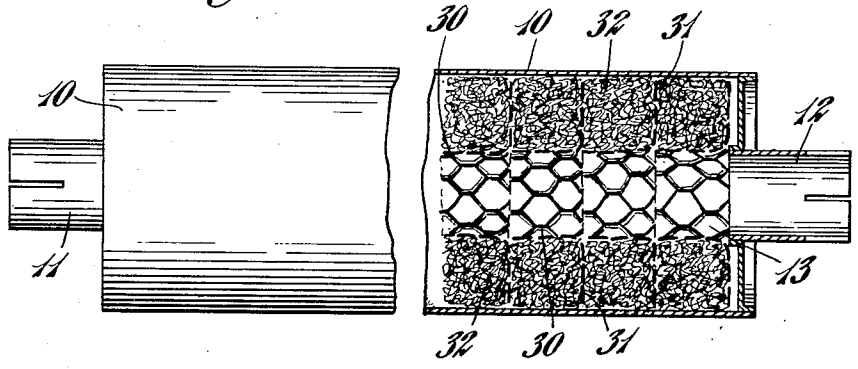


Fig. 6.



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2,073,951

UNITED STATES PATENT OFFICE

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SILENCER FOR GASEOUS CURRENTS

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Application February 28, 1936, Serial No. 66,156
In Great Britain December 9, 1935

8 Claims. (Cl. 181—42)

This invention relates to improvements in silencers for gaseous currents and in the method of producing the same, and is particularly applicable to exhaust silencers for internal combustion engines although it is applicable to other uses where it is desired to absorb the vibrations of a gaseous medium set up by any means; for example, it is applicable to the intake of a compressor. The chief object of the present invention is to provide an improved silencer of the type comprising a casing which is provided with a filling of sound absorbing material such, for example, as asbestos or mineral fibre, said filling being so disposed within the casing that there is left a free and unobstructed, or substantially unobstructed, passage or duct for the gases from the inlet to the outlet, and in this respect is differentiated from that type of silencer in which all of the gas is caused to pass through a sound absorbing material such as mineral fibre in its passage from the inlet to the outlet.

The silencer according to the present invention is characterized by the provision of a composite filling for the casing, said filling consisting of a comparatively fine fibrous or like sound absorbing material such as steel wool, glass wool, asbestos fibre or the like and a more rigid material such as expanded metal, wire netting or the like, which more rigid material also acts as a binding or lacing to hold the comparatively fine fibrous or like sound absorbing material together.

The steel wool or the like constituting the fine fibrous or like sound absorbing material according to the present invention is preferably, when the silencer is to be used for silencing the exhaust gases of an internal combustion engine or the like, of different grades. For example, the mass is composed of strands or fibres of different thickness or differing in other physical characteristics, this feature being hereinafter broadly referred to as "different grades of thickness."

The silencer according to the present invention, and particularly the construction hereinafter described, has been found in practice to be very efficient. Whilst I do not wish to restrict myself to any particular explanation of the cause of this very desirable efficiency, it is my present theory, based on extensive experimentation, that in a silencer sound waves of different frequency are best absorbed by sound absorbing materials of different characteristics and that in order to silence a gaseous current adequately it is necessary to cause the sound waves to do work. The sound waves in the exhaust of an internal combustion engine are of mixed frequencies from low to high and in my opinion sound waves of these different frequencies are more readily absorbed by materials of such different characteristics that suitable sound absorbing material is available for every variation of frequency. The more rigid material of the filling will, according to this theory, absorb sound waves of comparatively low frequencies whilst at the same time transmitting the sound waves of higher frequencies to the steel wool or the like and the steel wool or the like of different grades of thickness will selectively and efficiently absorb the higher frequencies.

In addition to serving the above described function of absorbing sound waves of comparatively low frequency and of transmitting the sound waves of higher frequencies very effectively to the steel wool or the like, the more rigid material also serves, in accordance with the present invention, to bind or lace the comparatively fine fibrous material together and to prevent the same being displaced by the gas pressure.

A further advantage of the composite filling according to the present invention is that it renders the provision of a central perforated tube defining the unobstructed passage from the inlet to the outlet unnecessary.

In the accompanying drawings, which illustrate by way of example and not of limitation certain convenient embodiments of this invention:—

Figure 1 is a longitudinal section through the preferred form of silencer according to the present invention.

Figure 2 is a perspective view illustrating the initial step in the preferred method of making the filling according to this invention, and

Figure 3 is a perspective view of the finished filling prepared by this method.

Figure 4 is a longitudinal section through a further form of silencer according to this invention.

Figure 5 is a perspective view of a modified form of filling according to this invention, and

Figure 6 is a section through still a further form of filling according to this invention.

Referring now more particularly to Figures 1 to 3 of the drawings, the silencer therein illustrated comprises a casing 10 having an inlet 11 and an outlet 12 and, for the reasons above stated, there is preferably no central duct or tube connecting the inlet to the outlet in the silencer according to the present invention. The composite filling is free within the casing, i. e., is not attached thereto, and fills or substantially fills the inside of the casing 10 with the exception

of a central free passage 13, the diameter of which is preferably approximately equal to the diameter of the inlet tube.

In one method of forming the composite filling according to the present invention there is taken a sheet of expanded metal 14, this forming the more rigid material of the composite filling according to this invention and one end of this expanded metal is first bent round a cylindrical former (not shown) so as to form a central support 15 encircling the passage 13. Steel wool 16 of mixed grades of thickness as above described (or, if desired, and particularly where the gaseous current does not comprise sound waves of different frequencies, as in the case of a compressor intake of a single grade) is then distributed in the form of an even or uneven layer of the desired thickness over the remainder of the expanded metal and the whole is rolled up to the form shown in Figure 3 so that there is formed a composite filling consisting of alternate layers of steel wool (the fine fibrous or like sound absorbing material) and expanded metal (the more rigid material). The size of the sheet of expanded metal 14 and the thickness of the layer of steel wool 16 are such that the finished filling shown in Figure 3 will slip easily into the outer casing 10 before one of the end caps is placed on and will substantially fill the casing.

The silencer is then complete and may, it will be seen, be easily and cheaply produced.

The expanded metal forms a very effective binding which holds the steel wool together and prevents it being ejected under the action of the gaseous currents. Furthermore, it serves a very useful purpose in effectively and quickly distributing to the whole of the mass of steel wool the sound vibrations of comparatively high periodicity which form the major part of the sound to be silenced so that the said vibrations may be the more quickly absorbed. The expanded metal itself in my opinion also acts as a sound absorber for sound waves of comparatively low periodicity.

It will be seen that the composite filling is exposed to the gaseous currents flowing through the central passage over the whole of the surface of the central passage so that the gas fills the whole of the casing and has its vibrations damped out in the filling which can vibrate freely.

In the modified construction shown in Figure 4 the filling is composed of a number of annular discs 20 each formed of a mass of steel wool. These annular discs may be formed after the same manner as the well known pot cleaners and are reinforced or laced with wire or the like on the outside, this wire or the like forming the more rigid material and serving to prevent the steel wool being dragged out by the pressure of the gaseous currents.

Figure 5 shows in perspective a further modified construction of filling according to the present invention. In this case, the steel wool is spun or otherwise formed into a rope or the like 21 with a reinforcement or lacing of wire (forming the more rigid material) along or around its outer face and is then coiled into a spiral, as shown, of the required size. This spiral forms the filling and is slipped into the casing as above described. In this case also the unobstructed central passage 13 is provided and the filling is freely exposed to the gaseous current over the whole of this passage.

Figure 6 illustrates a still further modified form of filling according to the present invention in which the central passage is formed of a number of sectional tubes 30 of expanded metal or the like, each of which is provided at one end with a flange 31. The flanges form the more rigid material and divide the cylindrical space of the casing into a plurality of compartments, each of which is filled with steel wool 32. The same effect is secured in this case as the sectional filling is free inside the casing and there is no fixed centre tube or duct down the centre of the casing.

Many modifications may be made in the above described construction without departing from the scope of the present invention, for example, in place of the expanded metal there may be used woven wire gauze of any suitable mesh, wire or other suitable netting or any other suitable material to bind the steel wool or the like. Again, instead of steel wool there may be used ordinary wool or loose felt (when the silencer is not being used with hot gases) glass wool, mineral fibre, asbestos fibre or the like.

The silencer according to the present invention may be made of any suitable cross-section and may be either straight or curved as desired.

A further advantage of the silencer according to the present invention is that the heat will be evenly distributed over and dissipated in the filling and so there will be less condensation and no hot spots which might tend to damage the casing.

I claim:—

1. A silencer for gaseous currents of the type specified, comprising the combination with a casing through which the gaseous currents are directed, of an annular composite sound absorbing filling in said casing, said filling comprising a relatively fine fibrous sound absorbing material such as steel wool, and a relatively rigid open-work material such as expanded metal, said last-named material being interlaced with the first-named material to serve additionally as a binder for holding the latter together.

2. A silencer as set forth in claim 1, in which the materials of said composite filling are arranged in alternate layers.

3. A silencer as set forth in claim 1, in which said relatively fine fibrous material is composed of different grades of thickness.

4. A silencer as set forth in claim 1, in which said rigid material comprises a sheet rolled to form a central tube and an outwardly spiralling portion, said relatively fine material being arranged around said tube and between the layers of said spiralling portion.

5. A silencer as set forth in claim 1, in which said relatively fine fibrous material comprises a plurality of separate annular discs.

6. A silencer as set forth in claim 1, in which said filling has the form of a spirally wound rope.

7. A silencer as set forth in claim 1, in which said filling has the form of a spirally wound rope, said rope comprising a core of said relatively fine material enveloped by a layer of said rigid material.

8. A silencer as set forth in claim 1, in which said rigid material comprises a plurality of axially aligned flanged sleeves, and said relatively fine material comprises annular wads disposed around said sleeves and between said flanges.

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