March 20, 1956 B. B. THROWER 2,738,854

EXHAUST FILTER

Filed May 17, 1954

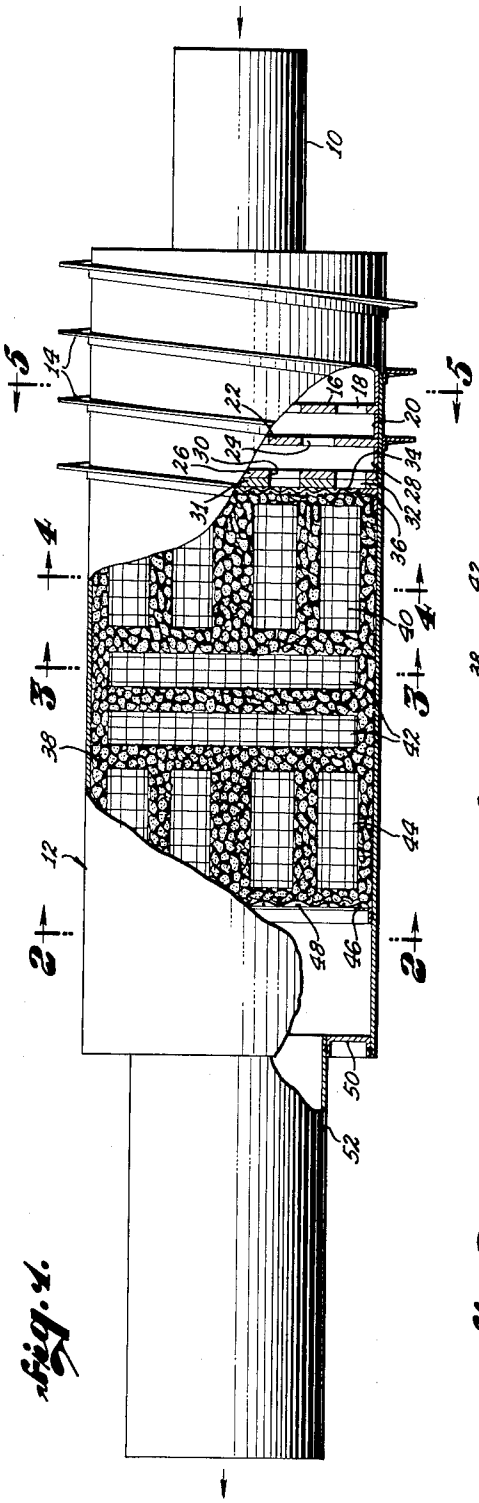

Fig. 1.

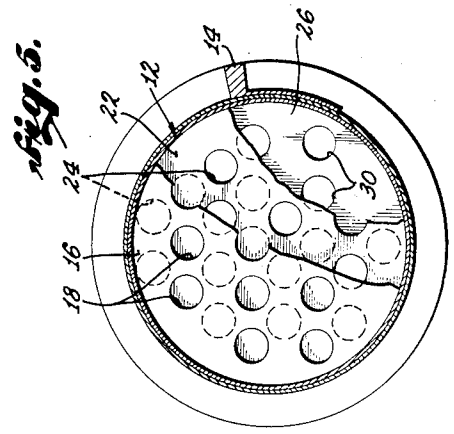

Fig. 5.

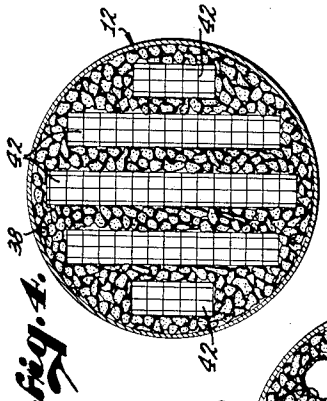

Fig. 4.

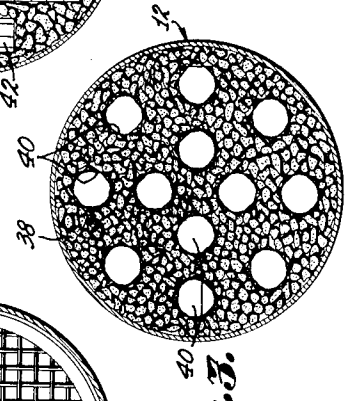

Fig. 3.

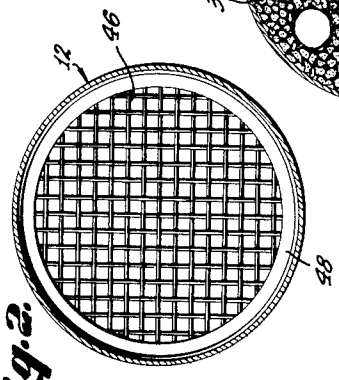

Fig. 2.

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United States Patent Office 2,738,854 Patented Mar. 20, 1956

2,738,854

EXHAUST FILTER

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Application May 17, 1954, Serial No. 430,170

5 Claims. (Cl. 183—4.3)

This invention relates to filters for automobiles and, more particularly, to apparatus which can be attached to the tailpipes of automobiles to prevent smoke and undesirable gases from escaping from the engine into the air.

At the present time, tens of millions of automobiles are in use throughout the country. In many of the larger cities the residents in the aggregate own hundreds of thousands and even a million or two automobiles. During their use, each of these automobiles emits undesirable and even noxious fumes such as carbon monoxide. These fumes result from impurities in the gasoline and from incomplete combustion of the gasoline. Partly as a result of such fumes, many large cities in this country face problems of smog and impure air.

Many attempts have been made to prevent the passage of undesirable fumes into the air as a result of gasoline combustion in automobile engines. However, the problem still exists and may even be growing worse. This invention provides apparatus which can be easily attached to an automobile tailpipe to absorb undesirable components in the exhaust gases from an automobile. In addition to serving as a purifier, the apparatus includes components which operate as a heat exchanger and as a muffler. The apparatus can be made inexpensively and has been found by actual tests to operate efficiently over long periods of time.

An object of this invention is to provide apparatus which can be attached to an automobile tailpipe to filter the exhaust gases escaping through the tailpipe.

Another object is to provide apparatus of the above character for transferring heat out of the exhaust gases before the gases are filtered for impurities.

A further object is to provide apparatus of the above character for muffling any noises in the gas stream after impurities have been removed from the screen.

Still another object is to provide apparatus of the above character which can be inexpensively manufactured, which can be easily attached to the tailpipes in cars now in use and which operates reliably over long periods of time.

Other objects and advantages will be apparent from a detailed description of the invention and from the appended drawings and claims.

In the drawings:

Figure 1 is a side elevational view, partly broken away to indicate components in section, of filtering apparatus constituting one embodiment of this invention; and

Figures 2 to 5, inclusive, are sectional views taken substantially on the lines 2—2, 3—3, 4—4 and 5—5, respectively, of Figure 1 to illustrate in further detail certain components shown in Figure 1.

The illustrated embodiment of the invention, referring now to the drawing and more particularly to Figure 1 thereof, comprises a cylindrical coupling 10 having a diameter such as 3 inches and made from a suitable material such as iron or steel which is adapted to fit snugly on an automobile tailpipe (not shown). A cylindrical

housing 12 having a suitable diameter on the order of 5 inches and a suitable length such as 12 inches extends from the coupling 10. The housing, as best seen in Figures 1 and 5, has helical fins 14 extending about its outer periphery to provide for the dissipation of heat in the exhaust gases passing through the housing 12.

A first baffle 16 fits tightly within the housing 12 at a position somewhat within the housing. The baffle 16 is made from a suitable material such as steel or iron having a thickness of approximately ⅛ inch. A plurality of holes 18 each having a diameter of approximately ½ inch are provided in the baffle 16 for the passage of the exhaust gases through the baffle.

An annular spacer 20 fits loosely within the housing 12 in contiguous relationship to the baffle 16. The spacer 20 properly positions a second baffle 22 a suitable distance from the baffle 16. The baffle 22 has characteristics similar to the baffle 16 except that it has holes 24 which are staggered at radial and arcuate distances with respect to the holes 18 to increase the length of the path which the exhaust gases must travel.

The baffle 22 is separated from a third baffle 26 by a spacer 28 corresponding to the spacer 20. The baffle 26 has holes 30 corresponding substantially in disposition to the holes 18 in the baffle 16. A plate 31 made from a suitable material such as asbestos to provide suitable heat insulating properties is disposed in contiguous relationship to the baffle 22. The plate 31 has holes 32 which are substantially aligned with the holes 30 in the baffle 26.

A wire mesh retainer 34 having wires separated by approximately ¼ inch is mounted on a support ring 36 which fits snugly within the housing 12 and which may be suitably secured to the housing 12 as by spot welding. The wire mesh provides a barrier for preventing particles of charcoal 38 from moving into the holes 32 and 30 to clog the passageways for the exhaust gases. As will be seen in Figure 1, the particles of charcoal 38 are disposed within the housing 12 at an intermediate position along the axial length of the housing.

The particles of charcoal 38 may be approximately ½ inch or slightly larger in size. Small particles are desirable since they tend to increase the total surface area presented by the charcoal to the exhaust gases and thereby improve the filtering action. However, the particles cannot be too small since they would otherwise pass through the holes in the wire mesh 34. Although charcoal has been designated, it should be appreciated that other material may also be used.

Particles of charcoal 38 are disposed around conduits 40 formed by rolling wire mesh into cylinders. The conduits 40 may be disposed at random within the cross-sectional area of the housing 12 or they may be disposed in a relatively neat and symmetrical pattern such as is shown in Figure 3. In Figures 1 and 3, the conduits 40 are also shown as extending in an axial direction.

A second plurality of conduits 42 may be disposed so that their axes extend in a radial direction through the housing 12, as shown in Figures 1 and 4, or at any rate in a direction transverse to the axis of the housing. A third plurality of conduits 44 may be disposed adjacent to the conduits 42 and somewhat removed from the conduits 40. The conduits 44 may also be disposed in a random fashion or they may be disposed in a pattern corresponding to the conduits 40, as is illustrated in Figure 1.

A support ring 46 corresponding to the ring 36 is suitably secured as by spot welding to the housing 12 at a position removed from the conduits 44 in the direction of gas travel. The ring 46 in turn supports a wire mesh retainer 48 corresponding to the retainer 34 disclosed above. One leg of an annular U-shaped bracket 50 (Fig-

ure 1) is also suitably secured as by spot welding to the housing **12** at the far end of the housing in the direction of gas travel. The other leg of the U-shaped bracket **50** is suitably secured as by spot welding to an outlet pipe **52** having an inner diameter larger than the cylinder **10** but less than the housing **12**. For example, when the coupling **10** and the housing **12** respectively have inner diameters of approximately 3 and 5 inches, the outlet pipe **52** has an inner diameter of approximately 4 inches.

Gasoline introduced into automobile engines is burned in the engine cylinders but for various reasons, the burning of the gasoline in the cylinders is not complete. This causes certain undesirable compounds such as carbon monoxide to be produced. As is well known, carbon monoxide is harmful and even deadly in small quantities. Furthermore, certain undesirable compounds result from impurities in the gasoline.

The undesirable compounds resulting from incomplete combustion and impurities pass with the other exhaust gases from the engine and into the tailpipe. The gases then pass through the coupling **10** into the housing **12** and travel through the holes **18** in the baffle **16**, the holes **24** in the baffle **22** and the holes **30** in the baffle **26**.

As the gases move past the baffles **16**, **22** and **26**, heat from the gases is conducted to the baffles. The heat is readily dissipated into the air as a result of the action of the helical fins **14**. Heat also passes to the housing **12** and the fins **14** by convection and radiation. Such passage of heat is facilitated by the tortuous path which the gases must travel. This tortuous path results from the staggered disposition of the holes **24** relative to the holes **18** and **30**.

After moving through the holes **30**, the gases move through the holes **32** in the asbestos plate **31**, which operates to serve as a heat barrier between the baffles such as the baffle **26** and the particles of charcoal **38**. The gases then travel through the bed of charcoal and the conduits **40**, **42** and **44** embedded therein. During their travel through the charcoal embedded conduits, the undesirable components of the exhaust gases such as smoke, drops of unburned gasoline and certain chemicals become adsorbed by the charcoal. The gases then move through the wire mesh retainer **48** into the output pipe **52**. Since the output pipe **52** has a larger diameter than the coupling **10**, the gases do not build up any back pressures and pass into the air in a steady stream. This is important in enhancing the quiet operation of the apparatus and to eliminate burning of the exhaust valves of the vehicle engine.

The apparatus disclosed above has several important advantages. By eliminating the heat from the exhaust gases before subjecting the gases to any filtering action, the efficient operation of the charcoal filter over long periods of time is assured. The efficient operation of the charcoal filter over long periods of time is also enhanced by the action of the conduits **40**, **42**, and **44** in preventing the charcoal from settling and packing. Packing of the charcoal is undesirable since it minimizes the external area presented by the charcoal particles to the gases. Because of the action of the conduits **40**, **42** and **44**, the charcoal **38** does not become packed even with the jarring forces imposed on the charcoal as the automobile travels over bumps.

It will thus be seen that the apparatus disclosed above operates not only as an efficient filter but also as a heat exchanger and muffler. The apparatus performs these functions in a relatively small space and with relatively simple and inexpensive components. The parts are so arranged that they can be easily replaced from time to time if necessary. Actually, only the charcoal would have to be periodically replaced and it is easily accessible and inexpensive.

Although the now preferred embodiment of the present invention has been shown and described herein, it is to be understood that the invention is not to be limited thereto, for it is susceptible to changes in form and detail within the scope of the appended claims.

I claim:

1. A filter device of the type described, comprising: a coupling for receiving exhaust gases from an automobile engine; a housing extending from the coupling; a plurality of baffles within the housing for dissipating heat in the exhaust gases, there being holes in each baffle disposed relative to the holes in the other baffles to provide a tortuous travel path for the gases through the baffles; a plurality of charcoal particles disposed within the housing to filter undesirable components in the exhaust gases after the cooling of the gases; a plurality of relatively short length porous conduits embedded within said charcoal particles to provide angularly related dispersion paths for gases moving through said particles and to prevent the packing of the particles; reticulated means disposed between the charcoal particles and the baffles to prevent the movement of the particles towards the baffles; a plate disposed between the porous means and the baffles to thermally isolate the charcoal particles from the baffles; an outlet pipe extending from the housing and having dimensions relative to the coupling to provide for the smooth flow of the exhaust gases through the pipe; and reticulated means disposed between the charcoal particles and the outlet pipe to prevent the movement of the particles into the pipe.

2. A filter device of the type described, comprising: a coupling member for receiving the exhaust gases of an internal combustion engine; a housing flow-connected at one end to said coupling member; apertured plates mounted in spaced-apart relationship transversely of said housing within the end portion thereof adjacent said coupling member, the apertures of each plate being disposed in staggered relationship to the apertures in the adjacent plates whereby said apertured plates define a plurality of tortuous paths for exhaust gases entering said housing; fin elements exteriorly carried by said end portion of the housing for dissipating heat of the exhaust gases conducted thereto; a mass of relatively small filter particles disposed within said housing to absorb undesirable components in the exhaust gases passed through said tortuous paths; and a plurality of conduits of reticulated material embedded within said filter particles and forming expansion chambers and conduits for dispersing and guiding exhaust gases in the flow path of the same through said housing, said conduits holding the filter particles against packing and insuring dispersion of said exhaust gases throughout said mass of filter particles.

3. A filter device of the type described comprising: a coupling member for receiving the exhaust gases of an internal combustion engine; a housing flow-connected at one end to said coupling member; apertured plates mounted in spaced-apart relationship transversely of said housing within the end portion thereof adjacent said coupling member, the apertures of each plate being disposed in staggered relationship to the apertures in the adjacent plates whereby said apertured plates define a plurality of tortuous paths for exhaust gases entering said housing; fin elements exteriorly carried by said end portion of the housing for dissipating heat of the exhaust gases conducted thereto; a mass of relatively small filter particles disposed within said housing to adsorb undesirable components in the exhaust gases passed therethrough; a plurality of conduits of reticulated material embedded within said mass of filter particles and forming expansion chambers and conduits for dispersing exhaust gases in the flow path of the same through said housing, said conduits holding the filter particles against packing and insuring dispersion of said exhaust gases throughout said mass of filter particles; and spaced apart means carried within said housing for confining said filter particles and including means for retarding heat transfer from said exhaust gases moving through said tortuous paths to said particles.

4. A filter device of the type described, comprising: a housing to be flow-connected to the exhaust pipe of an

internal combustion engine; means within the inlet end of said housing forming a plurality of tortuous passages for exhaust gases entering said housing; fin elements exteriorly carried by said housing for dissipating the heat of the exhaust gases moving through said tortuous passages; a pair of reticulated transverse wall members mounted in spaced apart relationship within said housing intermediate the ends thereof; a bed of relatively small filter particles confined within said housing between said wall members; a plurality of open ended conduits of mesh material embedded within said filter particles; a portion of said conduits having their axes angularly arranged relative to the flow-path of said exhaust gases through said housing, and at least some of said conduits being arranged within said bed of filter particles with their axes substantially aligned with the flow path of the exhaust gases through said bed.

5. A filter device as set forth in claim 4 in which said reticulated transverse wall member includes means for

thermally insulating the means forming said plurality of tortuous passageways from the filter particles to maintain the temperature of the particles at a temperature less than the exhaust gases entering said housing.

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