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GASOLINE ENGINE EXHAUST FLAME ARRESTOR

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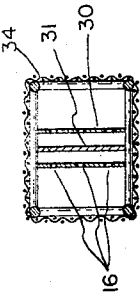


FIG. 3

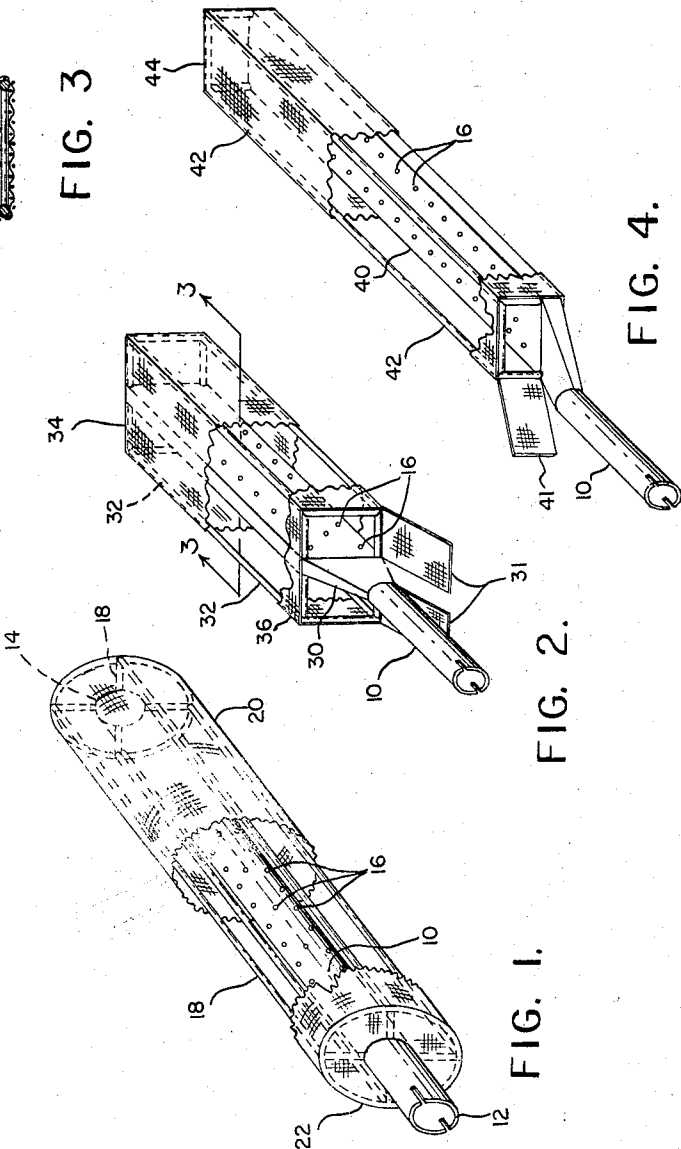


FIG. 2.

FIG. 1.

FIG. 4.

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GASOLINE ENGINE EXHAUST FLAME ARRESTOR

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3 Claims. (Cl. 60—29)

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The invention described herein may be manufactured or used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to flame arrestors and more particularly to a flame arrestor adapted for use on gasoline engine driven vehicles.

In many commercial facilities engaged in the manufacture of explosives or conducting a business where automotive vehicles operate in combustible laden air, it is necessary to provide such vehicles with a flame arrestor for preventing flame issuing from the engine exhaust system from entering the atmosphere and setting fire to debris beneath the vehicles and/or igniting a combustible gaseous mixture. At present there is a need for a small, inexpensive and efficient flame arrestor since those currently in use have proven unsatisfactory in service.

The flame arrestors of the type disclosed in this invention are all adapted for insertion in the engine exhaust system and are usually installed on the tail end of the exhaust pipe extending from the muffler. The flames emitted from the combustion area of the engine are arrested by the flame arrestor thereby preventing the escape of bare flame into the atmosphere.

There are many conditions which may cause a gasoline engine to afterfire and emit a flame which, in some cases, may extend several feet from the vehicle. Some engines are more prone to afterfire than others. Usually a large size gasoline engine truck installation will afterfire when decelerated or motored by the rear wheels. When this condition occurs in operation, a high intake manifold vacuum exists in the engine and more fuel is taken into the cylinders than is being burned. Upon acceleration of the engine, the unburned gases are discharged into the exhaust system and the hot exhaust manifold or an explosion from another cylinder ignites the unburned gases thereby causing the afterfire.

Afterfires with a properly adjusted engine may occur in starting. Improper starting procedures or slow cold weather starts may fill the exhaust system with unburned gases which are subsequently ignited by one of the cylinders of the engine. Afterfires may also be caused by faulty ignition, poor timing, worn or warped valves or excessive carbon. It is therefore apparent that afterfires are caused by many different and varied conditions in an engine, and as a result, a potential hazard is ever present in the operation of a vehicle.

Since the days of the earliest locomotives, many methods have been attempted to suppress the afterfire flame. The only positive way of suppressing this flame has been by exhausting through or over water but the disadvantages inherent in the structures utilized for this purpose are so great as to preclude their use.

Another method used to prevent afterfires is to maintain combustion in the exhaust system which eliminates all combustibles as they are discharged from the cylinders. However, these units are expensive and require

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frequent servicing, and further require the use of unleaded gasoline in the engine.

Still another method of preventing afterfires is to enrich the combustible mixture so that it will not support combustion. This is obtained by taking advantage of a very high intake manifold vacuum to reduce the air supply to the carburetor thereby eliminating afterfires at their source. Desirable results have been produced under certain conditions of operation but this is only a partial answer for safe operation in hazardous areas.

The present invention eliminates the deficiencies inherent in prior art apparatus by providing a flame arrestor which is inexpensive and efficient in operation, but still is of such small size as to be conveniently mounted on the exhaust pipes of present exhaust systems.

An object of the invention is to provide a flame arrestor which douses the exhaust flame while still preventing back pressure in the system.

A further object of the invention is to provide a flame dispersion tube in the flame arrestor for breaking the flame into a plurality of smaller units.

Another object of the invention is the provision of a fine wire mesh screen which is spaced from a flame dispersion tube and is capable of rapidly passing exhaust gases to the atmosphere.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

Fig. 1 is a perspective view of the flame arrestor of the invention showing a flame dispersion tube having a screen positioned therearound for containing an afterfire flame;

Fig. 2 is a perspective view showing a slightly modified form of the invention shown in Fig. 1;

Fig. 3 is a view taken on lines 3—3 of Fig. 2 showing a baffle arrangement in the flame dispersion tube; and

Fig. 4 is a perspective view showing another modification of the invention.

Referring now to the drawings wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in Fig. 1 a pipe 10 having an inlet 12 adapted for connection to the tail pipe of an engine driven vehicle. The other end of the pipe 10 is closed by a cap 14 so that exhaust gases or flames entering pipe 10 are forced out of dispersion holes 16 transversely bored in the circumferential portions of the pipe. Welded or otherwise secured to the outer periphery of pipe 10 is a tubular framework 18 of steel rods for supporting and spacing a wire mesh screen 20 from the pipe. The screen is preferably made of 6 by 6 or 8 by 8 mesh industrial bronze wire cloth, although other sizes may be used, and is closed at its back end to prevent the escape of flames directly to the atmosphere. The front end of screen 20, shown broken away in Fig. 1, extends forwardly to connect with a circular screen plate 22 of the same material so as to form a complete seal over the pipe 10.

The modification shown in Fig. 2 and 3 is somewhat similar to that of Fig. 1 except that an extension 30 is welded to the end of pipe 10 and is provided with dispersion holes 16 for breaking the flame into small components. The extension 30 is of rectangular shape and the dispersion holes are positioned on opposite sides for directing the flame outwardly of the pipe. Mounted within the extension and extending the length thereof is a section of sheet steel 31 which divides the extension into a pair of identical compartments. The function of section 31 is to prevent a "torching effect," which is the feeding of gases or flame through any one particular hole or series of holes on one side of the extension. Section 31 precludes this action from taking place and the

flames are caused to extend a like amount on opposite sides of the extension.

As is evident from these figures, framework 32 is attached, as by welding, to the top and bottom portions of extension 30 for supporting mesh screen 34 which encompasses the flame dispersion member. In the preferred form, the screen is permanently attached to the extension, but in some installations, it can be detachably mounted for cleaning purposes. The back end of extension 30 is closed by a plate which restricts the outlet of the flame to the dispersion holes 16. It is to be understood that screen 34 completely encompasses extension 30, when flaps 31 are welded in place, and forms a tight fit therewith so that the only openings between the extension and the atmosphere are those provided in the screen itself. The size of the screen and the size and relative location of the dispersion holes 16 on extension 30 are the same as those as described in Figure 1.

The modification shown in Fig. 4 is similar to the embodiments of Figs. 1 and 2 and differs in that an extension 40 is welded to the end of pipe 10. This likewise is of rectangular cross section and is provided with dispersion holes 16 which are formed only in the top surface thereof. A framework of tubular steel rods 42 are welded to the top of member 40 for receiving mesh screen 44 which is adapted to completely enclose extension member 40 when flap 41 is welded in place. This modification of the invention is considerably longer than the apparatus of Figures 1 and 2 since the dispersion holes are formed only in the top surface for providing an outlet for the flame. It is to be noted that a baffle arrangement is not necessary in this embodiment because the bottom plate opposite the dispersion openings serve to prevent the torching effect described above.

In each of the above-described modifications, the size and spacing of dispersion holes 16 extending longitudinally of the device must be selected according to the size of the exhaust system being modified. As a general proposition, the holes 16 must provide a discharge area at least equal to the cross-sectional area of the exhaust tail pipe. In all of the various modifications designed and tested, it has been found that the dispersion holes 16 will break a severe afterfire flame in the extension into many short lengths providing the holes are not too large or spaced too closely together.

Further, the enclosing screen must also be selected according to the exhaust system being treated. Where the screen is placed in close relationship with pipe 10 and the openings are of relatively large size, the afterfire will pierce the openings and flow into the atmosphere, thereby destroying the protection that the device affords. On the other hand, the screen must not be of too fine mesh, if closely positioned with respect to the extension, because explosive gases will be trapped within the screen and cause a flash-through thereby obtaining a detrimental and rapid burning of the wire screen.

The test results on the embodiment of Figure 2 for example, show that optimum performance was obtained where a 1" x 4" x 11" extension was attached to the end

of a two inch exhaust tail pipe. A total of 64 dispersion holes of 1/4" diameter were bored in the extension according to a predetermined pattern and covered by a 4" x 7 1/2" x 11", 6 x 6 mesh wire cloth. Different methods were utilized for producing afterfires and the most severe afterfire obtained under adverse conditions produced a flame through the dispersion holes of less than 3". It is to be understood that the scope of the invention is not to be construed as being limited to the specific dimensions described in the above illustration, since satisfactory results were obtained on many sizes and shapes of spark arrestors that were designed and tested.

The invention is also capable of preventing a flash-through which is caused by gases igniting within the screen. This however, requires a screen of approximately 40 mesh which is spaced a greater distance from the extension member than that recited in the above illustration.

Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In combination with a gasoline driven engine exhaust system, an after-fire arresting device comprising an elongated tube closed at one end and having an inlet adapted for attachment to said exhaust system, an elongated plate member within said tube and extending longitudinally thereof, whereby the tube is divided into two elongated passageways extending substantially the length thereof; said tube having formed therein, at spaced intervals, a plurality of flame dispersion holes for breaking flame into a number of small components, said holes having a total cross-sectional area at least as great as the cross-sectional area of said inlet, a fine mesh screen encompassing said tube and means for spacing said screen from said tube, said screen being of a size capable of confining said small flame components within said screen

2. The combination according to claim 1 wherein said tube is of a rectangular cross-section and said openings are formed in a pair of oppositely disposed sides.

3. The combination according to claim 2 wherein said elongated plate extends parallel to said pair of oppositely disposed sides, whereby said tube is divided into a plurality of elongated compartments of rectangular cross-section thereby preventing a torching effect from occurring within said tube.

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