Dec. 3, 1968 B. M. SCHONGS ET AL 3,413,804

DEVICE FOR TREATING EXHAUST GASES

Filed Sept. 1, 1966

Fig. 1

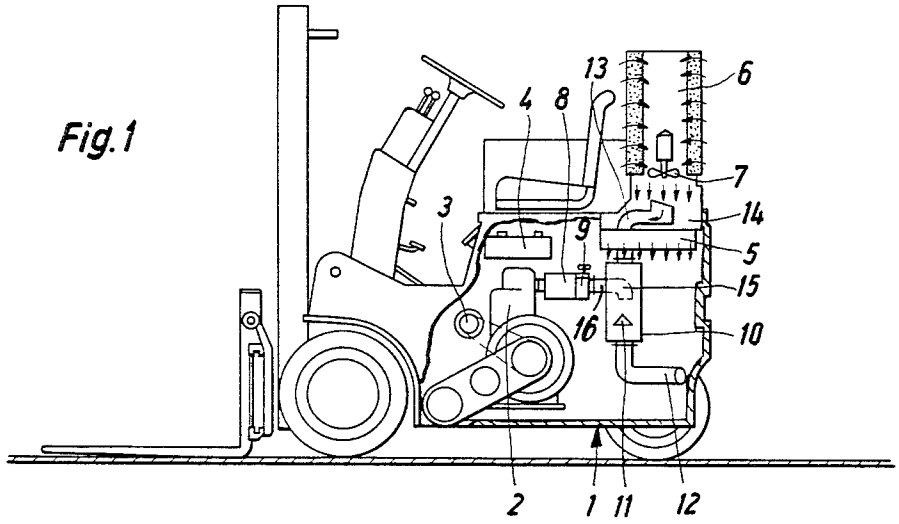
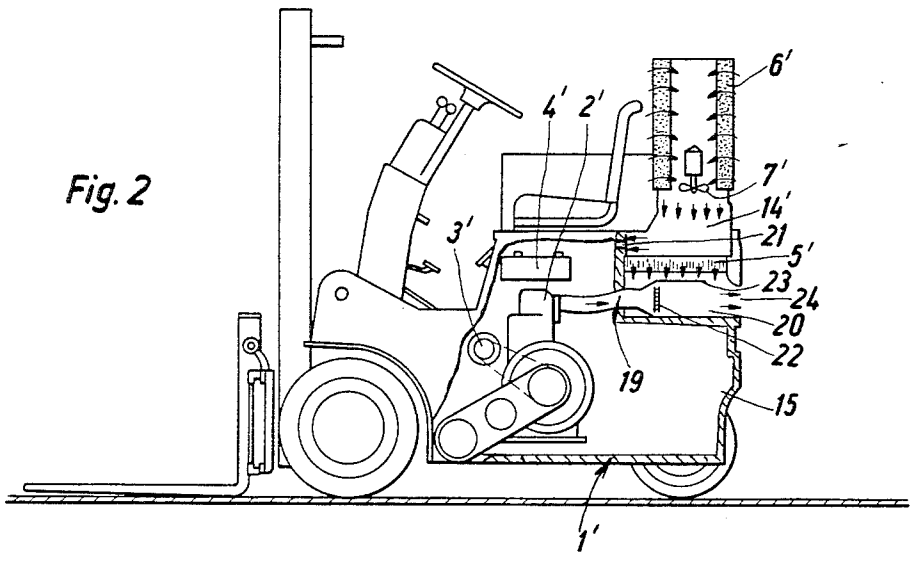


Fig. 2



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United States Patent Office

3,413,804

Patented Dec. 3, 1968

3,413,804

DEVICE FOR TREATING EXHAUST GASES

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Filed Sept. 1, 1966, Ser. No. 576,572
Claims priority, application Germany, Sept. 7, 1965, St 24,366
3 Claims. (Cl. 60—30)

ABSTRACT OF THE DISCLOSURE

A device for treating exhaust gases from internal combustion engines, particularly for use on vehicles carrying explosives or exposed to an explosive atmosphere, includes a mixing chamber connected to the exhaust gas conduit and which is arranged to receive fresh air from atmosphere for mixing with the exhaust gases in order to reduce the temperature of the gases below a temperature at which there is a danger of further ignition or explosion of the gases. In one embodiment the air is drawn directly through a filter which is constructed to entrain any explosive substances in suspension and into the mixing chamber for direct mixing with the exhaust gases. In another embodiment, the air is first directed through the engine water cooler or heat exchanger so that it is partially heated before it is brought in contact with the exhaust gases but is still cool enough to reduce the exhaust gases below a critical temperature to one in which ignition or sparking is not possible.

This invention relates in general to the construction of internal combustion engines and in particular to a new and useful exhaust gas treatment device for internal combustion engines which provides for means for mixing the hot exhaust gases with cooler primary air in order to lessen danger of explosion within the vicinity of the exhaust gases.

The present invention is particularly applicable for use with vehicles or field conveyors such as fork-lift trucks which include internal combustion engines as propulsion units. Such devices are sometimes employed for the transportation of explosives or employed within rooms which have explosion prone atmospheres. Therefore it is necessary to cool the exhaust gases of the internal combustion engines so that neither the high temperature gases or any sparks which may be present would be likely to set off an explosion. For this purpose, it is generally necessary to insure that the exhaust gases do not get any hotter than 120° C. and that the gases do not carry sparks or red hot particles which will be exhausted to the surrounding area.

In the conventional models of explosion protected exhaust gas systems for vehicles or field conveyors all spark forming parts are encapsulated separately or in structural groups. The entire exhaust system is cooled with water and the exhaust gas is passed through a water bath before it is discharge into the open. A disadvantage with such apparatus is that it is very complicated and expensive and difficult to maintain.

In accordance with the invention, there is provided a construction which includes an exhaust gasline for an internal combustion engine of an apparatus such as a field conveyor or fork-lift truck in which the exhaust line is directed into a mixing chamber into which cooling air is introduced along with the exhaust gases before the gases are permitted to discharge into atmosphere. In the preferred arrangement, cooling air is drawn in through a filter arrangement to insure that no explosive particles will reman in suspension in the cooling air which is subsequently

directed over the exhaust gases in a mixing chamber. Additional filter means may advantageously include spark interceptors and flame protection devices which are arranged in the path of the exhaust gases.

A feature of the construction is that the arrangement permits an inexpensive and simple arrangement for cooling the exhaust gases to a suitable low temperature at which they will be unlikely to cause explosion and also the removal of any particles from the gases which may be apt to carry sparks or glowing matter. The device provides high safety and operates with low power consumption and requires very little servicing. The effect of the use of the apparatus is to admix to the hot exhaust gases such a quantity of air of lower temperature that the resulting mixed temperature of the exhaust gas mixture which issues into the free atmosphere will lie below the temperature safety limits.

Accordingly, it is an object of the invention to provide an improved means for eliminating the danger of explosion from the exhaust gas of the internal combustion engine.

A further object of the invention is to provide a device for use in association wtih internal combustion engines on vehicles and the like and which includes means for directing a cooling air stream into association with the exhaust gases before they are delivered to atmosphere and for preferably additionally insuring that the exhaust gases are screened or filtered so that they do not carry over any sparks or ignitable elements.

A further object of the invention is to provide a device for use in association with exhaust gaslines of internal combustion engines for insuring the delivery of exhaust gases which will not produce explosions and which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

In the drawings:

FIG. 1 is a schematic partial side elevational and partial sectional view of an exhaust gas system for a fork-lift truck constructed in accordance with the invention;

FIG. 2 is similar to FIG. 1 of another embodiment of the invention.

Referring to the drawings in particular the invention embodied therein as indicated in FIG. 1 includes an exhaust gas treatment apparatus employed for a vehicle such as a fork-lift truck having a chassis or body which is generally designated **1**. An internal combustion engine **2** is mounted on the chassis **1** as is a battery **4** and a generator **3** for an electrical system therefor.

In accordance with the invention the exhaust gases from the engine **2** are directed outwardly first through a muffler or sound damper **8** which includes a flame protection device **9**. The gases which leave the flame protection device **9** are directed outwardly through a conduit **16** and are discharged through a nozzle **15** into a mixing chamber **10**. The mixing chamber **10** advantageously includes a conical baffle **11** for spreading the gases outwardly to facilitate the mixing of the gases with cooler air which is also directed into the mixing chamber.

In accordance with a feature of the invention, air is drawn inwardly through an air filter **6** arranged adjacent the top of the chassis **1** under the action of a fan **7** which is located within the filter. The air is directed by the fan **7** downwardly into a pressure chamber **14** after it is taken

in through the filter and part of it is directed through a conduit **13**, which extends through an engine water cooler or heat exchanger **5** and into the upper end of the mixing chamber **10**, and another part is directed directly through the heat exchanger **5**.

The nozzle **15** is advantageously shaped to provide a suction effect at its discharge so that it aids in drawing the air into the mixing chamber **10** where it is thoroughly mixed with the exhaust gases being discharged through the nozzle. The baffle **11** aids in insuring complete mixing of the air and the exhaust gases before they are directed outwardly through the exhaust conduit **12**. The inlet for the conduit **13** is located in a space **14** of maximum pressure between the fan **7** and the heat exchanger **5**.

In the embodiment illustrated in FIG. 2 there is shown a fork-lift truck having a chassis generally designated **1'**. An internal combustion driving engine **2'** is mounted on a chassis **1'** and is arranged to drive a generator **3'** as in the other embodiment. The battery **4'** is also indicated on the chassis. In this embodiment air is drawn through a filter **6'** by a fan **7'** and passes through a chamber **14'** where part may be delivered through apertures **21** to circulate within the interior portion **15** of the chassis over the exhaust line **19**. Additional parts of the air may be directed directly through a cooler **5'** into a mixing chamber **20** having a flame protection device or wall **22** therein at the location of the inlet of the exhaust line **19**. In addition, a protecting wall **23** is provided in the path of the incoming air stream in order to provide for a shielding action in the vicinity of hot exhaust gases and to prevent the rusting of the cooler **5**. The exhaust gases which are directed through the exhaust pipe **19** into the mixing chamber **20** are cooled so that the temperature of the mixed gases is lowered sufficiently below any ignition temperature before it passes through an outlet or discharge **24**. The embodiment indicated in FIG. 2 is particularly applicable for the use with vehicles having limited interior space. With this embodiment the primary air is utilized most economically for cooling purposes.

It should be appreciated that especially in the case of larger vehicles there are more spaces available for the installation and the driving engine **2** and therefore additional elements may be employed for an additive filtering of the air including an additional blower if possible. Where large quantities of air may be circulated, the air may be fed directly into the mixing chamber for lowering the temperature of the exhaust gases therein.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A device for treating exhaust gases from internal combustion engines, particularly for use on vehicles used for carrying explosives and for use in operating in explosive prone atmospheres comprising means defining a mixing chamber having a discharge to atmosphere for treated exhaust gases, an internal combustion engine exhaust conduit having a discharge opening in said mixing chamber, an air filter for entraining explosive substances in suspension, an engine water heat exchanger, and means for drawing air through said air filter from the atmosphere and for directing at least a portion of the air through said heat exchanger and at least a portion of the air into said mixing chamber to mix the air with and cool said exhaust gases to a temperature and consistency at which they will have substantially no tendency to initiate explosions, engine housing means surrounding said exhaust conduit, and passage means connected to said filter for directing a part of the incoming air from said filter into the interior of said housing means in order to build up an excess pressure therein.

2. A device according to claim **1**, including housing means for said engine surrounding said exhaust conduit, means defining a passage from said filter to said heat exchanger having an opening for the passage of a portion of the air entering said filter into said housing, said heat exchanger forming a wall of said mixing chamber and a portion of the air passing through said filter flowing through said heat exchanger into said mixing chamber, said means for drawing air through said filter comprising a fan located within said filter.

3. A device according to claim **2**, including a flame protection device arranged adjacent the discharge of said exhaust gases in said mixing chamber.

References Cited

UNITED STATES PATENTS

2,036,556	4/1936	Tomlinson	60—30
2,687,008	8/1954	Van Vactor	60—30
2,795,103	6/1957	Jenison	60—30
2,544,605	3/1951	Mallory	60—30 X

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