May 15, 1956 C. E. STOLTZ 2,745,646

EXHAUST GAS CONDITIONER

Filed March 30, 1954 3 Sheets-Sheet 1

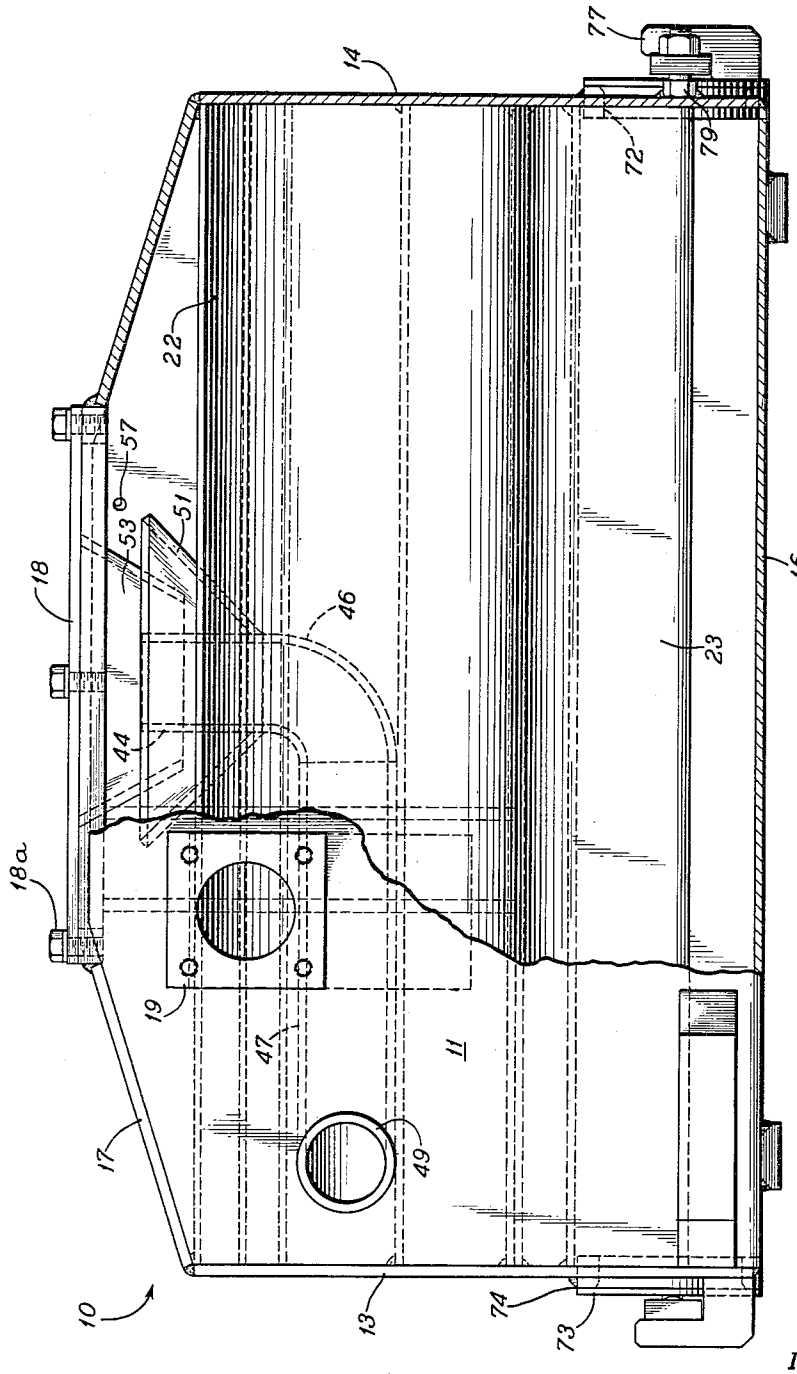


Fig. 1

INVENTOR.
Charles E. Stoltz
BY
Murray G. Gleeson
ATTORNEY

May 15, 1956 C. E. STOLTZ 2,745,646

EXHAUST GAS CONDITIONER

Filed March 30, 1954 3 Sheets-Sheet 2

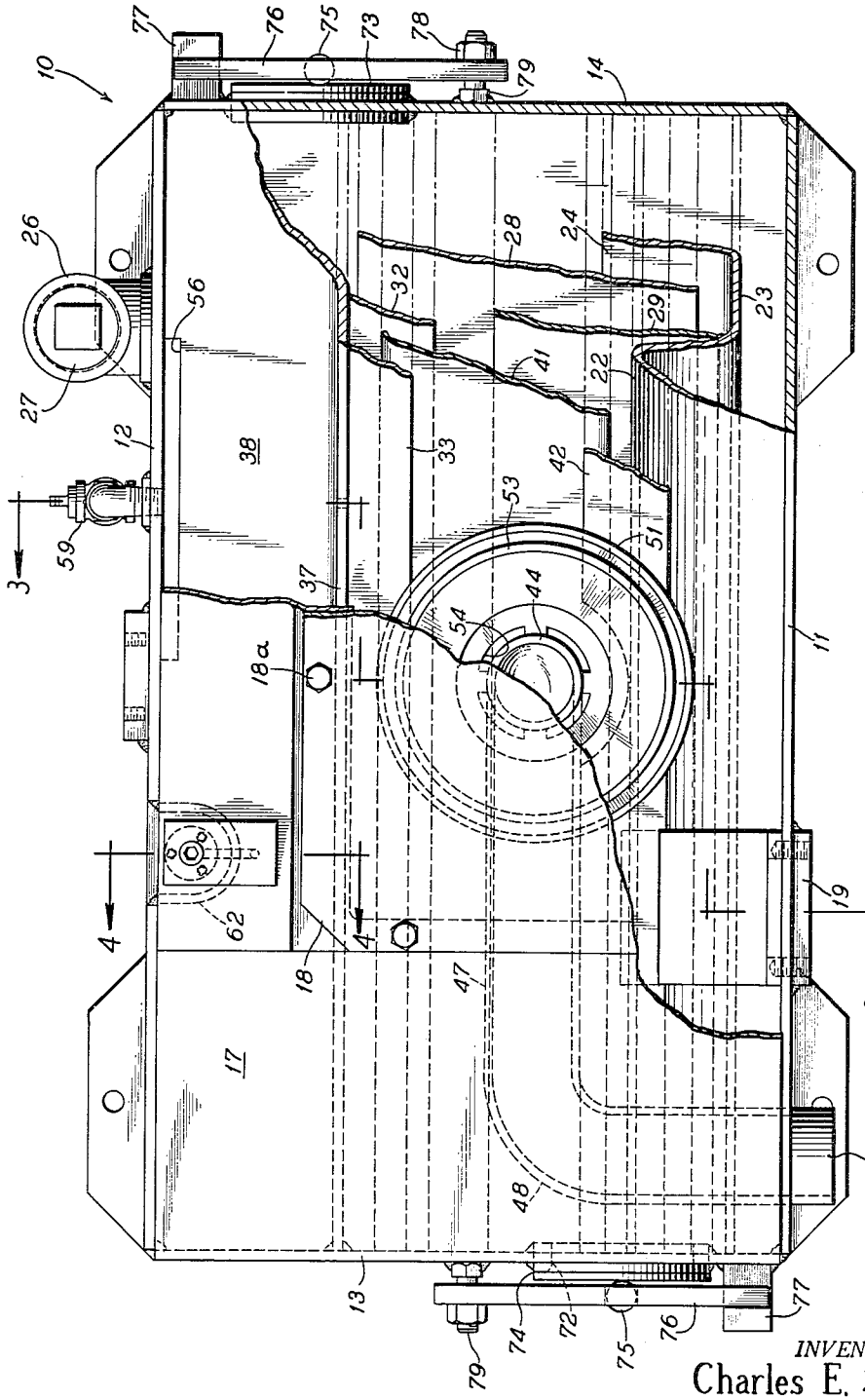


Fig. 2

INVENTOR.
Charles E. Stoltz
BY
Murray A. Gleeson
ATTORNEY

May 15, 1956 C. E. STOLTZ 2,745,646

EXHAUST GAS CONDITIONER

Filed March 30, 1954 3 Sheets-Sheet 3

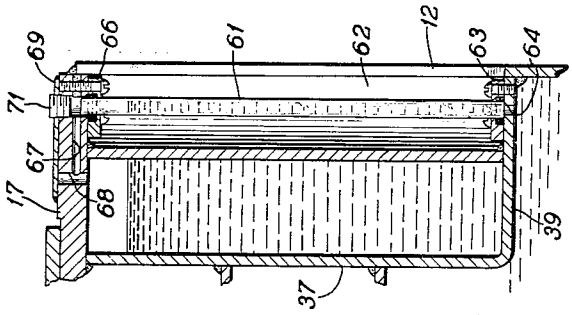


Fig. 4

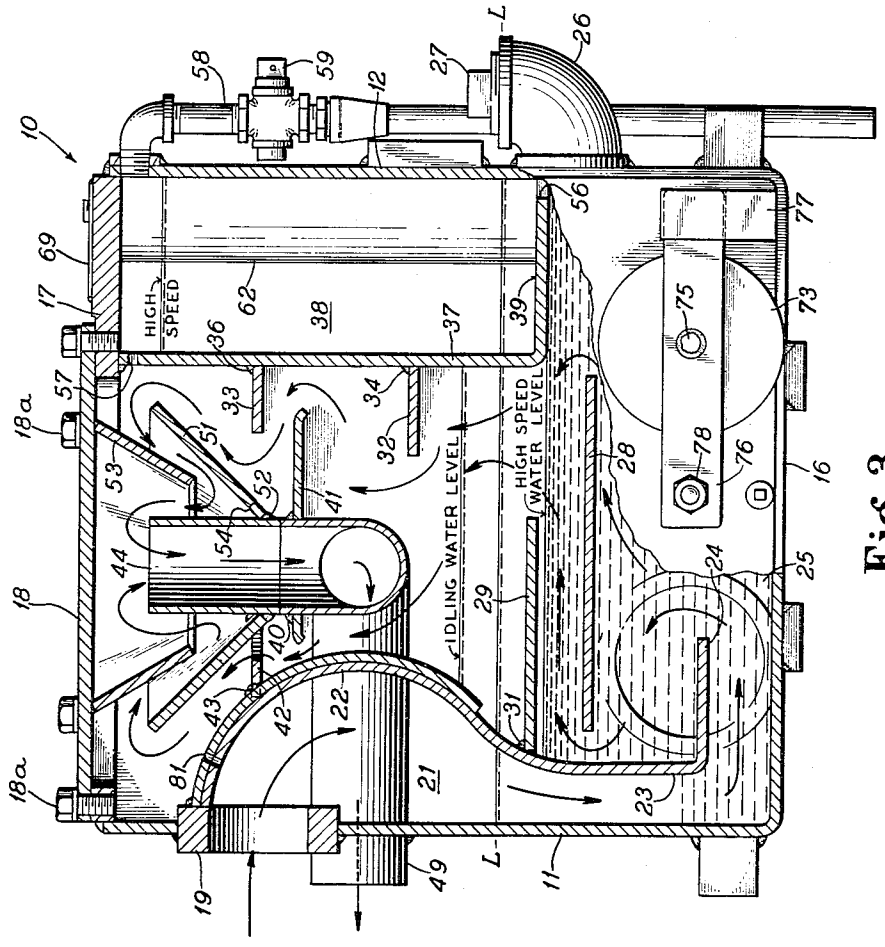


Fig. 3

INVENTOR.
Charles E. Stoltz
BY
Murray A. Gleeson
ATTORNEY

United States Patent Office 2,745,646 Patented May 15, 1956

2,745,646

EXHAUST GAS CONDITIONER

Charles E. Stoltz, Chicago, Ill., assignor to Goodman Manufacturing Company, Chicago, Ill., a corporation of Illinois

Application March 30, 1954, Serial No. 419,876

10 Claims. (Cl. 261—123)

This invention relates generally to the devices for conditioning the exhaust gases from a diesel engine or the like, and more particularly to improved apparatus whereby the amount of liquid for conditioning the exhaust gases may be varied in accordance with the operation of the engine.

Because of the low carbon monoxide content of the exhaust gases from a diesel engine, it is possible to operate diesel-powered locomotives in a mine underground. However, the exhaust gases contain certain noxious constituents such as oxides of sulfur and nitrogen, and certain organic compounds such as aldehydes and acrolein. All of these last constituents are miscible in water, and can be removed from the gases by the bubbling of same beneath a body of water.

In accordance with mine safety codes, the presence of such noxious materials in the exhaust gases must be kept below a stated minimum. Ordinarily this has been possible with the relatively inefficient conditioners of the prior art only when the locomotive is moving at relatively high speed, or ventilating air is flowing rapidly past it, so as to dilute the noxious gases that get through the conditioner in the ventilating air stream. An idling operation, and at relatively slow speeds, however, when the diluting effect of the moving air stream is relatively ineffective, the percentage of such noxious constituents is higher than at the normal running condition; at such time, it obviously would be desirable to provide a larger volume of conditioning liquid through which the exhaust gases may bubble, and to conserve the liquid at other times when less is required for conditioning.

A problem in the past with conventional conditioners has been that, whenever sufficient conditioning liquid is used to properly treat and remove the noxious gases during idling, a substantial amount of this conditioning liquid has been blown out when the locomotive is operating at high speed. Accordingly, it is an object of the present invention to take the liquid which rises above a predetermined level during high speed operation, and which would be carried out of the conditioner, and transfer it to a storage compartment from whence it is returned whenever the engine speed slows down.

According to the present invention the exhaust gases from a diesel engine are bubbled through a quantity of conditioning liquid, the gases taking a tortuous path therethrough. During idling, the amount of liquid is maintained at a desirable maximum, but under conditions when the engine is operating at higher speeds, only a smaller amount of conditioning liquid is required, and under such conditions the excess of conditioning liquid is caused to pass from one chamber into an auxiliary chamber where it is stored until required for the idling or low load condition of the engine.

The invention accordingly comprehends the provision of means which will act automatically to cause transfer of the excess of liquid from one chamber into the auxiliary chamber, and more particularly the provision of means controlling the pressure within the auxiliary chamber for determining the amount of liquid held in such auxiliary chamber.

With the foregoing considerations in mind it is a principal object of this invention to provide a conditioner for the exhaust gases from a diesel-powered mine locomotive or the like, where the liquid employed in conditioning the gases is varied in amount in accordance with the operating condition of the engine.

Other objects and important features of the invention will be apparent from a study of the following specification taken with the drawings which together show a preferred embodiment of the invention, and what is now considered to be the best mode of practicing the principles thereof. Other embodiments of the invention may be suggested to those having the benefit of the teachings herein, and it is accordingly intended that the scope of the invention not be limited by the precise embodiment herein shown, such other embodiments being intended to be reserved especially as they fall within the scope and purview of the subjoining claims.

In the drawings:

Fig. 1 is a front elevation view of an exhaust gas conditioner for a diesel mine locomotive or the like, certain parts being broken away in order to show details of construction of such conditioner;

Fig. 2 is a plan view thereof, certain parts being broken away to show additional details of construction;

Fig. 3 is a vertical section taken along the line 3—3 of Fig. 2, certain parts thereof being shown in end elevation; and

Fig. 4 is a vertical section taken along line 4—4 of Fig. 2.

Referring now to the drawings, the exhaust conditioner according to the present invention is referred to generally by the reference numeral 10, and includes a walled housing comprising a front wall 11, a back wall 12, and opposite end walls 13 and 14. The walls 11, 12, 13 and 14 extend upward from a bottom 16, and the walled chamber includes a top 17 provided with a closure 18 held to the top 17 by cap screws 18*a*.

Exhaust gases enter the housing described at a flange 19 to be dispersed evenly throughout the length of an expansion chamber 21, extending for the length of the front wall 11, and defined by a generally semicircular wall 22 and a lower wall 23 both spaced from the front wall 11, the lower wall 23 being turned inward from the front wall 11 as at 24. The inward extension 24 is spaced above the bottom 16 as seen in Fig. 3 and the gases entering at the flange 19 are thus expanded within the chamber 21 to pass between the extension 24 and the bottom 16 to bubble up through a body of liquid contained within a chamber 25 within the housing.

As seen in Fig. 3, the back wall 12 is provided with a filling elbow 26 closed by a plug 27 so that the chamber can be filled to a level L—L, which level is maintained when the engine is stopped.

The gases leaving the expansion chamber 21 are conditioned by bubbling thereof through the body of liquid contained within the chamber 25. The pressure of the engine gases causes the chamber 21 to be emptied of liquid and the liquid to rise in chamber 25 to the level marked "idling water level" during idling of the engine.

It is desirable to have the gases take as tortuous a path as possible through the body of liquid contained within the chamber 25, and to this end the gases emerging from beneath the extension 24 are diverted within the chamber 25 by a baffle 28 held at each end by weldments, not shown, to the inside of the end walls 13 and 14. As seen in Fig. 3, a portion of the gases are additionally caused to take a path between the baffle 28 and a baffle 29 disposed above baffle 28, and secured along one edge by a weldment 31 to the lower wall 23 of the

expansion chamber 21, the baffle 29 being additionally secured at its end by weldments, not shown, to the opposite end walls 13 and 14.

The gases bubbling up through the body of liquid within chamber 25 entrap the liquid in the form of a mist or the like, and such entrapped liquid is wrung out from the gases by additional baffling members now to be described. To this end baffling members 32 and 33 are secured respectively by weldments 34 and 36 to a wall 37 of an auxiliary chamber 38, said chamber 38 being provided with a bottom 39. The wall 37 and the bottom 39 are welded at their ends to the opposed end walls 13 and 14. In addition to the baffles 32 and 33, the gases must move past baffles 41 and 42, baffle 42 being secured by a weldment 43 to the curved wall 22 of the expansion chamber 21.

The gases which have been thus conditioned leave the chamber 25 by means of a vertical pipe 44 which is joined by an elbow 46, see Fig. 1, in turn joined to a pipe 47. An elbow 48 is joined to the pipe 47, see also Fig. 2, and the gases emerge from the chamber 25 by means of a pipe 49 passing through the front wall 11.

As seen in Fig. 3, the baffle 41 is held to the vertical pipe 44 by means of a circular weldment 40.

Before emerging from the chamber 25 by the piping system consisting of the pipes 44, 47, 49 and elbows 46 and 48, the gases are additionally separated from their entrained liquid by means of a frustro-conical baffle 53 welded to the underside of the closure 18. As seen in Fig. 3, the conical baffle 53 surrounds the pipe 44 to cause the emerging gases to take an additional tortuous path. Any water wrung out from the gases by the conical baffles 51 and 53 is returned to the body of liquid by means of openings 54 formed in the conical baffle 51.

Under conditions when the engine is operating at high speeds, less water is required to condition the gases, since under such conditions the locomotive is moving in the ambient which dilutes the gases readily. In order to conserve the conditioning liquid for the idling operation previously described, the liquid is accordingly moved in part by the higher pressures from the exhaust gases into the auxiliary chamber 38. The chamber 38 accordingly has an opening 56 in the bottom 39 for movement of the liquid, and a metering opening 57 at the top of the wall 37 controlling the pressure within chamber 38. In order to provide for a differential pressure between the chamber 25 and the auxiliary chamber 38 by means of throttling taking plate at the metering opening 57, the chamber 38 is vented by means of a pipe 58 having a valve 59 therein. The metering opening 57 and the valve 59 are thus arranged to give a lower pressure condition within the chamber 38 so that the liquid may rise therein to the high speed level shown. The valve 59 may accordingly be cracked, so as to regulate the pressure within the chamber and the height of the liquid therein.

Means are provided to give a visual indication of the proper level of the liquid within the chamber 38, and to this end a water gauge 61 is housed within a circular recess 62 in the back wall 12. Said water level gauge is supported at its lower end in a fitting 63, and the bottom of the tube thereof is open as at 64 to the chamber 25. The upper end of the tube 61 is also held in a similar fitting 66 and the upper end of the tube is open to the pressure within the chamber 38 by means of intersecting passageways 67 and 68 formed in the top 17 of the housing, the passageway 68 being closed by means of a plate 69 welded to the top plate 17. A clean-out plug 71 may be tapped into the plate 69 so that the tube may be cleaned as desired.

At the close of a shift the entire chamber 25 may be cleaned at clean-out openings 72 disposed in the end walls 13 and 14. Said clean-out openings are closed by a plate 73 and a gasket 74 held in place by a pressure arm 76. The pressure arm 76 is held in place by means of a latch 77 and the pressure against the plate 73 is exerted by a ball 75, pressure being adjusted by means of a nut 78 threaded to a stud 79 extending from the end wall 14.

Back siphoning of liquid from the chamber 25 when the engine cools after operation is prevented by an opening provided in the wall 22 above the level of the liquid. It will be apparent that the exhaust manifold of the engine which is connected to the conditioner at the flange 19, is thus connected to ambient through the outlet pipe 49 from the chamber 25.

From the foregoing description it is believed apparent that there has been provided a novel improvement in devices for conditioning the exhaust gases from a diesel engine or the like. According to the invention an auxiliary supply of conditioning liquid is made available during idling of the engine when the locomotive is generally in a stationary position, at which time the noxious constituents of the exhaust gases would tend to be greatly concentrated at one point. Under the high speed condition of the engine, when the locomotive is generally moving in the ambient, sufficient water only is provided to condition the gases, the excess of water being moved into the auxiliary chamber to be held available for a resumption of the idling condition.

While the invention has been described in a preferred embodiment thereof, it is intended that the scope of the invention be limited only by the claims here appended.

I claim as my invention:

1. A conditioner for exhaust gases from a diesel engine or the like comprising a walled housing, a vertical partition spaced from one of the walls of said housing so as to divide said housing into two side-by-side walled chambers, one of said chambers being connected to an exhaust manifold so as to enable exhaust gases to be expanded therein, a body of liquid contained in said other chamber, an opening between said two chambers so as to enable the exhaust gases to move from said first chamber to the second to bubble up through the liquid contained in said second chamber, an auxiliary chamber communicating with said second chamber and arranged to receive water from said second chamber when the pressure from said exhaust gases is in excess of a predetermined amount, and to discharge liquid back into said second chamber when the pressure from said exhaust gases decreases below a predetermined amount, means for regulating the amount of liquid moving from said second chamber to the auxiliary chamber by controlling the pressure within said auxiliary chamber including a metering passageway connecting said second chamber and said auxiliary chamber, and means for regulating the flow through said metering passageway.

2. A conditioner for exhaust gases from a diesel engine or the like comprising a walled housing, a vertical partition spaced from one of the walls of said housing so as to divide said housing into two side-by-side walled chambers, one of said chambers being connected to an exhaust manifold so as to enable exhaust gases to be expanded therein, a body of liquid contained in said other chamber, an opening between said two chambers so as to enable the exhaust gases to move from said first chamber to the second to bubble up through the liquid contained in said second chamber, an auxiliary chamber communicating with said second chamber only and arranged to receive water from said second chamber when the pressure from said exhaust gases is in excess of a predetermined amount, and to discharge liquid back into said second chamber when the pressure from said exhaust gases decreases below a predetermined amount, and means for controlling the amount of liquid moving from said second chamber to said auxiliary chamber comprising means for controlling the pressure within said auxiliary chamber.

3. A conditioner for exhaust gases from a diesel engine or the like comprising a walled housing, a vertical partition spaced from one of the walls of said housing so as to divide said housing into two side-by-side walled chambers, one of said chambers being connected to an exhaust manifold so as to enable exhaust gases to be expanded therein, a body of liquid contained in said other chamber, an opening between said two chambers so as to enable the exhaust gases to move from said first chamber to the second to bubble up through the liquid contained in said second chamber, an auxiliary chamber communicating with said second chamber only and arranged to receive liquid from said second chamber when the pressure from said exhaust gases is in excess of a predetermined amount, and to discharge liquid back into said second chamber when the pressure from said exhaust gases decreases below a predetermined amount, and means providing regulatable communication of said auxiliary chamber with the atmosphere for regulating the amount of liquid moving from said second chamber to said auxiliary chamber.

4. A conditioner for exhaust gases from a diesel engine or the like comprising a walled housing, a vertical partition spaced from one of the walls of said housing so as to divide said housing into two side-by-side walled chambers, one of said chambers being connected to an exhaust manifold so as to enable exhaust gases to be expanded therein, a body of liquid contained in said other chamber, an opening between said two chambers so as to enable the exhaust gases to move from said first chamber to the second to bubble up through the liquid contained in said second chamber, means for providing a tortuous path of said gases through said liquid, and an auxiliary chamber communicating with said second chamber only and arranged to receive liquid from said second chamber when the pressure from said exhaust gases is in excess of a predetermined amount, and to discharge liquid back into said second chamber when the pressure from said exhaust gases decreases below a predetermined amount, the level in said auxiliary chamber being adjusted by means controlling the pressure therewithin.

5. A conditioner for exhaust gases from a diesel engine or the like comprising a walled housing, a vertical partition spaced from one of the walls of said housing so as to divide said housing into two side-by-side walled chambers, one of said chambers being connected to an exhaust manifold so as to enable exhaust gases to be expanded therein, a body of liquid contained in said other chamber, an opening between said two chambers so as to enable the exhaust gases to move from said first chamber to the second to bubble up through the liquid contained in said second chamber, and an auxiliary chamber communicating with said second chamber only and arranged to receive liquid from said second chamber when the pressure from said exhaust gases is in excess of a predetermined amount, and to discharge liquid back into said second chamber when the pressure from said exhaust gases decreases below a predetermined amount, said auxiliary chamber having regulatable communication with the atmosphere.

6. A conditioner for the exhaust gases from a diesel engine or the like comprising a chamber having a quantity of conditioning liquid therein, means for introducing exhaust gases from said engine below the surface of said liquid, a second chamber in communication with said first chamber, said second chamber being arranged to receive conditioning liquid from said first chamber when the pressure of said exhaust gases increases beyond a predetermined amount and being arranged to return conditioning liquid to said first chamber when the pressure of said exhaust gases is below a predetermined amount, means for regulating the amount of liquid moving from said first chamber comprising pressure-controlling apparatus including a metering passageway connecting said

first chamber with said second chamber, and means for regulating the flow through said metering passageway.

7. A conditioner for the exhaust gases from a diesel engine or the like comprising a chamber having a quantity of conditioning liquid therein, means for introducing exhaust gases from said engine below the surface of said liquid, a second chamber in communication with said first chamber, said second chamber being arranged to receive conditioning liquid from said first chamber when the pressure of said exhaust gases increases beyond a predetermined amount and being arranged to return conditioning liquid to said first chamber when the pressure of said exhaust gases is below a predetermined amount, and means for regulating the amount of liquid moving from said first chamber to said second chamber comprising means for regulating the pressure within said second chamber.

8. A conditioner for the exhaust gases from a diesel engine or the like comprising a chamber having a quantity of conditioning liquid therein, means for introducing exhaust gases from said engine below the surface of said liquid, a second chamber in communication with said first chamber, said second chamber being arranged to receive conditioning liquid from said first chamber when the pressure of said exhaust gases increases beyond a predetermined amount and being arranged to return conditioning liquid to said first chamber when the pressure of said exhaust gases is below a predetermined amount, and means for regulating the amount of conditioning liquid moving from said first chamber to said second chamber by regulatable communication of said second chamber with the atmosphere.

9. A conditioner for the exhaust gases from a diesel engine or the like comprising a chamber having a quantity of conditioning liquid therein, means for introducing exhaust gases from said engine below the surface of said liquid, means for providing a tortuous path of said gases through said liquid, and a second chamber in communication with said first chamber, including means for controllably connecting said second chamber to ambient, said second chamber being arranged to receive conditioning liquid from said first chamber when the pressure of said exhaust gases increases beyond a predetermined amount and being arranged to return conditioning liquid to said first chamber when the pressure of said exhaust gases is below a predetermined amount.

10. A conditioner for the exhaust gases from a diesel engine or the like comprising a walled chamber having a quantity of conditioning liquid therein, means for introducing exhaust gases from said engine below the surface of said liquid, and a second chamber in communication with said walled chamber, said second chamber being arranged to receive conditioning liquid from said walled chamber when the pressure of said exhaust gases increases beyond a predetermined amount and being arranged to return conditioning liquid to said walled chamber when the pressure of said exhaust gases is below a predetermined amount, additional means for causing communication between said chamber and said walled chamber, and controlled means connecting said second chamber to ambient so as to regulate the amount of conditioning liquid going into said second chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

724,124	Perkins	Mar. 31, 1903
1,017,900	Phillips	Feb. 20, 1912
1,367,164	Miller	Feb. 1, 1921
1,524,333	Brand et al.	Jan. 27, 1925

FOREIGN PATENTS

38,303	Germany	Jan. 17, 1887
316,594	Germany	Dec. 2, 1919
370,219	Germany	Feb. 28, 1923