Oct. 18, 1932. G. D. EBBETS 1,883,635

MERCURY BOILER

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Fig. 1

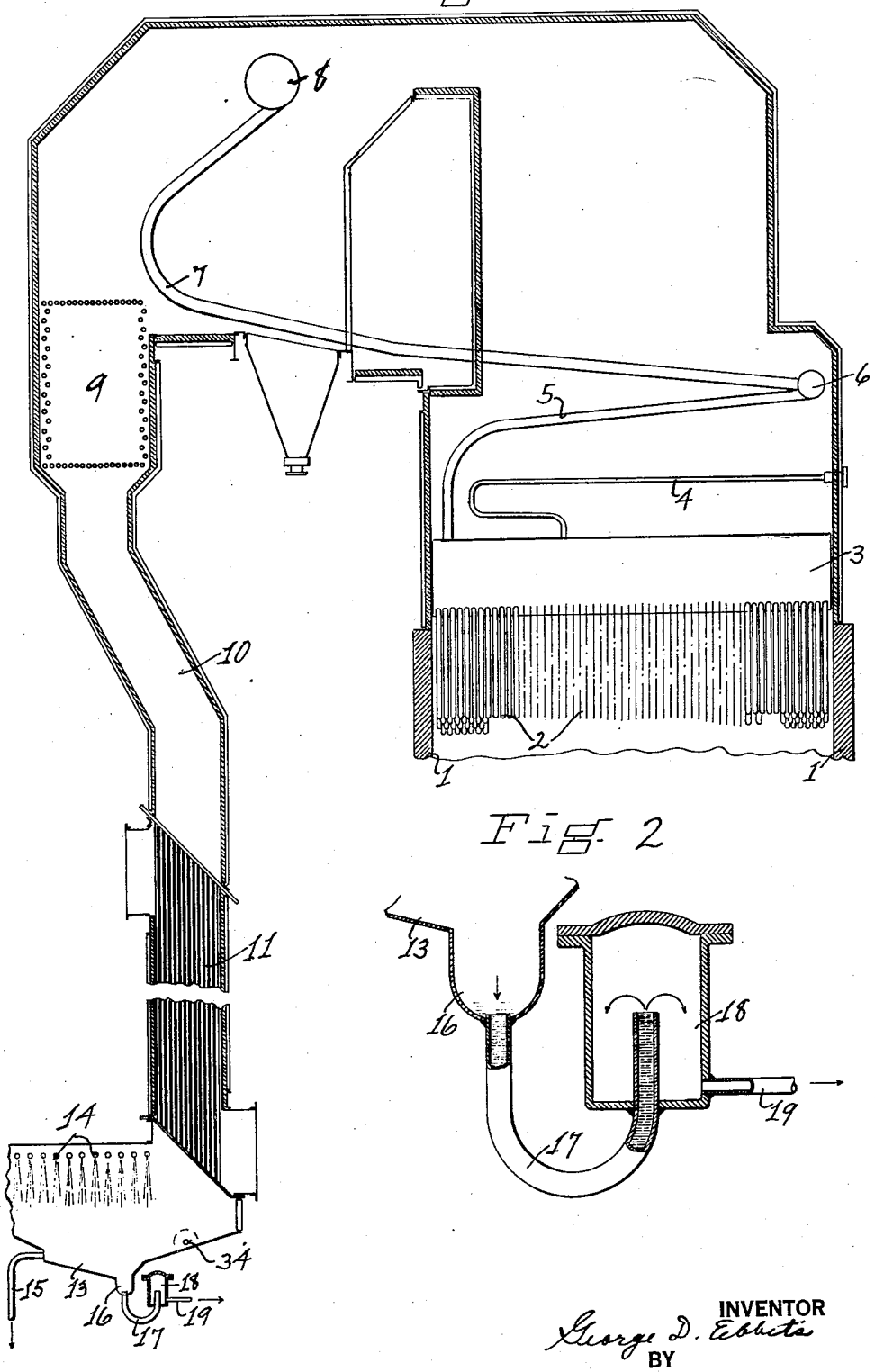


Fig. 2

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Fig. 4

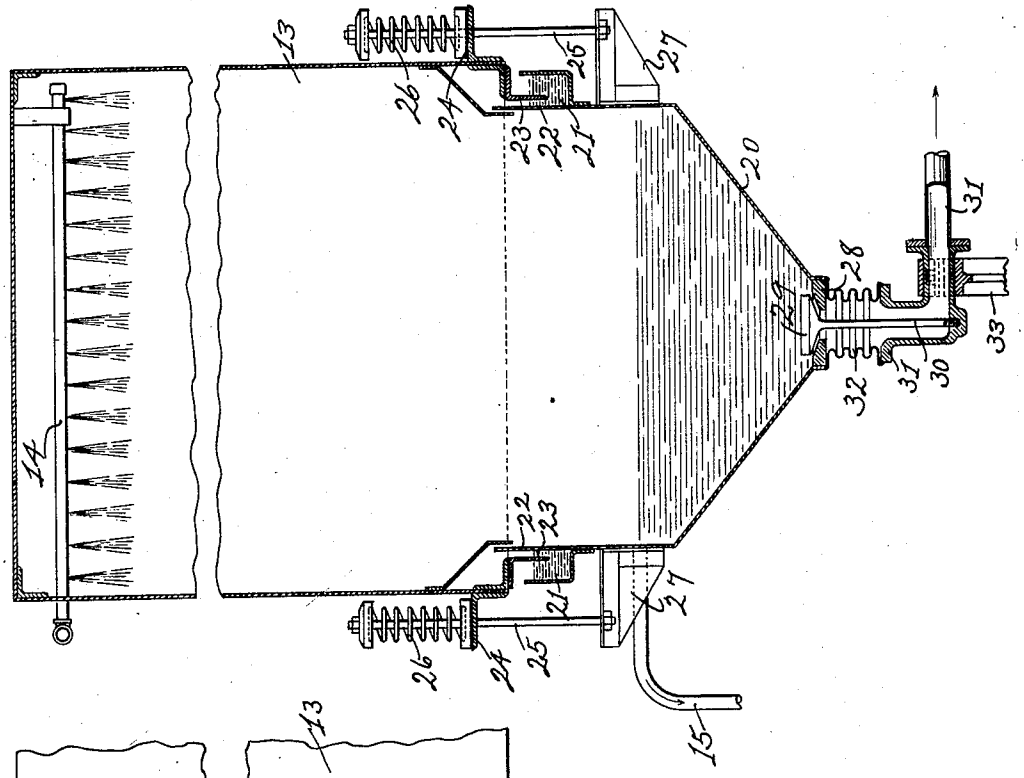
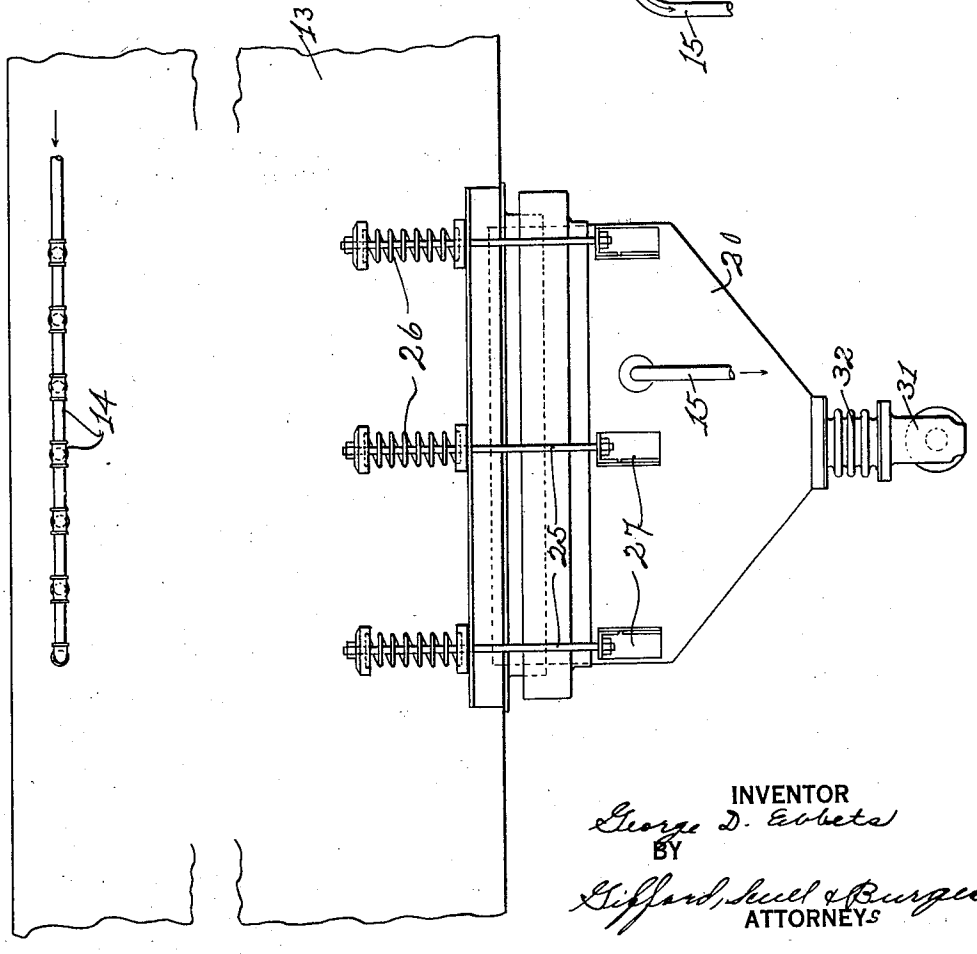


Fig. 3



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UNITED STATES PATENT OFFICE

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MERCURY BOILER

Application filed May 17, 1929. Serial No. 363,872.

This invention relates to a mercury boiler so arranged that the mercury vapors can be recovered in case of rupture of a mercury vapor generating element.

The invention will be understood from the description in connection with the accompanying drawings in which Fig. 1 is a vertical section through an illustrative embodiment of the invention; Fig. 2 is a vertical section on an enlarged scale, showing some of the details; Fig. 3 is a side view of a modification of some of the parts; and Fig. 4 is a section at right angles to Fig. 3.

In the drawings reference character 1 indicates the walls of the furnace in the upper portion of which a mercury boiler is located having mercury vapor generating tubes 2 depending from headers 3 in the well known way. Feed pipes 4 for mercury are provided leading to the upper portions of the drums 3 and mercury vapor pipes 5 extend from the upper portions of the drums 3 to a header 6 from which tubes 7 lead to a header 8 that may be connected to the place where the mercury vapors are used.

An economizer 9 of a well known sort may be located in the flue 10 through which the waste gases from the furnace pass downwardly. An air heater 11 is also located in the flue 10, preferably below the economizer 9. A receptacle 13 through which the waste gases pass is provided below the air heater 11. A series of perforated pipes 14 extend across the upper portion of the receptacle 13 for spraying water into the receptacle 13, which is provided with a sloping bottom. A water outlet pipe 15 extends from a point along the sloping bottom of the receptacle some distance above its lowermost point. A sump 16 is provided at the lowest point of the sloping bottom of the receptacle 13 and a U-shaped outlet 17 leads from the sump 16 to a container 18 at the lower portion of which an outlet pipe 19 is provided. The outlet end of the U-shaped pipe 17 extends upwardly into the container 18 to a level approximately the same as the bottom of the sump 16. The pipe 17 serves as a trap for mercury.

Heretofore when mercury boilers have become ruptured the mercury vapors became commingled with the hot gases that are used for generating the vapors and were carried out through the stack and lost. By the present invention the mercury, which would otherwise be lost in this way, is recovered. The hot gases carrying the mercury vapors, which accidentally escape into these gases, are cooled by passing across the tubes of the economizer 9 and are further cooled by passing through the air heater 11. When a rupture occurs to cause mercury vapors to escape into the hot gases, the pipe leading to the perforated pipes 14 is opened to cause sprays to be projected downwardly into the gases passing through the receptacle 13, thus further cooling the gases and condensing the mercury vapors and removing the mercury from the gases. The spray may be operated manually when a rupture occurs or it may be made to operate automatically when a changed condition occurs in the boiler due to rupture, such as a decrease in the pressure in the boiler or an increase in the temperature of the escaping furnace gases. The mixture of water and mercury collects in the lower portion of the receptacle 13, the mercury gravitating to the bottom. When the mercury accumulates sufficiently to fill the tube 17 with a slight excess, the excess mercury passes into the container 18 and out through the pipe 19. The excess water escapes through the pipe 15 as soon as the water level reaches this point. The mercury in the tube 17 prevents water from passing out through this tube. The legs of the U-tube are sufficiently long to enable enough water to accumulate in the receptacle 13 to overflow through the pipe 15, without forcing the level of the mercury to the lower end of the leg that is attached to the sump 16.

The economizer 9 may be used for heating water that passes through it or it may be used for preheating the mercury before it is introduced into the drums 3 during the normal operation of the boiler. The air heater 11 may heat combustion air for the boiler furnace.

In Figs. 3 and 4 a modification is shown in which the mercury and water are separated

after the mercury has been condensed by the water spray, and the mercury is withdrawn automatically from the receptacle after a predetermined amount thereof has accumulated. In this modification the bottom portion 20 of the receptacle 13 is made separate from the remainder of the receptacle and is movable in a vertical direction. A liquid seal 21 is provided between the upper edge 22 of the portion 20 and the lower edge 23 of the receptacle 13. Supports 24 are provided near the lower portion of the receptacle 13 and supporting rods 25 for the lower portion 20 are supported upon springs 26 upon the supports 24. The rods 25 are attached to brackets 27 upon the movable portion 20.

A valve seat 28 is provided in the lower end of the conical bottom of the portion 20 and a fixed valve 29 is provided for the valve seat 28. The stem 30 of the valve 29 is screwed into a threaded lug in the fixed outlet pipe 31 and an expansible tube connection 32 is provided between the valve seat 28 and the upper end of the pipe 31. The pipe 31 may be supported in a fixed position by means of the support 33.

In the modification shown in Figs. 3 and 4 the valve 29 is kept closed normally by the springs 26 holding the bottom 20 in its uppermost position with the seat 28 and valve 29 in contact. The springs are so adjusted that the weight of a sufficient amount of water accumulated in the portion 20 to overflow through the outlet 15 will not compress the springs 26 sufficiently to move the portion 20 downwardly. If, however, a portion of the liquid in the bottom 20 filling the same to the overflow pipe 15 is mercury, the weight will be sufficient to open the valve 29 and permit the mercury to escape. As soon as the mercury escapes the springs 26 raise the bottom with its decreased weight of liquid sufficiently to close the valve 29 before the water begins to escape. The mercury and water are thereby automatically separated from each other. The mercury that would otherwise be wasted is recovered.

A soot blower 34 shown somewhat diagrammatically in Fig. 1 may be provided in the receptacle 13 to remove soot that may collect during the normal operation of the boiler.

I claim:

1. In a mercury boiler, a flue for spent gases leaving said boiler and means in said flue for recovering mercury from said gases that may escape from said boiler into said gases, said means comprising a cold water spray, and over-flow means actuated by a predetermined bulk of mercury within said recovering means.

2. The combination in a mercury boiler of an outlet for the heating gases, a mercury condensing chamber associated with said outlet and through which said gases pass, means for cooling said gases in said chamber to condense mercury vapor mixed with said gases and to deposit liquid mercury in the bottom thereof, an outlet in the bottom of said chamber and means operated by the accumulation of mercury for delivering mercury only through said outlet.

3. The combination in a mercury boiler of an outlet for the heating gases, a mercury condensing chamber associated with said outlet and through which said gases pass, means for cooling said gases in said chamber to condense mercury vapor mixed with said gases and to deposit liquid mercury in the bottom thereof, an outlet in the bottom of said chamber and valve means operated by the accumulation of mercury for delivering mercury only through said outlet.

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