

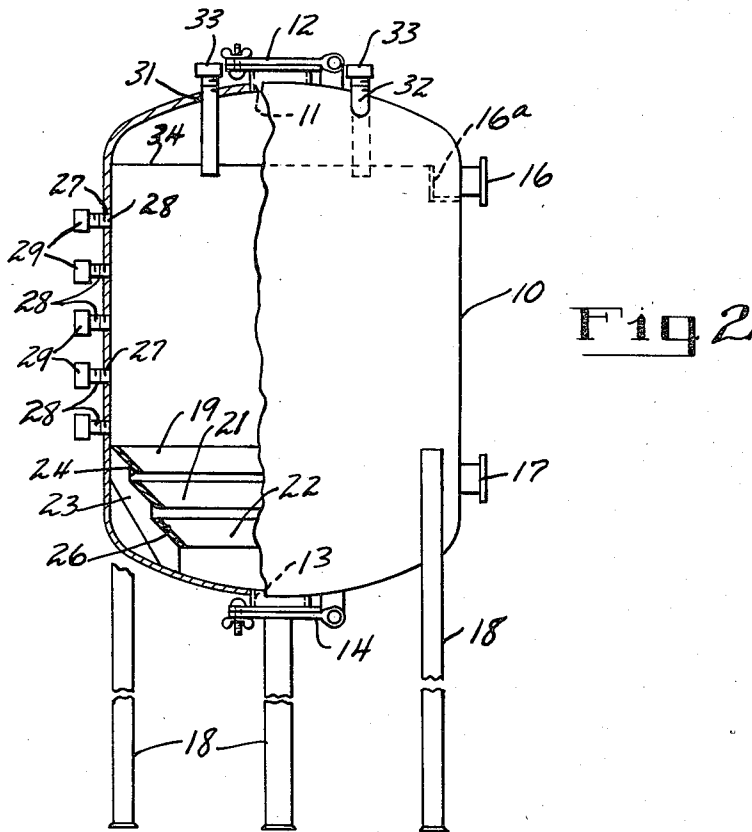
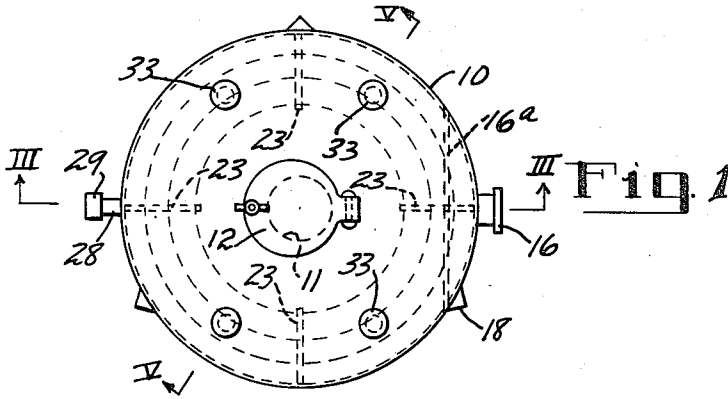
**April 24, 1951**

**C. B. GAMBLE**  
GAS PURIFIER

**2,550,463**

Filed Aug. 15, 1947

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 3

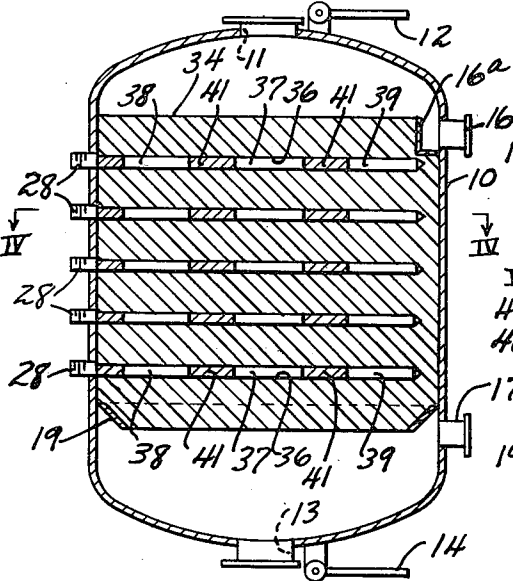


Fig. 5

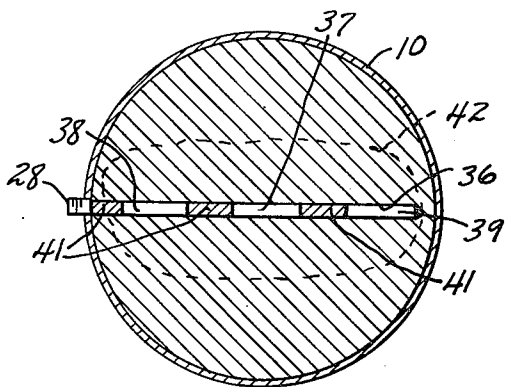
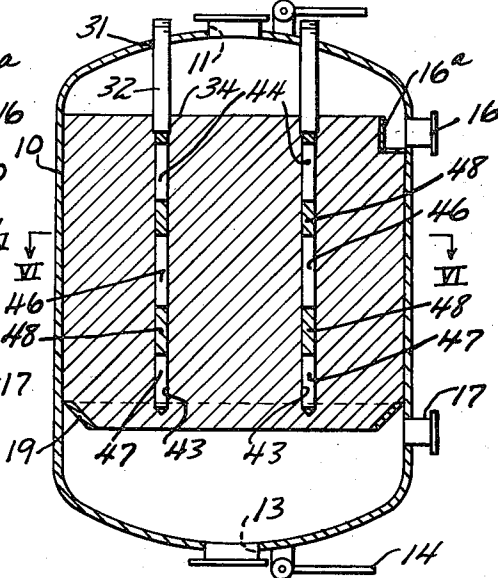


Fig. 4

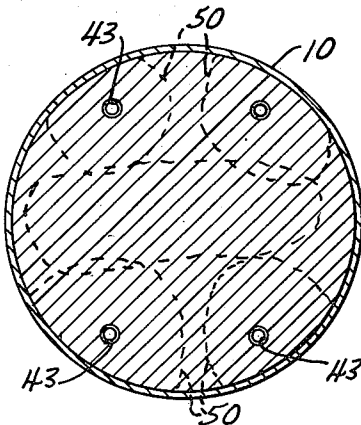


Fig. 6

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## UNITED STATES PATENT OFFICE

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## GAS PURIFIER

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2 Claims. (Cl. 23—284)

1

This invention relates to a gas purifier of that type embodying an enclosed vessel containing a mass of purifying material through which the gas is passed, and has for an object the provision of apparatus of the character designated which shall provide an improved support for the purifying material which shall be simple of design, economical of construction, and which shall be permanently mounted within the enclosed vessel.

Another object of my invention is to provide a method of discharging a gas purifying chamber of the character described which comprises subjecting the mass of material within the chamber to the explosive action of charges disposed within the mass, thereby to loosen the same for discharge through a bottom opening in the purifier.

A further object of my invention is to provide a method of discharging a chamber filled with a solidified mass of material which comprises placing a series of explosive charges in holes drilled horizontally into the mass and exploding the charges successively from the top to the bottom of the mass, thereby to loosen the same in generally horizontal layers, and then placing a series of charges in holes drilled vertically in those portions of the mass not broken up by the first mentioned charges, and exploding the vertically disposed charges, thus to completely break up the remaining large solidified masses of material within the chamber.

As is well understood in the art to which my invention relates, hydrogen-sulfide is removed from gas by passing the same through a bed of iron oxide. In practice, the iron oxide is usually precipitated on wood chips, the oxide coated chips are loaded into a closed vessel, and the gas is passed through the mass of coated chips. Heretofore in this art, it has been the practice to support the purifying material on removable trays or other movable supports so that when it became saturated with impurities removed from the gas, it has been necessary to enter and clean the material off the trays or supports, requiring considerable labor. In accordance with my invention, I provide a support for the purifying materials disposed within the lower part of the vessel and comprising one or more superposed frusto-conical rings of progressively decreasing diameter from the uppermost ring downward and spaced apart to provide passages for the gas between the rings. The uppermost ring fits snugly within the vessel and is attached gas tight to it, while the lowermost ring extends close to the bottom of the enclosed vessel.

Likewise, as is well known in this art, after

2

a purifier has been operating for a considerable length of time, the mass of coated chips forming the bed becomes solidified to the extent that its removal by manual means is extremely difficult and arduous. This difficulty is further increased due to the fact that in operation the vessel must be closed, requiring that the removal operation take place through upper and lower manholes provided therein. Accordingly, it is a prime object of my invention to provide an apparatus for purifying gases which shall have improved operating and discharge characteristics over those heretofore existing, and to provide a method of discharging the apparatus by means of a plurality of horizontally disposed explosive charges placed in the vessel and exploded successively from top to bottom of the solidified mass. After exploding the first charges, I place in the mass a second series of vertically spaced charges located on either side of a vertical plane passing through the first charges. These charges are exploded successively and the entire mass within the enclosed vessel is broken up into small pieces which may readily be discharged through a manhole provided in the bottom of the vessel.

Apparatus embodying features of my invention is illustrated in the accompanying drawings forming a part of this application in which:

Fig. 1 is a plan view of my improved purifying vessel;

Fig. 2 is a side elevational view partly broken away and in section;

Fig. 3 is a diagrammatic sectional view taken along line III—III of Fig. 1 and illustrating all of the horizontally disposed charges in position within the solidified mass;

Fig. 4 is a sectional view taken along line IV—IV of Fig. 3;

Fig. 5 is a diagrammatic sectional view taken along line V—V of Fig. 1 and showing two groups of the vertical charges in place; and

Fig. 6 is a sectional view taken along line VI—VI of Fig. 5.

Referring now to the drawing for a better understanding of my invention, I show a cylindrical tank 10 having a top opening 11 with a suitable closure member 12 and a bottom opening 13 with a suitable closure member 14. A gas circulating conduit 16 connects with the upper end of the cylindrical vessel 10 and a gas circulating conduit 17 connects to the lower end thereof. As is well understood, gas may enter or leave the tank by either of said conduits. A baffle 16a is spaced from the inner end of the conduit 16 to prevent material in the tank from entering the

conduit 16. The tank may be supported in any suitable manner as by legs 18.

My improved purifying material support consists of an upper frusto-conical ring 19, and if desired additional frusto-conical rings 21 and 22, disposed in the bottom of the vessel 10. The ring 19 fits snugly within the vessel and has its upper peripheral edge secured to the inner walls of the tank. The rings 21 and 22 if used, are progressively smaller in diameter than the ring 19. The rings are in spaced relation with respect to each other and the bottom of the vessel thereby providing spaces for gas to pass between the rings into the annular space formed between the edges of the rings and the sides of the vessel. The rings may be supported by means of a plurality of plates 23 set edgewise with respect to the rings and having their upper ends joined to the side of the tank and their lower ends joined to the bottom thereof as shown in Fig. 2. The plates 23 are notched at 24 and 26 whereby the rings 19, 21, and 22 fit snugly thereagainst.

Along one side, the vessel 10 is provided with a plurality of openings 27. Disposed in each of the openings 27 and welded therein to the sides of the vessel are a plurality of short sections of pipe 28, the outer ends of which may be threaded to receive caps 29. The top of the vessel is provided with openings 31 for receiving short sections of pipe 32, which extend downwardly into the tank as shown and are threaded on their outer ends to receive caps 33. As best shown in Figs. 3 and 4, there is a single row of the pipes 28 vertically aligned in the sidewall of the vessel 10. As best shown in Figs. 1, 5, and 6, four of the pipes 32 are provided and the same preferably placed so that they are positioned over the areas of the mass of material not broken up by the horizontally disposed explosive charges, as will later be described.

In use, the purifying material is loaded into the vessel through the opening 11 and up to the line 34 shown in Figs. 2, 3, and 5. Due to the fact that the purifying material used is rather expensive, I prefer to fill the bottom of the vessel 10 with some inert material such for instance, as coke, up to the lower edge of the uppermost cone 19, if it alone is used, or to the lower edge of the lowermost cone, if more than one is used. It will be apparent that contact of the gas with the bed of oxide begins or terminates at these points. Gas is now circulated through the conduits 16 and 17, the same circulating either down through the bed or upwardly through the same, and, by the well known reaction, the impurities are removed by the iron oxide coated chips. When the purifying material has become saturated with sulphur and other impurities removed from the gas, the bed of material must be removed and a new charge placed in the vessel 10. Upon opening the manholes of the vessel it will be found that the material has solidified into a very dense and hard mass, which, as indicated previously, is extremely difficult to remove with the ordinary hand tools. In accordance with my method, I remove the cap 29 from the upper pipe 28 and with an auger bore a hole 36 through the solidified material, the hole extending substantially across the diameter of the vessel. Into this hole I place a group of explosive charges comprising a centrally disposed charge 37 and other charges 38 and 39 disposed adjacent the peripheral edge of the mass. Between these charges I provide stemming 41, and tamp the same in the hole. With the charges positioned

in the upper hole 36 as shown in Figs. 3 and 4, and using any suitable means such for instance as electric blasting caps and a generator, not shown, I explode the same. After the charges in the uppermost hole are exploded, I remove the cap 29 from the next lower pipe 28, drill another hole 36 into the mass, insert another group of charges 37, 38, and 39, and explode the same. This operation is repeated until charges have been exploded from top to bottom of the mass. This series of explosions loosens a generally centrally disposed core of material indicated by the dotted line 42 in Fig. 4 extending from the top to the bottom of the mass. After these charges are exploded, I drill a hole 43 beneath one of the vertically disposed pipes 32 and place therein a series of charges 44, 46, and 47 between which I tamp stemming 48. These charges are located within the areas not broken up by the charges previously fired and, through the same of suitable detonators I explode the same. After this group of charges is exploded I drill another hole 43 into the material through another of the vertical pipes 32 and insert a like group of charges 44, 46 and 47, and fire the same. This operation is continued until groups of charges have been exploded in holes drilled beneath each of the pipes 32. These explosions loosen vertically disposed cores of material indicated by the dotted lines 50 in Fig. 6. It will now be found that the material within the vessel may be readily discharged by inserting hand tools through the opening 13 and working the same out.

By way of example, and not by limitation, the following is cited to show the type and quantity of explosives necessary to accomplish the discharge of a purifier which is 11 feet in diameter and having a bed of purifying material approximately ten feet high. The charges 37 consist of four sticks of 40% permissible powder and each of the charges 38, 39, 44, 46 and 47 consists of three sticks of 40% permissible powder. I have found that placing charges of this quantity and strength approximately equal distance apart in the openings 36 across the diameter of the tank results in very satisfactory breaking up of the material. Also, I prefer to place the vertical charges 44, 46, and 47 substantially equal distances apart vertically in the mass of material. Also, in firing the charges 37, 38 and 39, I have found it advantageous to fire the center charge 37 first and to fire the charges 38 and 39 with a time delay of 2 and 4½ seconds, respectively. Likewise, I prefer to fire the upper charge 44 first, then after a delay of 2 seconds, charge 46, and charge 47 after a further delay of 2½ seconds.

From the foregoing, it will be apparent that I have devised an improved apparatus for purifying gas and an improved method for discharging the solidified mass of purifying materials therefrom when necessary. I have found that when using my improved method, no damage occurs to the vessel or to the conical rings at the bottom thereof, and that the material is broken up into lumps small enough to be discharged through an average size opening in the bottom of the vessel.

Likewise, by using explosives of the order of 40% permissible powder, I have found that sympathetic detonation of the individual charges of the horizontal and vertical groups does not occur.

In actual practice, I have found that an eleven foot vessel constructed in accordance with my invention may be discharged by my improved method with a fraction the man hours of labor

5

required when discharging the usual type of vessel without the use of my improved method.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications, without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In a gas purifier embodying an enclosed cylindrical vessel adapted to contain a solid mass of intersticed purifying material through which the gas is passed, a plurality of inverted frusto-conical rings mounted one above the other in the lower end of the vessel, the said rings being progressively smaller in diameter from the uppermost downwards and spaced vertically apart, the upper ring fitting snugly within the vessel to form therewith an annular space and the succeeding rings being spaced from the wall of the vessel, inclined notched plates joined to the bottom and side of the vessel and supporting the rings, a gas circulating conduit connected to the lower end of the vessel behind the said rings, a second gas circulating conduit connected to the upper end of the vessel, a purifying material discharge outlet in the bottom of the vessel, and a plurality of short sections of pipe vertically aligned on a side of the vessel above the rings and providing access to the mass of purifying material within the vessel at a plurality of points.

6

2. In a gas purifier embodying an enclosed cylindrical vessel adapted to contain, a solid mass of intersticed purifying material through which the gas is passed, a plurality of inverted frusto-conical rings mounted one above the other in vertically spaced relation in the lower end of the vessel, the upper ring being joined to the side of the vessel and opening toward the bottom of the vessel, the succeeding rings being progressively smaller in diameter than the superposed rings and smaller in diameter than the vessel and spaced from the wall thereof at the point where the lower rings are installed, the rings and purifying material adjacent thereto forming with the side of the vessel an annular space, a gas circulating conduit communicating with the annular space, and a purifying material outlet in the bottom of the vessel.

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