June 14, 1932. L. GILLETT 1,862,746

DRYING TOWER

Filed Oct. 16, 1926 2 Sheets-Sheet 1

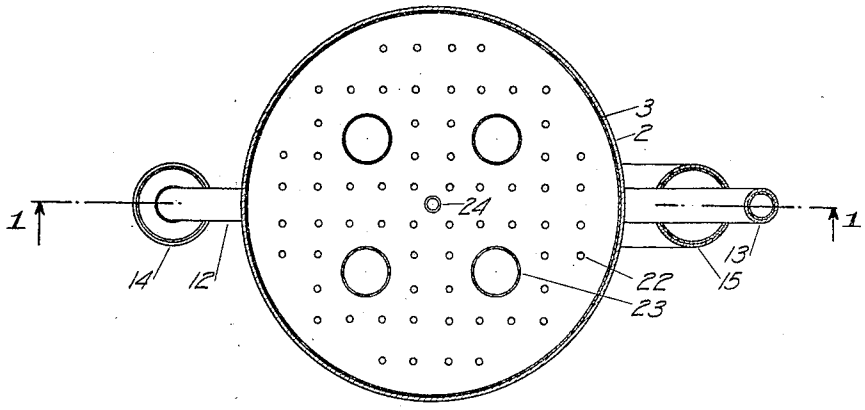


FIG. 2

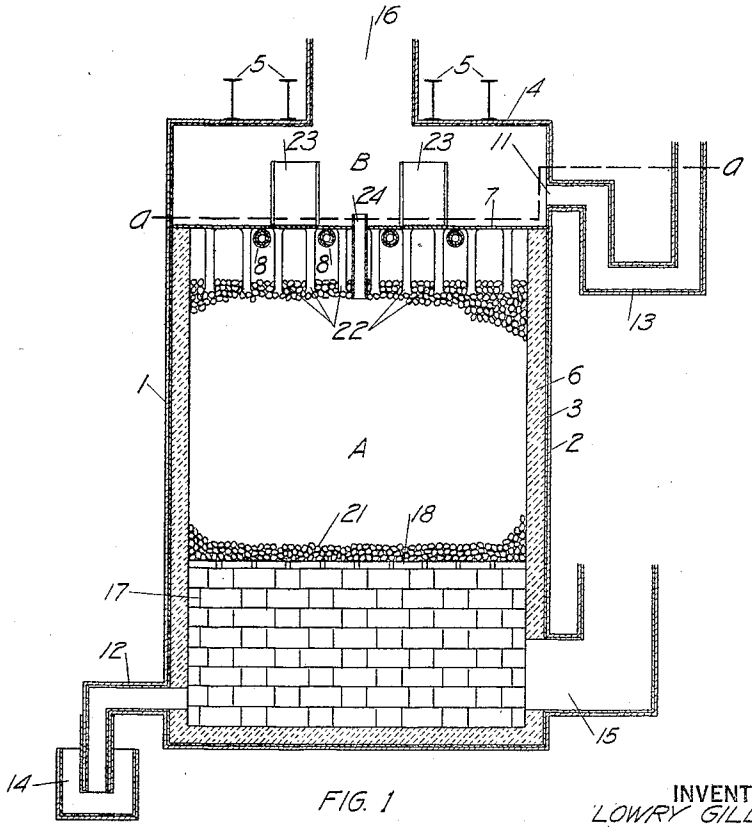


FIG. 1

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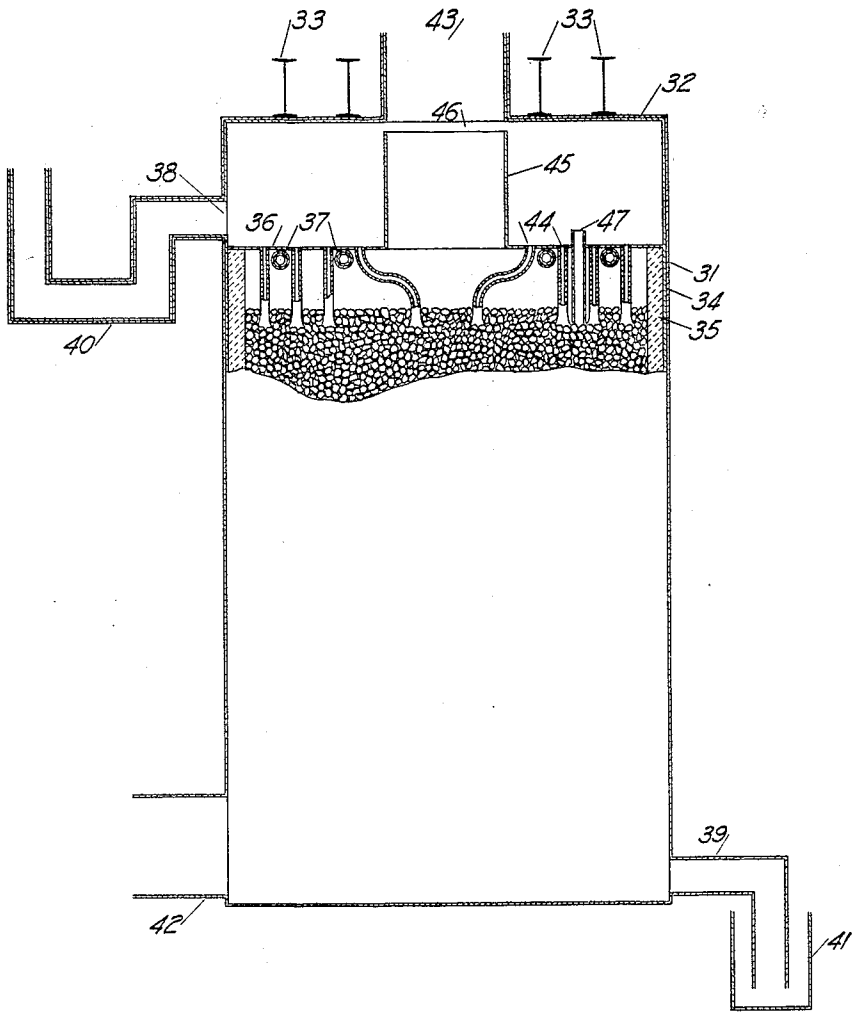


FIG. 3

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Patented June 14, 1932 1,862,746

UNITED STATES PATENT OFFICE

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DRYING TOWER

Application filed October 16, 1926. Serial No. 142,137.

This invention relates to improvements in gas drying apparatus and more particularly to an air drying tower.

Heretofore it has been customary to dry air or other gases with sulfuric acid in a tower operated under negative pressure, i. e. wherein the gases are caused to travel through the tower by suction. In operating this system, however, the gases leaving the tower always carry a mist of sulfuric acid. This condition is very objectionable since the acid mist corrodes the subsequent apparatus, as for example the blowers, with which it contacts, and the gas thus contaminated is difficult to handle or purify.

I have discovered that the foregoing difficulties may be avoided and the advantages of positive pressure operation efficiently availed of as well, by providing pressure-regulating and gas-conveying means as described in detail hereinafter, within a tower specially constructed for operation under positive pressure, i. e. wherein the gases are caused to travel through the tower by the pressure of a blower positioned before the gas inlet. For example, one obvious advantage would be the decreased volume of gas required to be handled and the corresponding reduction in the size of apparatus. The conventional tower of the prior art, however, has been found to be defective when operating under positive pressure and wholly unsuitable for such conditions. The lead plates of the tower were bulged and deformed, various parts developed leaks and failed, and the repair costs of such towers became so excessive as to preclude their use.

I have invented a tower in the operation of which entrainment of acid mist in the exit gases is substantially avoided and which is especially adapted for positive pressure operation. Certain preferred forms of embodiment of the present invention are illustrated in the accompanying drawing in which:

Fig. 1 is an elevation in section taken along central line 1—1, Fig. 2, of one embodiment of my invention,

Fig. 2 is a transverse section taken on the line *a*—*a* of Fig. 1,

Fig. 3 is an elevation, partly in section of another preferred form of my invention.

Similar numerals of reference refer to similar parts throughout the accompanying drawings.

I will now describe my invention with particular reference to Figs. 1 and 2.

The tower 1 consists of a rigid gas-tight shell or container 2, preferably cylindrical in shape, and constructed of steel or iron. The interior thereof is completely covered with a lining 3 of lead or other suitable corrosion resisting material. The top 4 of the tower may be supported in any desired manner but is preferably supported by a plurality of beams 5 positioned externally thereof. This arrangement avoids difficulties encountered in preventing corrosion of internally placed beams and does not interefere with the free flow of the gas.

A lining 6 of acid proof brick is positioned contiguous to the inner wall of the lead lined shell and extends upwardly to a point adjacent the liquid distributing plate 7. The plate 7 separates the tower into a gas drying compartment A and a gas collecting compartment B. The plate is preferably made of lead and is supported by a plurality of lead-coated iron or steel pipes 8 which rest in niches in said brick so that the upper surfaces of the pipes are in the plane of the tops of the brick. The ends of the supporting pipes 8 may be provided with suitable lugs to prevent rotation thereof in the niches.

An inlet 11 for the drying acid is provided in the shell at any desirable height above the distributing plate. Near the bottom of the shell an outlet 12 for acid is provided. An acid seal 13 is positioned ahead of the acid inlet 11 and a similar seal 14 is provided after the outlet 12. By this arrangement it is possible to operate the tower under positive pressure without the liability of the acid being blown out through the feed and exit lines. The depth of the acid seals will correspond to the pressure to be maintained in the tower as is well understood by those skilled in the art.

A gas inlet 15 is provided near the bottom of the tower. In the top and preferably in a central portion of the top, as shown in Fig.

1, there is a suitable gas outlet or exit 16. The gas inlet leads to a checkerwork 17 of acid-proof brick which is built up from the bottom of the tower and extends above the inlet 15. A grillework 18 of closely laid brick is placed above the checkerwork and serves to support a layer of pebbles 21 or other desirable packing material. This layer of pebbles extends upwardly to within a short distance of the distributing plate.

A large number of lead tubes 22, called distributing tubes, extend through the distributing plate and project from the underside thereof, terminating below the level of the packing 21. This arrangement whereby the tubes terminate internally of the packing provides for the introduction and distribution of acid without splash. The tubes 22 are burned or otherwise attached to the distributing plate and are disposed substantially uniformly with respect to each other as may be clearly seen in Fig. 2.

The distributing plate is also provided with a plurality of gas outlet flues 23. According to my preferred embodiment there are four flues of lead which extend through the plate and are burned to the upper surface thereof. The flues extend upwardly considerably above the level of the acid but terminate somewhat below the top of the tower. The acid level will be maintained at any predetermined point according to the amount introduced. However, to prevent the level rising above a definite limit, as might occur if a number of the distributing pipes became clogged, an overflow pipe 24 is provided. The pipe extends above the distributing plate to the predetermined acid-limit level and also extends below the plate terminating below the level of the packing. The pipe is secured to the distributing plate in any convenient manner but preferably by burning.

The operation of my improved drying tower will be readily apparent to one skilled in the art. A suitable drying reagent, such as strong sulfuric acid, is fed into the tower through the seal 13 and acid inlet 11. The acid flows over the distributing plate 7 and through the distributing tubes 22 to the packing 21. By continuously maintaining a layer of acid of suitable depth on the feed plate a uniform flow of acid through each of the tubes is insured. As the acid trickles downwardly over the packing in a suitable film it comes into intimate contact with the air or other gas to be dried. The acid leaves the tower through the outlet 12 and acid seal 14.

The air or other gas to be dried is fed by a suitable blower and under a positive pressure into the tower by way of the inlet 15 and is distributed uniformly throughout the checkerwork 17. Passing upwardly through the packing and in intimate contact with the acid it is deprived of substantially all of its moisture. It then leaves the gas drying compartment A through the flues 23 and enters the gas collecting compartment B, passing therefrom through the outlet 16. By causing the gas to pass from the flues 23 into a large chamber B the reduction in velocity tends to precipitate even what acid mist may have become entrained at any point in the system.

In Fig. 3 I have shown another preferred form of my invention. The structure is similar to that shown in Figs. 1 and 2, consisting of a gas-tight shell 31, top 32 supported by the beams 33, lead lining 34, and acid-proof brick lining 35. A liquid distributing plate 36 is supported by a plurality of lead-coated pipes 37 resting in niches in the brick. The inlet 38 and outlet 39, together with the liquid seals 40 and 41 respectively, serve to convey the drying reagent to and from the tower while maintaining a positive pressure therein. A gas inlet 42 is provided at the bottom of the tower and a gas outlet 43 is arranged at the top, preferably near the center. Suitable packing of any preferred type may be employed.

A plurality of tubes 44 suitably connected to the distributing plate and terminating below the level of the packing serve to distribute the liquid drying reagent. For conveying the dried gas from the drying compartment below the plate 36, however, a single large lead flue 45 is employed, extending through the plate 36 and terminating adjacent the outlet 43 and in alignment therewith. A narrow slit 46 is thereby provided between the flue 45 and the outlet 43, whereby the pressures inside the flue, and outside the flue and above the liquid drying reagent are equalized. A suitable overflow pipe 47 is provided to limit the level of the drying reagent above the plate 36. A particular advantage is obtained by this structure, namely, that the dried gas is prevented from contacting with the liquid drying reagent after it is removed from the drying compartment, thereby preventing possible mechanical entrainment of the drying reagent by the gas which is in more or less turbulent flow through the gas collecting compartment B in the structure shown in Fig. 1.

It is to be particularly noted that the arrangement provides for equalizing the gas pressure above and below the distributing plate. The equalization of the pressure permits a substantially steady flow of acid downwardly through the distributing tubes irrespective of any variation in the absolute positive pressure in the system and thereby provides uniform drying conditions. Moreover, by the foregoing structure I have succeeded in substantially avoiding the objectionable entrainment in the exit gas of the material amounts of mist incident to the operation of the structures of the prior art, as a result of the considerable splash and spray of acid usually occurring therein. The attainment

of this very desirable result in the operation of my structure is mainly attributable to the provision of the passages which equalize the pressure above and below the distributing plate and which, moreover, convey the outgoing gas through said plate out of contact with the acid also passing therethrough. This elimination of mist in the exit gas is also aided by locating the gas outlet at a point well removed from both the acid inlet and the delivery ends of the distributing tubes, whereby no cross or counter-current of acid will be encountered by the outgoing gas in too close proximity to the gas exit; and further by providing that the distributing tubes shall terminate well below the level of the packing.

The hereinbefore described towers are adapted to operate with sulfuric acid varying in concentration from 60–66° Bé. Where 98% sulfuric acid is used as a drying agent, it is more desirable to use a slightly modified form of tower. Such modification comprises no essential change in structure but rather the employment of cast iron in place of the composite lead-steel structure. A cast iron distributing plate rather than the described lead plate may be used, such structure making unnecessary the supporting pipes 8. If desired, the distributing pipes 22, gas outlet flues 23 and 45, and overflow pipe 24 may be cast integral with the distributing plate or they may be secured thereto in any other well-known manner.

While preferred constructions are illustrated and described it is to be understood that variations may be made without departing from the scope and spirit of the invention.

I claim:

1. A tower for drying gas comprising a container, a distributing plate positioned within said container, said plate having a plurality of openings therein disposed to obtain a uniform flow of drying reagent therethough, an inlet and an outlet for the drying reagent and the gas, respectively, positioned above said plate, an outlet and an inlet for the drying reagent and the gas, respectively, positioned below said plate, and means for conveying the dried gas from below the plate to the gas outlet and for equalizing the pressures above and below said plate.

2. A gas drying tower comprising a gas drying portion, a gas collecting portion adjacent said gas drying portion, a set of inlets and outlets for the drying reagent and the gas, operatively associated with the adjacent portions, means connecting said portions for distributing acid to said gas drying portion, and means associated with the adjacent portions for equalizing the pressure therein and conveying the dried gas from said drying portion to said collecting portion out of contact with the acid being distributed by said first named means.

3. A tower for drying gas adapted to operate under positive pressure comprising a container provided with separate inlets and outlets for the drying reagent and the gas respectively and a distributing plate dividing the container into gas drying and gas collecting compartments, means associated with the plate to obtain a flow of drying reagent therethrough, said distributing plate having gas flues joined thereto and extending above the level of the drying reagent on the said plate.

4. A tower for drying gas comprising a container having separate inlets and outlets for the gas and drying reagent, a distributing plate positioned within said container dividing the latter into a gas drying compartment and a gas collecting compartment, a gas conduit for connecting and equalizing the pressures in the drying compartment and in the collecting compartment, means for preventing the passage of drying reagent from the collecting compartment to the drying compartment through the gas conduit, packing material filling said gas drying compartment to a point adjacent the lower surface of the said plate, and distributing tubes in said plate extending downwardly therefrom and terminating below the level of said packing material.

5. A tower for drying gas comprising a container having separate inlets and outlets for the gas and drying reagent, a distributing plate positioned within said container dividing the latter into a gas collecting compartment and a gas drying compartment, a gas conduit for connecting and equalizing the pressures in the drying compartment and in the collecting compartment, means for preventing the passage of drying reagent from the collecting compartment to the drying compartment through the gas conduit, packing material filling said gas drying compartment to a point adjacent the lower surface of said plate, said packing material consisting of a lower part of checkerwork brick and an upper part of loose material, and distributing tubes in said plate extending therethrough and terminating below the level of said loose packing material.

6. A tower for drying gas comprising a container having separate inlets and outlets for the gas and drying reagent, a distributing plate positioned within said container to divide the latter into a gas drying compartment and a gas collecting compartment, said plate having a plurality of openings therein disposed to obtain a uniform flow of drying reagent therethrough, an overflow vent extending on both sides of said plate and establishing a limit for the level of the drying reagent on the distributing plate, and a gas conduit passing through said plate for connecting and equalizing the pressures in the drying compartment and in the collecting compartment, said conduit projecting substantially

above the upper surface of the distributing plate so as to prevent passage of drying reagent from the collecting compartment to the drying compartment.

7. A gas drying tower comprising a gas drying portion, a gas collecting portion, means positioned between and connecting said drying portion and said collecting portion for distributing drying reagent to said drying portion, and means formed so as to prevent passage of drying reagent from the collecting portion to the drying portion for connecting said drying portion and said collecting portion independently of said first named means and for equalizing the pressures in said portions.

8. A gas drying tower comprising a gas drying portion, a gas collecting portion, means positioned between said drying portion and said collecting portion for distributing drying reagent to said drying portion, and means connecting said drying portion and said collecting portion for delivering gas from said drying portion to said collecting portion and equalizing the pressures in said portions, said connecting means terminating in the collecting portion above the level of the drying reagent being distributed by said distributing means.

9. A gas drying tower comprising a gas drying portion, a gas collecting portion, means providing passage between said collecting portion and said drying portion for distributing drying reagent to said drying portion, and means providing passage for gas between said drying portion and said collecting portion out of contact with drying reagent passing to the drying portion and for equalizing the pressures in said portions.

10. A gas drying tower comprising a gas drying compartment, a gas collecting compartment adapted to contain drying reagent, means positioned between and connecting said drying compartment and said collecting compartment for distributing drying reagent to said drying compartment, a connection comprising a gas passage connecting the collecting compartment and the drying compartment, and means for preventing the passage of drying reagent from the collecting compartment to the drying compartment through the said gas passage.

11. A gas drying tower comprising a container having separate inlets and outlets for the drying reagent and the gas, a plate positioned within said container provided with passages for distributing the drying reagent, a gas conduit passing through said plate for equalizing the pressures on the opposite sides of said plate, and means for preventing the passage of drying reagent through said conduit.

In testimony whereof, I affix my signature.

LOWRY GILLETT.