C. H. LEINERT.

APPARATUS FOR DRYING GASES.

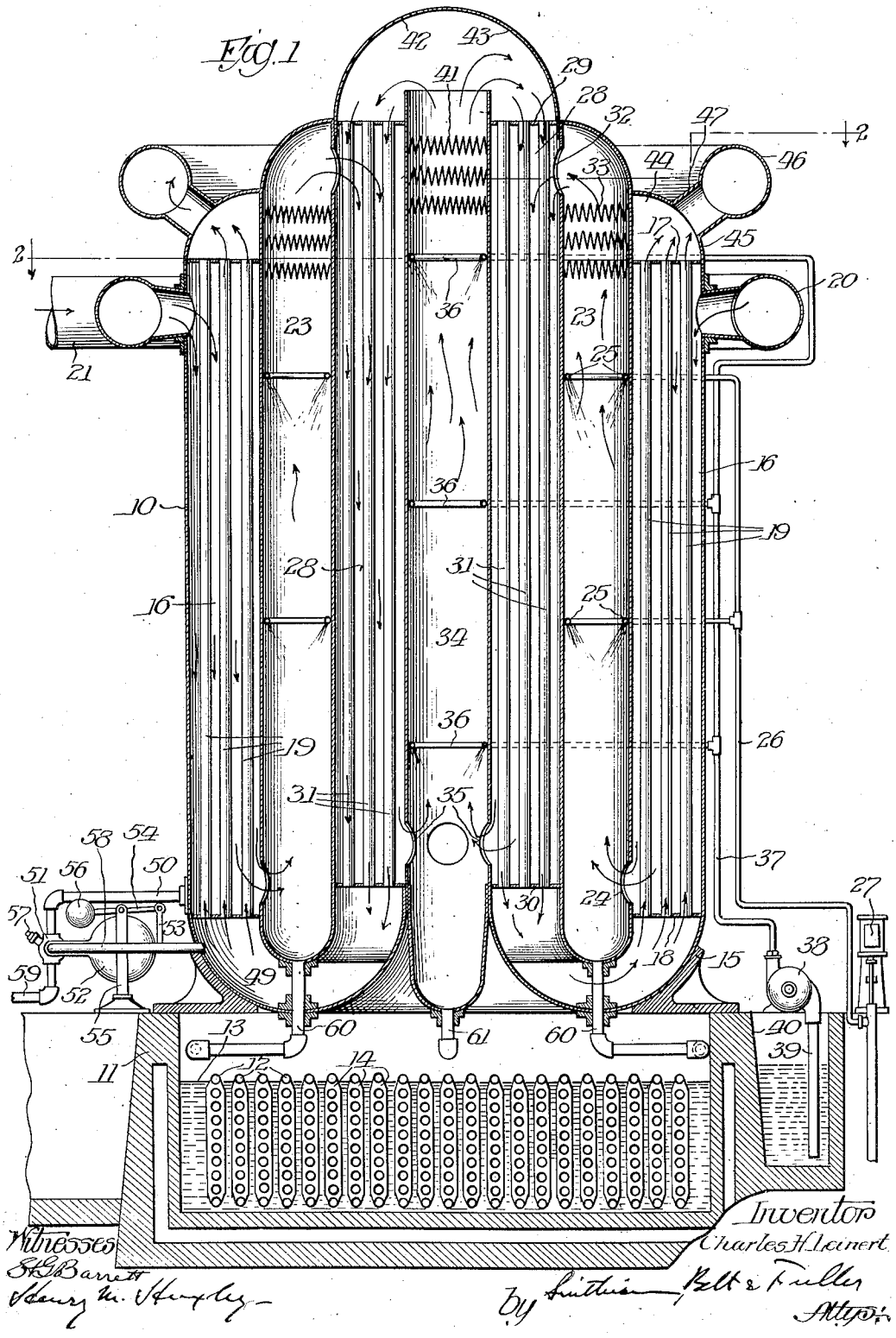
APPLICATION FILED MAY 21, 1913.

1,093,869.

Patented Apr. 21, 1914.

2 SHEETS—SHEET 1.

Fig. 1



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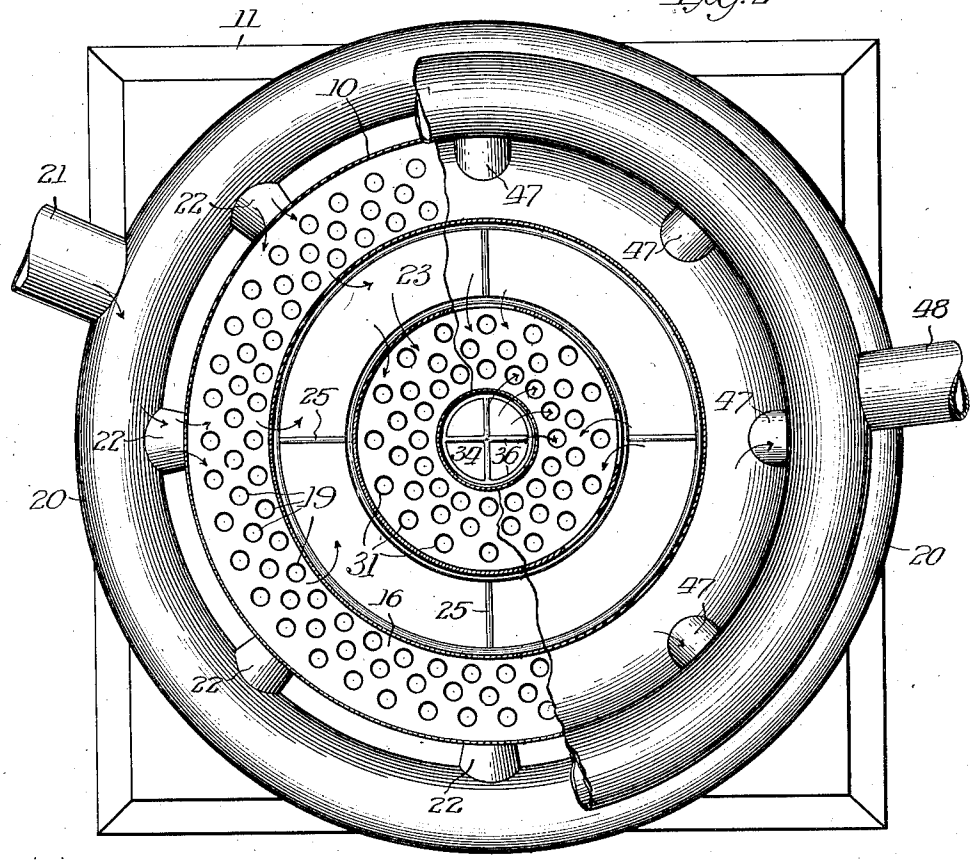
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2 SHEETS—SHEET 2.

Fig. 2



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR DRYING GASES.

1,093,869. Specification of Letters Patent. Patented Apr. 21, 1914.

Application filed May 21, 1913. Serial No. 769,034.

To all whom it may concern:

Be it known that I, CHARLES H. LEINERT, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Drying Gases, of which the following is a specification.

My invention relates to drying apparatus and refers particularly to apparatus which may be used for drying large quantities of air for use in blast furnaces or the like.

In my co-pending application, Serial No. 700,637, filed May 31, 1912, I have described a form of cooling tower which is used between the blowing engine and the hot blast stoves. In other words, the air is cooled after compression. I have found that this system is of particular advantage on account of the economies effected, since, in order to reduce the percentage of moisture in air at atmospheric pressure to a predetermined amount, the result may be accomplished at a considerably higher temperature when the air is under compression than when it is at atmospheric pressure.

According to the system described in my co-pending application just mentioned, the air from the cooling tower passes to the stoves at the minimum temperature which the air attains in the cooling tower. It is then necessary to heat the air from this minimum temperature.

It is the object of the present invention to effect economies by cooling the compressed air in the cooling tower to the minimum temperature and then utilizing this cooled air for cooling the air as it first comes into the cooling tower, thereby relieving the cooling means proper within the tower of a certain amount of work, while at the same time the air which has been cooled to the minimum temperature is heated by the partial equalization of temperatures, and this air then passes to the hot blast stoves at a considerably higher temperature than is the case in the system described in my co-pending application previously mentioned. By the use of my improved cooling tower, therefore, not only are economies effected in cooling the air for the purpose of drying it, but also further economies result in the subsequent heating of the air in the hot blast stoves. These and other advantages of my invention will be more readily apparent by reference to the accompanying drawings, which show a preferred embodiment of my invention, and in which—

Figure 1 is a vertical longitudinal section through my improved cooling tower and the apparatus immediately associated therewith; and Fig. 2 is a partial plan and partial horizontal section taken on the line 2—2 of Fig. 1.

Beneath the cooling tower, represented as a whole by 10, is a cooling tank 11, preferably constructed of concrete or some similar material. This tank 11 is provided with a plurality of cooling coils 12 which are supplied with ammonia, brine or other well known cooling agent. It is by means of these coils that the liquid 13 accumulating in the tank 11 is cooled. In many cases the cooling action is such that the coils 12 become surrounded by ice 14.

The cooling tower 10 is supported at its bottom by the frame 15. The cooling tower is of a cylindrical shape and comprises a number of cooling and equalizing chambers which I will now proceed to describe. Immediately within the outer shell of the cooling tower 10 is located the outer equalizing chamber 16, closed at its top by the horizontal plate 17 and at its bottom by the horizontal plate 18. Extending between the plates 17 and 18 is a plurality of pipes 19, the ends of these pipes being received in suitable apertures in the plates 17 and 18. Inclosing the upper portion of the outer equalizing chamber 16 is the bustle pipe 20, which in turn communicates with the blowing engine through the pipe or conduit 21. A plurality of entrance pipes 22 establish communication between the bustle pipe 20 and the outer equalizing chamber 16.

Immediately within the outer equalizing chamber 16 is the outer cooling chamber 23, which communicates at its lower portion through the apertures 24 with the outer equalizing chamber. The outer cooling chamber 23 is provided with a plurality of water sprays 25, which are supplied with water at the temperature ordinarily found in lakes, wells or the like, through the pipe 26, which has the pump 27 communicating therewith. Immediately within the outer cooling chamber 23 is the inner equalizing chamber 28 having the horizontal plates 29 and 30 at its upper and lower ends, respectively. The vertical pipes 31 extend between these plates and have their ends fastened in suitable apertures in said plates.

The inner equalizing chamber 29 communicates with the outer cooling chamber 23 through a plurality of apertures 32. The moisture eliminators 33 are located within the outer cooling chamber 23 just below the apertures 32.

Inside of the annular inner equalizing chamber 28 is the inner cooling chamber 34, which at its lower portion communicates with the equalizing chamber 28 through the apertures 35. This cooling chamber 34 is provided with a plurality of sprays 36, which are supplied with liquid by means of the pipe 37, which has communicating therewith the pump 38. The pipe 39 leads from the compartment 40 of the cooling tank 11 to the pump 38. The upper portion of the cooling chamber 34 is provided with the moisture eliminators 41. The upper end of the cooling chamber 34 is open and communicates with the space 42 inclosed by the cap 43, which extends over the upper ends of the equalizer chamber 28 and the inner cooling chamber 34.

Immediately above the outer equalizing chamber 16 is the annular space 44, closed by the plate 45. The bustle pipe 46 incloses the cooling tower just outside of this plate 45 and communicates with the space 44 through the short pipes 47. A pipe 48 leads from the bustle pipe 46 to the hot blast stove. The pipes 19, extending through the outer equalizing chamber 16, communicate with the pipes 31 extending through the inner cooling chamber 28 through the connecting chamber 49 located below the lower end of the outer cooling chamber 23.

I will next describe the apparatus used for draining the equalizing and cooling chambers. This apparatus is shown most clearly in Fig. 1 in connection with the outer equalizing chamber 16. A pipe 50 leads from the lower portion of the chamber 16. A three-way valve 51 is located in the pipe 50. Attached to the movable portion of this valve is a trap 52, which has the link 53 pivotally attached thereto, this link in turn being connected with the lever 54 pivotally mounted on the frame 55. This lever carries at its outward end a counterbalancing weight 56. It is therefore evident that the function of the weight 56 is to resist the downward movement of the trap 52. The three-way valve 51 has communicating therewith the pipe 57 in communication with a source of compressed air. A pipe 58 leads from the connecting chamber 49 to the three-way valve 51 and communicates therewith in the same manner as the pipe 50. The operation of this trap is as follows: When the parts are in the position shown in Fig. 1, the three-way valve 57 serves to afford communication between pipes 50 and 58, on the one hand, and the trap 52, on the other, communication between the trap 52 and the portion 59 of the pipe 50 located below the valve 51 being interrupted, while at the same time communication between pipe 57 and trap 52 is also interrupted. As water accumulates in the equalizing chamber 16 and the communicating chamber 49 in the manner presently to be described, this water will flow through the pipes 50 and 58 to the trap 52, in which the water will thus gradually accumulate. When this trap is approximately half full of water, the adjustment of parts is such that the weight of the water causes the trap 52 to move downwardly, thereby rotating the valve 51 and interrupting communication between the pipes 50 and 58, on the one hand, and the trap 52, on the other, while at the same time communication is established between the pipe 57 and the trap 52, as well as between the latter and pipe 59. The compresed air now serves to expel the water from the trap 52, this water passing into the portion 59 of the pipe 50. From the pipe 50 the water passes to a drain, or, if pure water is used in the tank 11, the water from pipe 50 may be returned to said tank. After the water is expelled from the trap 52, the weight 56 serves to return this trap to the position shown in Fig. 1 and the water gradually again accumulates in the trap in the manner previously described. The outer cooling chamber 23 is provided with one or more discharge pipes 60, which in turn have traps of the same type as the trap just described as being used in connection with the pipe 50. The inner cooling chamber 34 also has a discharge pipe 61 with an appropriate trap. The liquid from the sprays 36 within the inner cooling chamber 34 is returned through the discharge pipe 61 and its associated trap to the tank 11, while the liquid from the sprays 25 within the outer cooling chamber 23 passes through the discharge pipes 60 and their associated traps to a drain, unless both the outer cooling chamber 23, as well as the inner cooling chamber 34, is supplied with liquid from the tank 11, in which case the liquid from the outer cooling chamber is returned to the tank 11.

I will now describe the operation of my cooling tower as a whole: Compressed air from the blowing engine is admitted through the pipe 21 to the bustle pipe 20 and thence passes through the short pipes 22 to the upper portion of the outer equalizing chamber 16. The air passes downwardly through this equalizing chamber, coming in contact with the exteriors of the pipes 19. The air passes from the lower portion of the equalizing chamber 16 to the outer cooling chamber 23, through which the air now passes upwardly and is subjected to the cooling action of the water coming through the sprays 25. The air being thus cooled, a considerable percentage of moisture is removed from the

air. After passing through the moisture eliminators 33, the air next passes through the apertures 32 into the upper end of the inner equalizing chamber 28. The air passes downwardly through this chamber, coming in contact with the exteriors of the pipes 31. The air then passes through the apertures 35 into the lower end of the inner cooling chamber 34, where the air is subjected to the further cooling action of the sprays 36, the liquid for these sprays being drawn from the cooling tank 11 and being at a comparatively low temperature. I preferably employ brine as the cooling medium in the inner cooling chamber 34, since brine may be cooled to a lower temperature than water without freezing. After passing upwardly through the inner cooling chamber 34 in the manner just described and passing through the moisture eliminators 41, the air, which has now been cooled to its minimum temperature and has its moisture reduced to the desired percentage, passes into the space 42 and then downwardly through the pipes 31 of the inner equalizing chamber 28. Since the air which is passing through the equalizing chamber from the outer cooling chamber 23 to the inner cooling chamber 34 comes in contact with the exteriors of the pipes 31, the colder air passing through these pipes will serve, on the one hand, to cool the air passing from the outer cooling chamber to the inner cooling chamber, while at the same time the temperature of the air passing through the pipes 31 will be elevated, so that an equalizing action takes place. From the pipes 31 the air next passes through the connecting chamber 49 to the pipes 19 and then upwardly through the latter, serving to cool the air passing from the bustle pipe 20 through the equalizing chamber 16 to the cooling chamber 23, at the same time the temperature of the air passing through the pipes 19 being elevated. From the pipes 19 the air passes into the space 44 and then through the short pipes 47 to the bustle pipe 46. It then passes through the pipe 48 to the hot blast stoves, where it is heated to the desired temperature for use in the hot blast.

It will be apparent to those skilled in the art that many changes could be made in the detailed construction of the various parts which I have described without departing from the spirit or scope of my invention or sacrificing any of the advantages thereof.

What I claim is:

In a drying apparatus, a substantially cylindrical cooling tower comprising a pair of annular equalizing chambers, a cooling chamber between said equalizing chambers, a second cooling chamber within the inner equalizing chamber, said equalizing and cooling chambers communicating with each other *seriatim*, and a plurality of pipes extending through each of said equalizing chambers and communicating with said inner cooling chamber, whereby the gas flowing from said inner chamber serves to cool the gas passing through said equalizing chambers to said cooling chambers, substantially as described.

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