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O. P. OSTERGREN.

MANUFACTURE OF CARBONIC ACID.

(Application filed May 4, 1900. Renewed Mar. 23, 1901.)

(No Model.) 2 Sheets—Sheet 1.

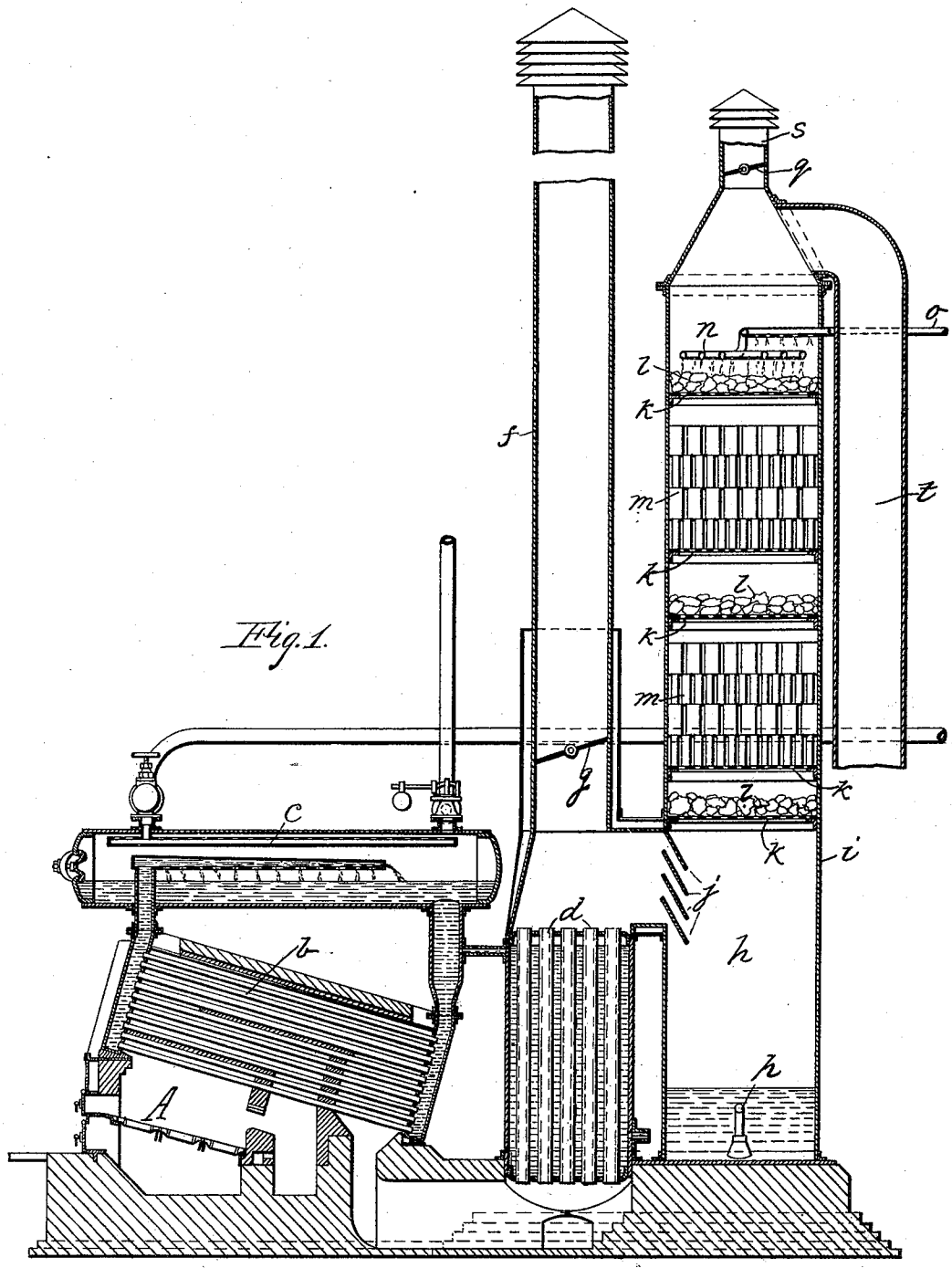


Fig. 1.

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OSCAR P. OSTERGREN, OF NEW YORK, N. Y., ASSIGNOR TO THE OSTERGREN MANUFACTURING COMPANY, A CORPORATION OF NEW JERSEY.

MANUFACTURE OF CARBONIC ACID.

SPECIFICATION forming part of Letters Patent No. 684,854, dated October 22, 1901.

Application filed May 4, 1900. Renewed March 23, 1901. Serial No. 52,604. (No model.)

To all whom it may concern:

Be it known that I, OSCAR P. OSTERGREN, a citizen of the United States of America, and a resident of Bedford Park, borough of Bronx, New York city, State of New York, have invented certain new and useful Improvements in the Manufacture of Carbonic Acid, of which the following is a specification.

My invention consists of means for separating and condensing the carbonic acid developed in the combustion of fuel by the power of the heat developed in the combustion, as hereinafter described, reference being made to the accompanying drawings, in which—

Figure 1 is a sectional elevation of a boiler-furnace and boiler such as may be used for burning the coal and producing steam for the application of the power of the heat for separating and condensing the carbonic acid. It also shows a sectional elevation of a separating-tower for removing impurities from the gas. Fig. 2 is a sectional elevation of the power-engine and the rest of the apparatus for condensing and separating the gas. Fig. 3 is a horizontal section of the refrigerating, separating, and condensing apparatus, the section being taken on the line 3 3 of Fig. 2.

A represents a boiler-furnace; *b* and *c*, parts of a steam-generating boiler; *d*, a feed-water heater, and *e* a steam-engine such as may be employed for burning the fuel and utilizing the heat of the combustion for power to be used for purifying, separating, and condensing the carbonic acid from said furnace by mechanical means; but any other suitable steam-power apparatus may be used, and it is unnecessary to describe these parts in detail.

f is a smoke-pipe for escape of the products of combustion until the requisite steam-pressure is obtained to set the apparatus in motion, when the damper *g* in said pipe is to be closed to direct the gases into a chambar *h* in the base of the hollow tower *i* through downwardly-directing baffle-plates *j*, above which chamber are perforated trays *k*, one above another at suitable distances apart, on which layers of coke *l* and brick *m* are placed alternately. Over the upper layer of coke a perforated coiled water-distributing pipe *n* is placed, which being supplied with water through a feed-pipe *o* distributes water over the coke and brick, thus exposing the ascending gases from the furnace to large wetted areas of coke and brick for cooling them.

p is a pipe through which the heated water falling down to the bottom of chamber *h* may be discharged.

q is a damper in a conduit *s* at the top of the apparatus, through which some of the lightest gases, such as nitrogen, may be partially let out to the atmosphere.

t is a large conduit leading from the top of the cooling-tower down to a centrifugal blower *u*, which sucks the gases through the tower and all the passages thereto and discharges them into the top of a purifier *v*, in which is a bucket *w*, having a perforated bottom *x* and being filled with iron or lime *y*, or both, and suspended so that the gases pass through the same into the space below, and thereby the sulfurous acid of the gases is absorbed, and a great part of the moisture absorbed in the gases from the cooling-tower will be deposited and may be drawn off as water through the pipe *z*. The bucket may be recharged with fresh material from time to time, as needful. More than one purifier of this type may be used in a series with different material in each, according to the nature of the impurities of the fuel, so that ammonia may be absorbed in one purifier, sulfurous acid in another, &c., and, besides, they form additional moisture-traps. Another centrifugal blower, as 2, is provided in the circuit, with its suction-pipe 3 connected with the exhaust side of the purifier for aiding the circulation through the purifier or purifiers and for increasing the pressure of the gases in the next part of the process. Of course any approved form of blower may be used. Following the blower 2 is a device which I call a "combined refrigerating separator and liquefier," into which the gases are discharged from said blower through pipe 4. It comprises an upright sheet-metal case 5 of oblong rectangular horizontal section and oval top, in which is a convolute passage 6, formed of two metallic sheets 7 and 8, rolled or bent parallel with each other and at the edges suitably joined to the end sheets 13 of the case 5 to make a gas-tight passage, said passage receiving at its outer extremity the

gases from blower 2 and terminating in a central space 10. Each lower transverse course of the passage 6 is broadened to form a chamber 11, in which liquefied or solidified matters will deposit, and taps r and doors 12 are provided to be opened from time to time for the removal of such matters. The sheets 7 and 8 are also so bent that another convolute passage is formed, the inner extremity of which is at 14, and the outer extremity connects with a discharge-passage 15 at the top of case 5 for discharging the unliquefied gas into the atmosphere, with a damper 16 for regulating and controlling the pressure of such gas within the apparatus, free escape not being desired. For cooling, condensing, and separating the gas thus circulating in this refrigerating apparatus an air compressor and cooler is employed, as follows: To the power-engine is connected the piston 17 of an air-compressing cylinder 18, to the ports of which compressing and cooling attachments are respectively connected, consisting of the hollow cylinders 19, containing air and water tubes 20, communicating between the ports 21, and chambers 22 in the upper ends of said cylinders, which are provided with induction-valves 23 and eduction-valves 24, and the cylinders have induction and eduction pipes 25 and 26 for the circulation of cooling-water around tubes 20. The cylinder 18 and tubes 20 are charged with water packing to act intermediately between the piston and air for applying the compressing force and as a circulating medium to distribute and equalize the heat generated by compression throughout the compressing apparatus isothermally, whereby better results are obtained. The compressed air expelled from the compressor through the eduction-valves 24 passes into a trap 27 for separating any water that may be contained in the air and drying it for increasing its expansive action. Any suitable trap may be employed, and it is unnecessary to describe the trap here shown in detail. From the trap the dry compressed air passes through pipe 28 into a header 29, located in the outer extremity of the convolute passage 6 and in the path of the hot gases of combustion entering said passage from the blower 2. From this header a multitude of small pipes 30, tapped into one side, extend along the first convolution of passage 6 into another header 31 for absorbing heat from the gases entering chamber 10 and cooling them and at the same time increasing the expansive power of the air. From the header 31 the air is conducted through pipe 32 and moisture-separating trap 33 to the admission side of an air-power cylinder 34, the piston of which is connected with the air-compressor and the steam-power engine. The compressed air expanded and cooled in the air-power engine is exhausted through another moisture-separating trap 34^a into a header 35, traversing the upper part of chamber 10 in the refrigerator and regenerator and having a multitude of small tubes 36 tapped into its side and extending outward through all the convolutions of passage 6 and the reversely-flowing gases of combustion therein into a header 37, through which and pipe 38 the expanded air, having absorbed all available heat from the said gases, returns to the suction side of the compressor for being again compressed and cooled preparatory to another circuit through the recooler and air-power engine.

Water absorbed by the air from the water packing in the compressor and separated from the air in the trap can be returned to the water-packing chamber through a pipe 39 from time to time, said pipe having a cock for controlling it. Water collecting in the traps 33 and 34^a may be ejected from time to time through discharge-pipes 40 by compressed air admitted from pipe 28 through pipe 41, said pipe 41 being provided with suitable controlling-cocks 42.

What I claim as my invention is—

1. The combination in apparatus for the manufacture of carbonic acid, of a combustion-furnace, means for transforming part of the heat of the furnace into mechanical power through the instrumentality of an expansive vapor, means for purifying the gases of combustion, and means for refrigerating, liquefying and solidifying the carbonic acid of said purified gases through the instrumentality of said mechanical power and another vapor or gas.

2. The combination in apparatus for the manufacture of carbonic acid, of a combustion-furnace, steam or other vapor power apparatus energized by the heat of said combustion, means for collecting, cooling and purifying the gases of said combustion, a refrigerating, liquefying and solidifying apparatus receiving the said purified gases of combustion, and an air compressor and cooler actuated by said power apparatus and operating said refrigerating apparatus by the heat-absorbing action of the compressed air circulating and expanding in the refrigerator, on the gases also circulating therein.

3. The combination in apparatus for the manufacture of carbonic acid, of a combustion-furnace, steam or other vapor power apparatus energized by the heat of the combustion, means for collecting, cooling and purifying the gases of said combustion, a refrigerating, liquefying and solidifying apparatus receiving the purified gases of combustion, an air compressor and cooler actuated by said power apparatus and operating the refrigerating apparatus, and an air-expanding power-engine operated by air of the compressor regenerated in the liquefying apparatus, and expanded and cooled in said engine preparatory to further action in the liquefier.

4. The combination in apparatus for the manufacture of carbonic acid, of a combustion-furnace, steam or other vapor power apparatus energized by the heat of the combus-

tion, means for collecting, cooling and purifying the gases of said combustion, an air compressor and cooler actuated by said power apparatus, and a refrigerating, liquefying and solidifying apparatus receiving the purified gases of combustion, and operated by the heat-absorbing action of the compressed air circulating and expanding therein on the gases also circulating in said refrigerator, said refrigerator and compressor connected for endless circulation of the air for compression and expansion successively.

5. The combination in apparatus for the manufacture of carbonic acid, of a combustion-furnace, steam or other vapor power apparatus energized by the heat of the combustion, means for collecting, cooling and purifying the gases of said combustion, an air compressor and cooler actuated by said power apparatus, a refrigerating, liquefying and solidifying apparatus receiving the purified gases of combustion, and operated by the heat-absorbing action of the compressed air circulating and expanding therein on the gases also circulating in said refrigerator, and a power-engine actuated by air from the compressor regenerated by heat absorbed from the gases of combustion in the refrigerator, and exhausted from said power-engine through the regenerator for further service therein, and being in the cycle of the compressor and refrigerator.

Signed by me at New York this 15th day of April, 1900.

OSCAR P. OSTERGREN.

Witnesses:
A. P. THAYER,
C. SEDGWICK.