(No Model.) 2 Sheets—Sheet 1.

L. CHAPMAN.

APPARATUS FOR THE PRODUCTION OF OXYGEN.

No. 418,864. Patented Jan. 7, 1890.

Fig. 2.

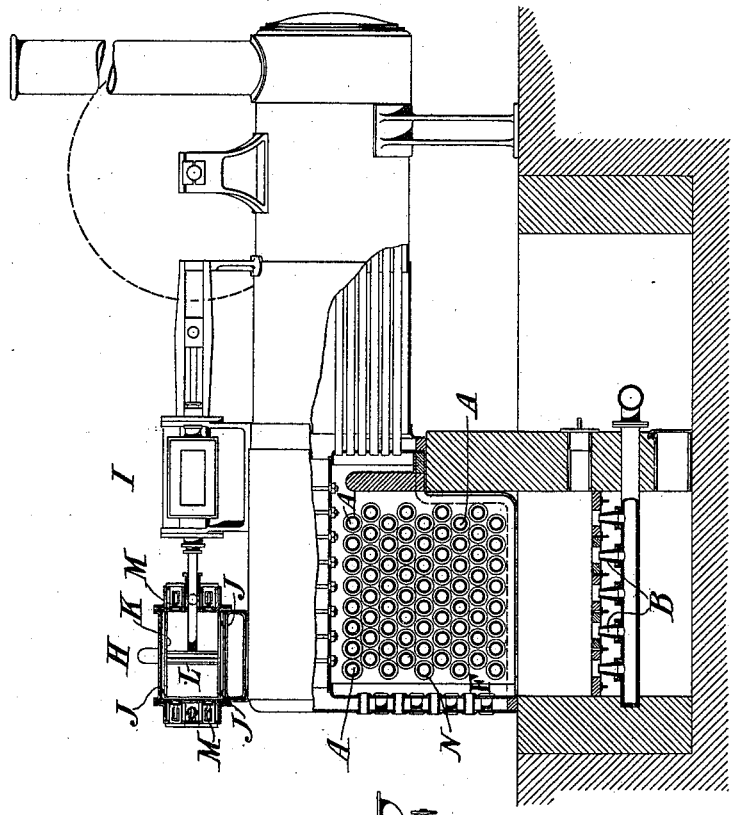
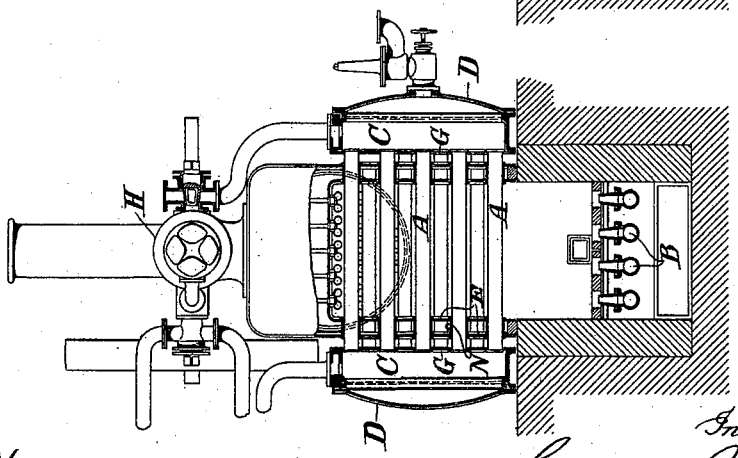


Fig. 1.



Attest:
Joe Hagmann
Geo. T. Smallwood

Inventor:
Leonard Chapman
by A. Pollok
his attorney

(No Model.) 2 Sheets—Sheet 2.

L. CHAPMAN.

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Fig. 4.

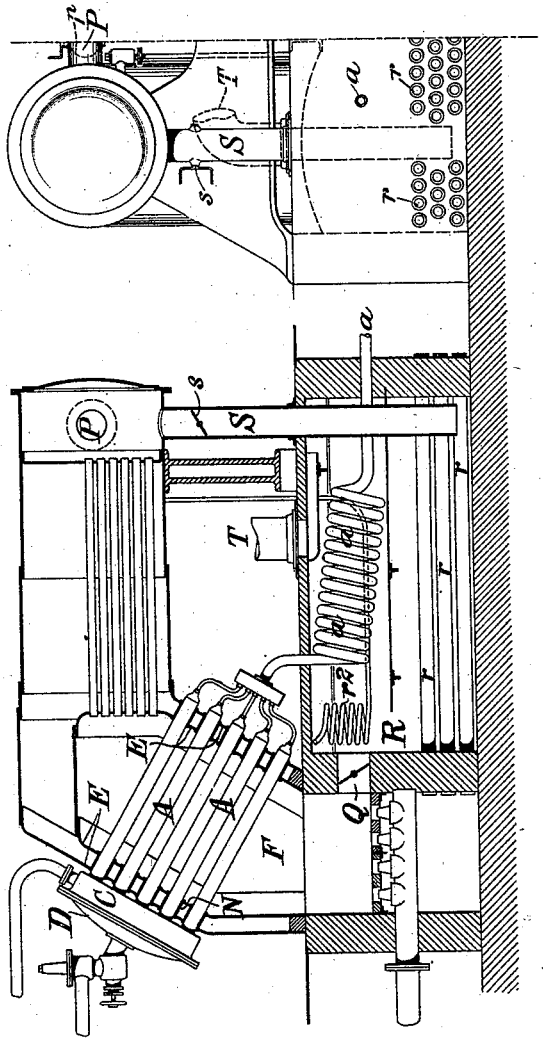

Fig. 3.

Witnesses:
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Inventor:
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his attorney

UNITED STATES PATENT OFFICE.

LEONARD CHAPMAN, OF WESTMINSTER, ENGLAND, ASSIGNOR TO THE CONTINENTAL OXYGEN COMPANY, (LIMITED,) OF SAME PLACE.

APPARATUS FOR THE PRODUCTION OF OXYGEN.

SPECIFICATION forming part of Letters Patent No. 418,864, dated January 7, 1890.

Application filed July 10, 1889. Serial No. 317,050. (No model.) Patented in England December 9, 1887, No. 16,987.

To all whom it may concern:

Be it known that I, LEONARD CHAPMAN, engineer, a subject of the Queen of Great Britain, residing at Connaught Mansions, Victoria Street, in the city of Westminster, England, have invented certain Improvements in Apparatus for the Production of Oxygen and Nitrogen Gases from Atmospheric Air, (for which I, in conjunction with Edward Baudowin Ellice-Clark, civil engineer, of Connaught Mansions, aforesaid, have obtained a patent in Great Britain, No. 16,987, dated December 9, 1887,) of which the following is a specification.

This invention has for its object to effect economy in cost and time in the production of oxygen and nitrogen gases from atmospheric air, and has reference to such a process as is described in the specification of British Letters Patent No. 157, granted to Arthur Brin and Léon Quentin Brin, and dated the 5th day of January, 1885.

According to the present improvements the retorts in which the anhydrous barium oxide is contained are preferably made of but small sectional area, so as to each contain but a relatively small quantity or depth of the anhydrous barium oxide and to present a large surface to the furnace or heating medium, and all or a number of the said retorts are at their respective ends caused to open into one common chamber covered by a door or cover, thus reducing the cost of fittings and facilitating the working and the making of tight joints. In order to prevent such a settlement of the barium oxide in the retorts as would leave a passage for the air above the said barium oxide without contact with it, I prefer to place the retorts in position inclined to the horizon, so that the barium oxide leaves no such clear air-space, and all the air consequently passes through or in contact with the barium oxide. It is desirable that the change of temperature requisite for effecting the peroxidation of the barium oxide and the deoxidation thereof should be effected as rapidly as possible, and it has been found that this can be facilitated by making the walls of the furnace in which the retorts are placed of a water-casing, which may be a steam-boiler or part of a steam-boiler for generating steam for driving the pump which is used in the process or for other purposes.

The following description, with reference to the accompanying drawings, of a construction according to this invention will serve to explain more fully its nature; but it is premised that the invention is not limited to the precise details which are hereinafter described and illustrated.

Figure 1 is a transverse section, and Fig. 2 is a longitudinal section, of an apparatus constructed according to this invention with retorts arranged horizontally in the water-jacketed fire-box of a boiler of the locomotive type. Figs. 3 and 4 show a modified arrangement, wherein the retorts are in an inclined position, Fig. 3 being a longitudinal section and Fig. 4 an end view.

This arrangement is supposed to be in a connected pair, of which one only is shown, the other being a duplication of it on the other side of the dot-and-pick line in Fig. 4.

The whole of the furnace may be constructed of metal; but to prevent the retorts nearest the sides and top of the furnace being objectionably cooled down, owing to their radiant heat being absorbed by the comparatively-cool surface forming the sides and top of the furnace, I prefer to line the inside of the furnace with fire-brick or other refractory material.

Referring first to the arrangement illustrated in Figs. 1 and 2, the retorts A, which contain the barium oxide, pass through sleeves N, extending from the sides of the fire-box through the water-space to the outside or skin of the said space. The ends of the said retorts are secured into the inner plates or sides of chambers C, situated at a short distance from the skin of the water-space and common on each side to all the retorts, each chamber C being provided with a door D, by which access can be had to all the retorts. If the number of retorts be large, two or more such chambers C, each provided with a door, may be employed at both ends of the retorts, instead of one only, each chamber and door

being common to any convenient number of retorts.

To prevent settlement of the barium oxide in the retorts in such a way that the air pumped in to peroxidize the barium oxide passes along the space left between the surface of the barium oxide and the upper part of the retort, instead of passing through and in contact with the whole of the barium oxide, the retorts may be placed at an incline to the horizon, and in order the more rapidly to withdraw such inclined retorts from the furnace, I prefer to secure their upper ends into one or more chambers, each provided with a door, as above described, and to provide the lower end of each retort with a cover of the same external diameter as the retort. This is the arrangement shown in Figs. 3 and 4, in which but one chamber C and cover D are shown, and parts which correspond with those shown in Figs. 1 and 2 are marked with the same letters of reference.

Both the above-described arrangements of horizontal and inclined retorts can most conveniently be employed in boilers of the locomotive type, and the pumping-engine for peroxidizing and deoxidizing the barium oxide can be mounted on the top of such a boiler, as is done in portable engines. This is illustrated in Figs. 1 and 2, where the pump is marked H and the motor-engine thereof is marked I.

To economize fuel when boilers of the locomotive type are employed I prefer to arrange two such boilers side by side, as mentioned with regard to Fig. 4, with their smoke-boxes connected in such a way (as by the pipe P, Fig. 4) that communication between them can be readily closed by a damper *p*. The furnace of each boiler is provided with the necessary heating apparatus. Both here and in Figs. 1 and 2 this is shown as consisting of burners B for burning gaseous fuel and air, and leading out of each furnace there is a flue provided with a damper Q, to convey products of combustion to a heating-chamber R common to both furnaces.

As before stated, barium oxide gives up the oxygen it has absorbed most readily at a temperature considerably higher than that at which it best takes it up. I therefore heat only that one of the furnaces in which are the retorts containing the barium oxide being deoxidized, and I pass the products of combustion from the furnace after having deprived them of a certain amount of their heat in the first boiler through the tubes or flues of the other boiler by opening the damper *p* in the passage P, so as to maintain the retorts in the furnace being peroxidized at the proper lower temperature. After having done this they pass from this furnace by the flue Q to the heating-chamber R, in which they circulate around and heat a coil of pipes *r*, Figs. 3 and 4, through which air is drawn or forced for supporting combustion of the gaseous fuel in the furnaces, and around pipes or a coil r^2 for heating the feed-water for the boiler. Either or both of these pipes or coils may be used. From this chamber R the products of combustion pass up the chimney shown at T, Figs. 3 and 4.

S are pipes (provided with dampers *s*) which lead from each smoke-box to the heating-chamber R beneath.

After deoxidizing the barium oxide in the retorts in a furnace it is required to cool it down as quickly as possible. Therefore the supply of gaseous fuel to its burners is shut off, and as the waste gases therefrom are consequently no longer available to continue the heating of the companion furnace the burners belonging to the latter are lighted; but as such cooling down of the first-named furnace would be retarded if the products of combustion from the other furnace being heated up were allowed to pass into the first-named furnace which is to be cooled down, I deal with these waste gases in the manner hereinafter described.

Upon opening the damper *s* in the pipe S from the smoke-box of the furnace to be heated up, and closing communication between the smoke-boxes by shutting the damper *p*, the products of combustion from the furnace being heated up go direct to the heating-chamber, and after heating the air-supply to the burners and the feed-water any or all of them pass up the chimney, and the first-named furnace is left to cool as quickly as the water surrounding it will absorb the heat stored in its fire-brick lining (if such be used) and in the retorts and barium oxide therein contained. As soon as this furnace has been cooled to a suitable temperature for commencing peroxidation it is maintained at that temperature by means of the waste gases, which will be obtainable from the companion furnace, (the barium oxide in which is by that time ready to be or is being deoxidized,) the said waste gases being diverted from passing directly into the heating-chamber and being caused to travel by way of the pipe P into the smoke-box and through the tubes of the boiler, giving up heat to the water surrounding them, and after circulating around the retorts in the fire-box arriving at the heating-chamber by the flue Q.

Instead of filling the jacket surrounding either of the types of furnaces above described with water, air may be drawn or forced through such jackets, and the heat absorbed thereby during its passage over the heated surfaces can then be economically employed in heating the air for supporting the combustion of the gaseous fuel, while the passage of the cold air would also offer a ready means of rapidly cooling down a highly-heated furnace.

In the air-jacketed furnace the sides of the inner or furnace walls exposed to the contact of air might be advantageously provided with a number of projecting wings or their equivalents to offer a greatly-increased heated surface to contact with the air.

An apparatus made as described may be mounted on wheels to be transportable, or it may be stationary.

The boiler or furnaces containing the retorts, as aforesaid, may be of a type other than that mentioned—for example, it may be of saddle shape.

The sets of retorts may be arranged in any suitable number, after the manner hereinbefore described, and there may be a pump for each set, or a pump common to any number of or to all the sets.

The spaces in the chambers C are of course provided with air inlets and outlets and communications with the pump which may be like or analogous to those ordinarily used in the aforesaid process.

In Figs. 3 and 4 at the end of the retorts, where there is no chamber C, the air is admitted by a pipe *a* and branches a^2.

In apparatus of the class to which this invention relates the air is caused on its way to the retorts to be drawn by a pump through a chamber containing a material to remove moisture. Instead of placing the pump so as to draw the air through this chamber it is proposed to place it so that it forces the air into and through the chamber, as by this means the air, instead of being in an attenuated condition in the chamber, is in a compressed state, and in that state more readily parts with moisture.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In apparatus for the production of oxygen and nitrogen from atmospheric air, the combination of a furnace having a water-jacketed fire-box, a series of tubular retorts in said fire-box having one or both ends fixed in a plate or plates situated a short distance from said water-jacket, a removable cover common to the several retorts, and pipes for supplying the retorts with air during the operation, substantially as described.

2. In apparatus for the production of oxygen and nitrogen from atmospheric air, a series of retorts for containing barium oxide, said retorts being inclined to the horizon so as to compel the contact of air with the barium oxide therein, and being provided with means for passing air through the same, substantially as described.

3. In apparatus for the production of oxygen and nitrogen from atmospheric air, the combination of a pair of furnaces, retorts in the fire-box of each furnace, water-jackets in the walls of the fire-boxes, and a flue connecting the smoke-boxes of the two furnaces so that the products of combustion after heating the retorts containing barium oxide undergoing deoxidation are partially cooled by the water-jackets, and thence pass to the retorts of the other furnace, substantially as described.

4. In apparatus of the character specified, the combination of two furnaces containing retorts, a pipe or flue connecting the smoke-boxes of said furnaces, whereby the products of combustion may pass from one to the other, and a damper in said flue or pipe for cutting off such communication when desired, substantially as described.

5. In apparatus of the character specified, the combination of a pair of furnaces, a pipe connecting the smoke-boxes thereof, a heating-chamber common to both furnaces, pipes or flues communicating therewith, and dampers in the several pipes or flues for controlling the circulation of the products of combustion, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LEONARD CHAPMAN.

Witnesses:

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ALBERT DAVIS,
47 *Lincoln's Inn Fields, London, W. C., Clerk.*