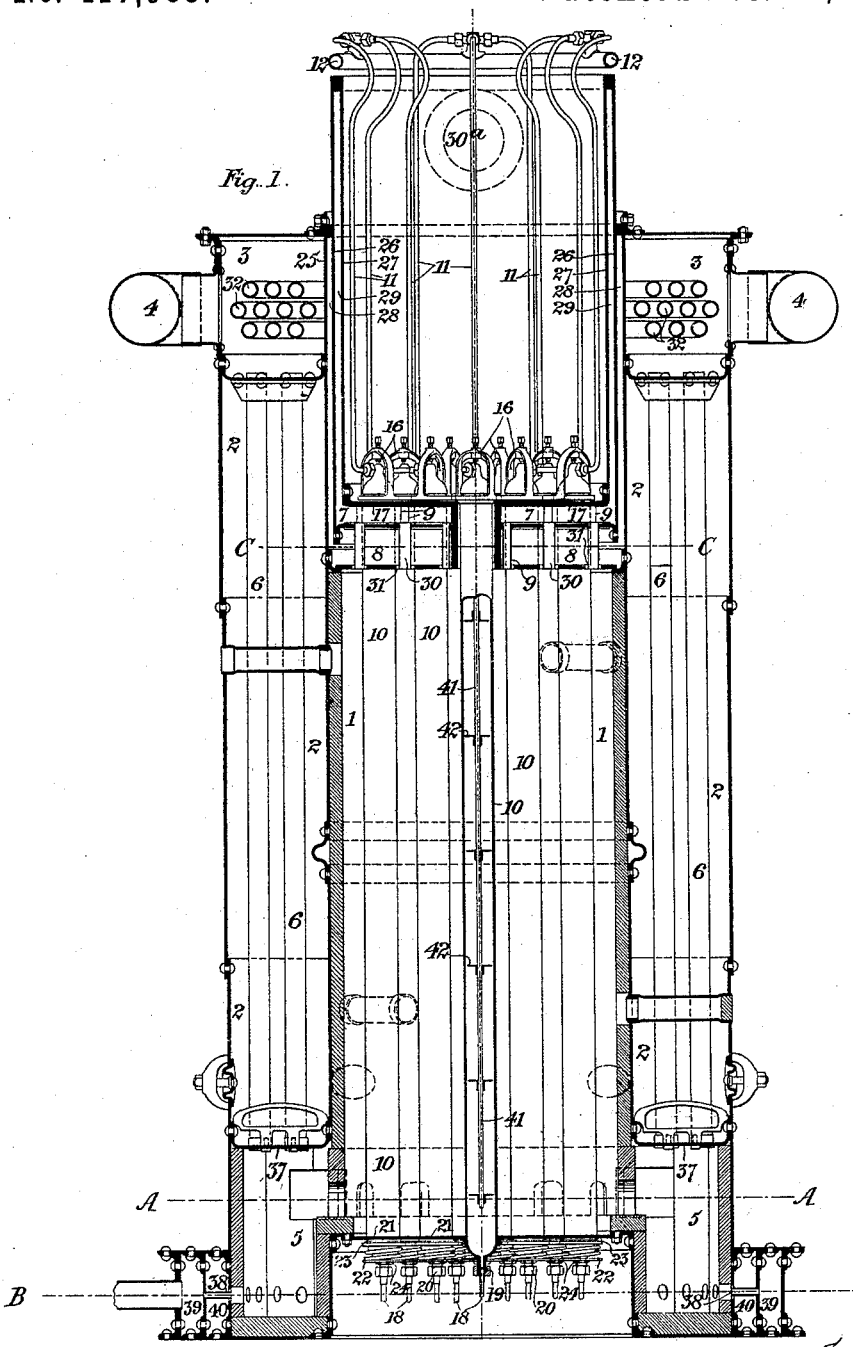
(No Model.) 5 Sheets—Sheet 1.

# L. CHAPMAN.

## APPARATUS FOR OBTAINING OXYGEN FROM AIR.

No. 417,985. Patented Dec. 24, 1889.

Fig. 1.

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## APPARATUS FOR OBTAINING OXYGEN FROM AIR.

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Fig. 2.

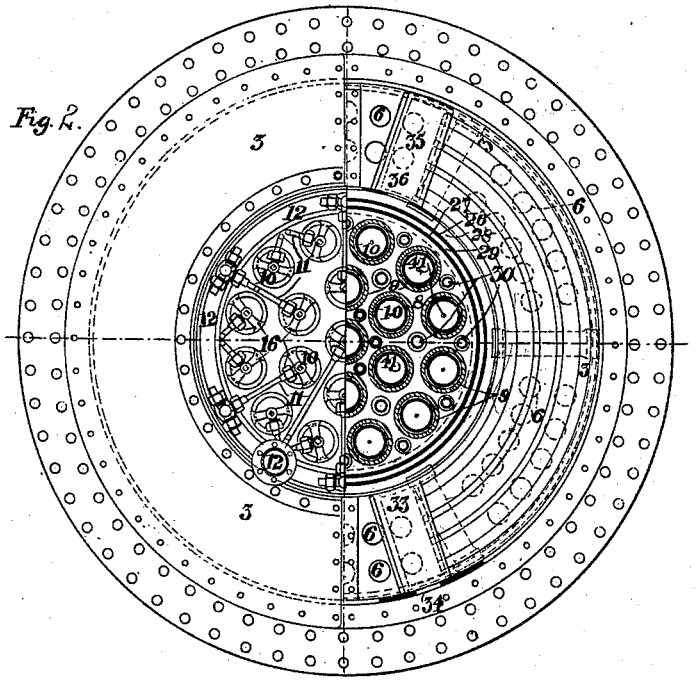
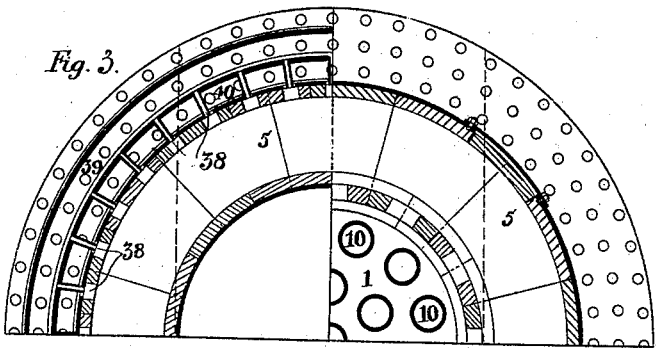



Fig. 3.

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## APPARATUS FOR OBTAINING OXYGEN FROM AIR.

No. 417,985. Patented Dec. 24, 1889.

Fig. 4.

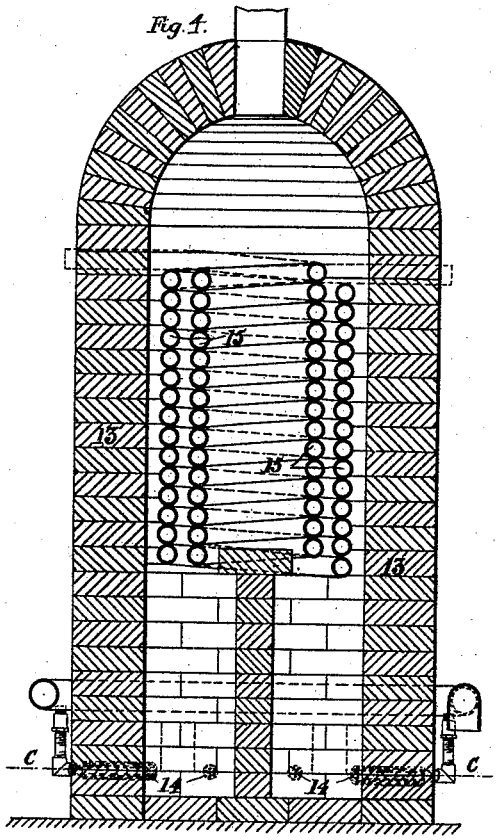
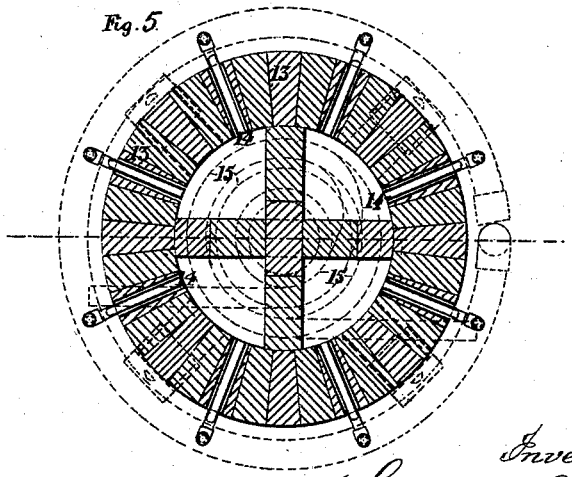



Fig. 5.

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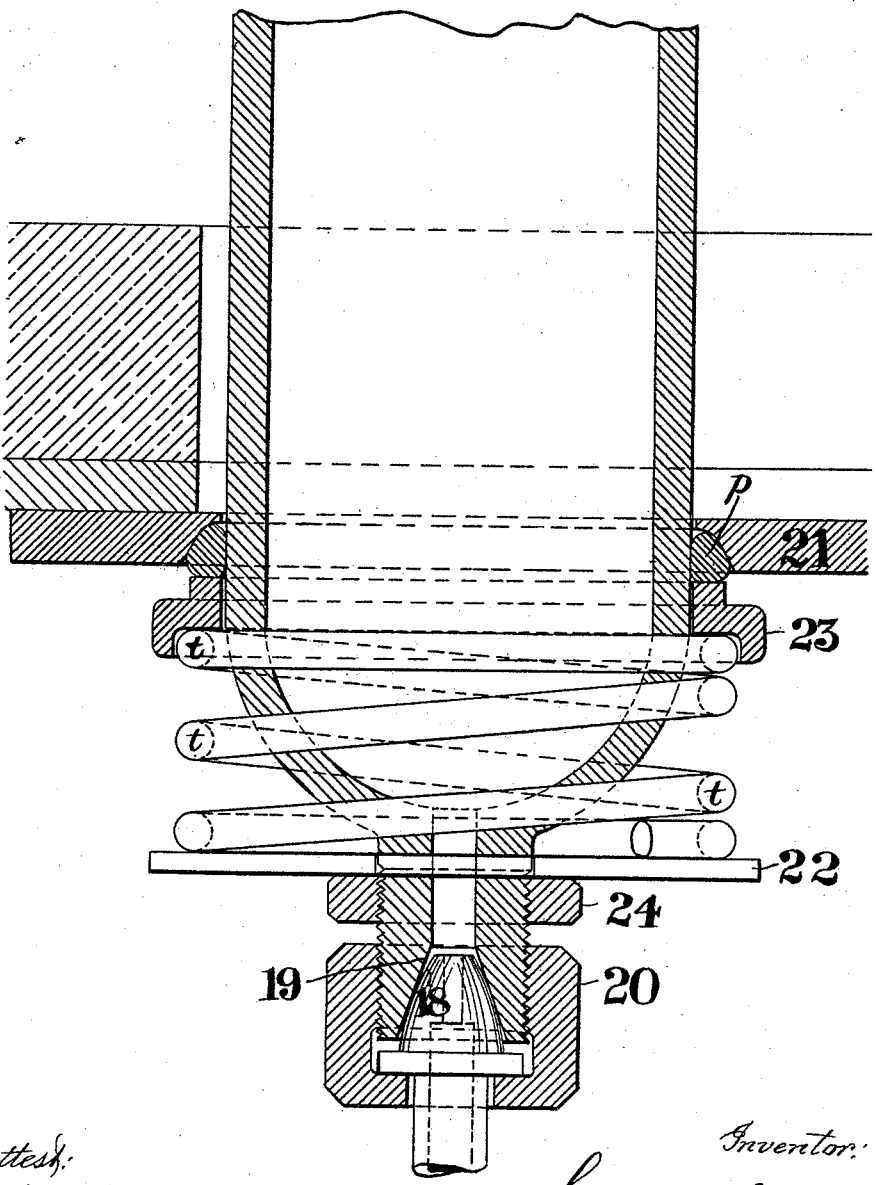
## APPARATUS FOR OBTAINING OXYGEN FROM AIR.

No. 417,985. Patented Dec. 24, 1889.

*Fig. 6.*

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## APPARATUS FOR OBTAINING OXYGEN FROM AIR.

No. 417,985. Patented Dec. 24, 1889.

Fig. 7.

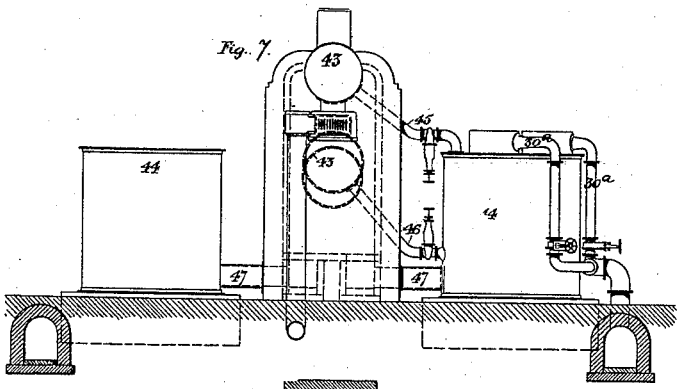
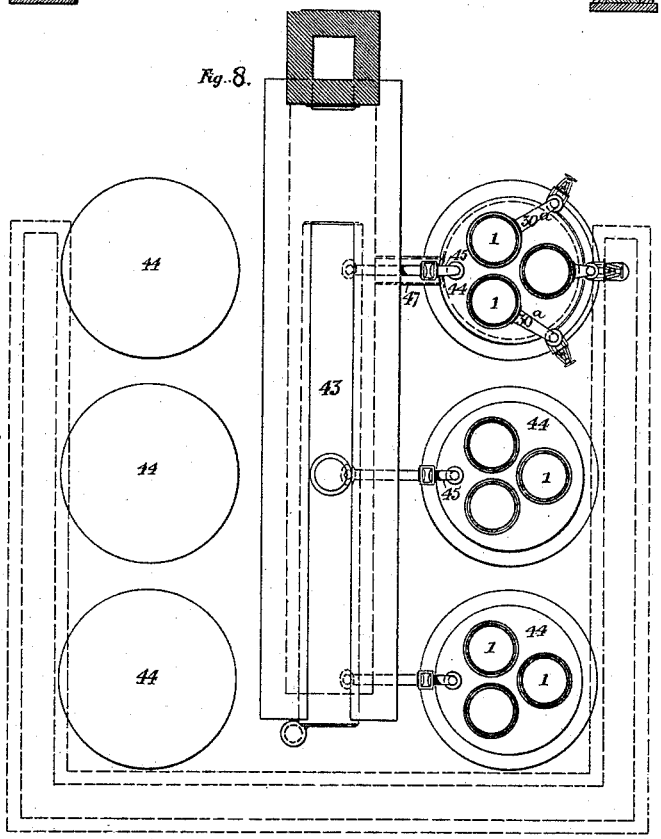



Fig. 8.

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# UNITED STATES PATENT OFFICE.

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

## APPARATUS FOR OBTAINING OXYGEN FROM AIR.

SPECIFICATION forming part of Letters Patent No. 417,985, dated December 24, 1889.

Application filed July 10, 1889. Serial No. 317,051. (No model.) Patented in England March 13, 1888, No. 3,880.

*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 Obtainment of Oxygen and Nitrogen Gases from Atmospheric Air, (for which I, in conjunction with Edward Baudouin Ellice-Clark, civil engineer, of Connaught Mansions, Victoria Street, in the city of Westminster, England, have obtained a patent in Great Britain, No. 3,880, dated March 13, 1888,) of which the following is a specification.

This invention has for its object to provide an apparatus whereby the obtaining of oxygen and nitrogen gases from atmospheric air is much facilitated and more economically worked. It refers to such a process as that known as the "Brin process," as described in the specification of British Letters Patent No. 157 of 1885.

The apparatus consists of a boiler or shell, in which is situated an inner chamber, constituting a furnace or several such inner chambers. For the purpose of obtaining the maximum of efficiency and the minimum of space and with as little supervision as possible, I generally prefer to use three such inner chambers in one outer shell, and I will describe the invention in that connection; but it is to be understood that I do not limit myself to that number. The space between the inner chambers or furnaces and the outer shell constitutes a water and steam space, and at top and bottom are chambers which are in communication with the furnaces. Tubes pass through the water-space and communicate with the said top and bottom chambers. The top chamber constitutes a smoke-box, and has outlets or chimneys for the escape of products of combustion. In the top of the furnaces are openings, in which are suspended retorts for the barium oxide used in the said Brin process, the said retorts passing down through the furnaces and lower chamber and having at top and bottom inlet and outlet pipes for the passage of the air and gases, the connections with the pipes being made so that they can readily be disconnected and a retort be withdrawn for repair or renewal without disturbing the others or interrupting the process. The tops of the retorts are preferably covered by lids analogous to those used for closing gas-retorts. The heating medium is preferably a mixture of gaseous fuel and air, which may either or both be preheated by passing through a pipe or passage in the smoke-box. The jets of gaseous fuel and air can be admitted at the upper end of the furnaces, and the products of combustion pass downward into the lower chamber and in contact with the lower plate of the water-space up the tubes into the smoke-box and thence to the chimney or chimneys. Extra flames may be employed in the lower chamber to maintain the heat, when necessary.

The aforesaid mode of arranging the retorts can be applied to furnaces for the production of oxygen and nitrogen from atmospheric air, whether made with a water-space, as described, or not. The retorts may be provided with supports for the barium oxide, consisting, for instance, of perforated disks or trays, which may be mounted on a support passing down the retort. The top of the furnace, which supports the retorts, may constitute the gas and air chambers for supplying the burners, the chambers being preferably double, with tubes passing from the one for supplying gas, these tubes being surrounded by the outlets for hot air from the other chamber. Sleeves pass through both chambers to constitute orifices through which the retorts are introduced. The air which is supplied to the retorts for the obtainment of the oxygen and nitrogen gases may be preheated by passing it through pipes or passages exposed to a high temperature.

In order that my said invention may be fully understood, I shall now proceed more particularly to describe the same, and for that purpose shall refer to the several figures on the annexed sheets of drawings, the same letters and figures of reference indicating corresponding parts in all the figures.

Figure 1 is a vertical section. Fig. 2 is a part plan and part section on the line C C, Fig. 1; and Fig. 3 is a half-section partly on

the line A A and partly on the line B B, Fig. 1. Figs. 4 and 5 show an air-heating apparatus. Fig. 6 is an enlarged detail view, and Figs. 7 and 8 illustrate a modified form of apparatus.

The furnace 1 is lined with fire-brick and encircled by the water-space 2, which has at top a smoke-box 3, from which lead the chimneys 4. At bottom is the combustion-chamber 5, which also is lined with fire-brick, and from which lead tubes 6 through the water-space to the smoke-box. The top of the furnace is formed by a chamber containing two compartments 7 and 8, one above the other, with sleeves 9 passing through them for the reception of the retorts 10, which rest by the stirrups screwed onto their upper ends on the top of the chamber. The retorts are covered at top by lids, each preferably secured, as shown, by one screw through the stirrups. From these covers lead pipes 11, opening into a general pipe 12, through which the nitrogen is, during the peroxidation of the barium oxide, conveyed away to the relief-valve, through which it is blown off and escapes or is collected, as may be desired. The oxygen is, during the deoxidation, withdrawn from the barium oxide in the retorts by the same pipe, which is then put in communication with the pumps, which deliver the oxygen into a gasometer or elsewhere, as may be desired. The air for peroxidizing the barium oxide is admitted at the bottom of the retorts after having first been heated to a suitable temperature on its way from the pumps by being passed through an air-heating stove, a suitable form of which is shown in vertical and horizontal sections, respectively, in Figs. 4 and 5, consisting of a brick-chamber 13, provided with gas and air burners at 14 and with a coil 15, heated thereby, through which the air for the retorts is passed.

The lower parts of the stirrups 16, screwed onto the tops of the retorts, are in the form of a conical ring, which rests upon a conical seating in the plate 17. The retorts' lower ends preferably pass through holes in the bottom plate, outside of which the connections are made, they being conveniently effected by the curved conical end of the air-pipe 18, seating in the straight conical orifice 19 at the bottom end of the retort and secured by the screw-collar 20, this arrangement being drawn to a larger scale in Fig. 6. The retorts are suspended upon the upper plate, and in order to keep the lower ends tight where they pass through the plate 21, and still allow for contraction and expansion in the retorts, I provide a circular plate 22, (see detail view, Fig. 6,) situated a short distance beneath the plate 21, and I place loose on the retort a ring 23, between which and the circular plate 22 I place a spring *t*, which presses the upper side of the ring 23 up against the packing *p*, received in a groove in the edge of the hole in the plate 21, through which the retort passes. The same arrangement is used for all the retorts.

24 is a nut screwed on the contracted end of the retorts and bearing on the plate 22.

Although at the commencement of an operation the furnace and the retorts may have been sufficiently cooled down, the barium oxide inside the retorts may, owing to its bad heat-conducting properties, have been but slightly reduced in temperature. I therefore prefer at the beginning of the peroxidation to admit air direct from the pumps without passing it through the air-heating stove.

With regard to the supply of gaseous fuel to the furnace it will be seen that the inner wall 25 of the water-space 2, together with the plate-rings 26 and 27, form annuli 28 and 29, the latter of which, closed at its upper end, receives the gas-supply at $30^a$ and communicates at its lower end with compartments 7, while the annulus 28, which is also closed at its upper end, forms a communication between the atmosphere and compartment 8 by way of the heater in the smoke-box 3. From compartment 7 descend tubes 30, which pass through holes 31 in the bottom of the lower compartment, the said holes being of greater diameter than the external diameter of such tubes, and through the annular spaces thus formed enters the air for supporting combustion of the gaseous fuel, such air having been previously heated by passing through tubular air-heaters 32 in the smoke-box 3. These air-heaters consist of boxes 33 and 35, into one of which the air enters through an opening 34, controlled by a sliding door adjustable from below, then passes by the tubes 32 into the box 35, and thence through the outlet 36 into the space 28 and to the burners. The heated gases from the burners pass down the furnace in contact with the retorts, which they heat, then into the combustion-chambers, and then up the tubes 6 into the smoke-box 3, assisting in heating the water for generating steam on their way to the smoke-box, where, before being drawn into the chimneys, they circulate around the tubes 32 of the air-heater.

At a lower level than the tube-plate 37 at the bottom of the water-space of the boiler are supplementary burners 38 to allow of the heating of the water in the jacket or the generation of steam being carried on independently of the burners at the top of the furnace proper. These burners are supplied with gas and air, respectively, from the two annular chambers 39 and 40, gas passing from the chamber 39 by pipes 38, passing through the air-chamber 40, from which the air (which is received thereinto by any suitable openings) passes by openings surrounding the pipes 38, and so mixes with the gaseous fuel to support its combustion.

In order to maintain the barium oxide in a favorable condition for the air to pass in contact with it and to enable the oxygen to be

readily drawn off and the barium oxide to be readily removed when required, I suspend a rod 41 down the center of each retort, the said rod having fixed to it at intervals perforated disks 42 or trays, upon which the barium oxide rests.

I have described the lower ends of the retorts as passing through the bottom plate; but if the retorts do not so pass through the said plate the introduction of air may be effected by a tube passed down through the cover to near the lower end of the retort. The rod supporting the aforesaid disks, if made tubular and attached to an air-inlet on the cover, will answer for this purpose.

I have shown one furnace only in the water-space; but to economize space I prefer to use three furnaces, each constructed as above described, arranged in one water-jacket, as shown in the arrangement, Figs. 7 and 8.

Figs. 7 and 8 show an arrangement which I prefer to use when operating on a large scale, in order to give only one water-level and pressure indicator to attend to. Along each side of a boiler 43 (here shown as being an elephant boiler) I arrange the vessels 44, constituting the water-jacketing for the retort furnace or furnaces 1. Pipes 45 lead from the upper part of the water-space of the boiler to each of the water-jacketing vessels, and return-pipes 46 lead from each such vessel back to the boiler. The furnace of each set of retorts is put in communication with the heating-space of the boiler by the passages 47, so that the products of combustion pass thereinto on their way to the chimney.

$30^a$ $30^a$ are the pipes leading the gaseous fuel to the furnaces, as in Figs. 1, 2, and 3. Valves are arranged on these pipes and on the water-pipes 45 and 46, and dampers are arranged in the passages 47, so that any furnace or set of furnaces can be thrown out of action when required.

In the arrangement of vertical retorts described any retort can be conveniently withdrawn by undoing the connections at top and bottom and drawing the retort upward.

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 an apparatus for the production of oxygen and nitrogen from atmospheric air, the combination, with a furnace, of vertical retorts, the latter being supported at their lower ends in said plate, so that they are inclosed for practically their full length by said heating-chamber, and pipes communicating with said retorts beneath said plate, substantially as described.

2. In apparatus for the production of oxygen and nitrogen from atmospheric air, the combination of a vertical retort, a burner at the top thereof, air and gas pipes leading to said burner, and passages for conducting the hot products of combustion downward adjacent to said retort, substantially as described.

3. In apparatus for the production of oxygen and nitrogen from atmospheric air, the combination, with a furnace having plates or divisions near the top and bottom, of a series of retorts for containing the barium oxide, arranged vertically in said furnace and supported by said plates or divisions, each retort being secured in place by detachable devices, so that it can be disconnected and removed independently of the others, substantially as described.

4. In apparatus of the character indicated, the combination, with vertical retorts suspended from a horizontal plate, of air and gas chambers surrounding the upper ends of said retorts, and burners at the top of the retorts supplied by said air and gas chambers, substantially as described.

5. In apparatus of the character indicated, the combination, with a supporting-plate, of a series of vertical retorts separated by intervening spaces, and burners at the top of said retorts, whereby the products of combustion are conveyed downward around said retorts, substantially as described.

6. In combination with retorts for obtaining oxygen and nitrogen gases from atmospheric air, the rods carrying disks for supporting the barium oxide, substantially as hereinbefore described, whether the said rods be used as air-inlets or not.

7. In apparatus for producing oxygen and nitrogen gases from atmospheric air, the arrangement of a furnace or furnaces with burners at the upper part and inclosed in a water-space, with a combustion-chamber at bottom, with tubes or a passage or passages through or in proximity to the water-space, and with or without a smoke-box at top, substantially as hereinbefore described.

8. In apparatus of the character indicated, the combination of a furnace having an inclosing water-space, a series of retorts supported therein, burners at the top of said retorts, passages for conducting the products of combustion downward adjacent to said retorts, auxiliary burners beneath said water-space, and tubes passing upward through or in proximity to said water-space, substantially as described.

9. In apparatus of the character indicated, the combination, with the furnace having a supporting plate or division, of a retort passing at one end through said plate, and an elastic packing and screw-coupling therefor, whereby said retort is firmly held in position and a tight joint effected, while permitting the ready removal of said retort, substantially as described.

10. In apparatus of the character indicated, the combination of a furnace having a division-plate, on one side of which the products of combustion circulate, a retort having one end projecting through said plate, a packing-ring, a loose collar bearing against said ring, a loose plate, a spiral spring between said collar and plate, and a tightening-nut screwed

onto the threaded end of said retort, substantially as described.

11. In apparatus of the character indicated, the combination, with a retort-furnace having a smoke-box, of burners, pipes for supplying air and gas to said burners, the air-pipe being arranged in said smoke-box, and passages for conveying the products of combustion to the smoke-box after circulating around the retorts, substantially as described.

12. In apparatus of the character indicated, the combination, with a water-casing, of a series of two or more retort-furnaces inclosed in said casing, and pipes for supplying air to the several retorts of said furnaces, substantially as described.

13. The combination, with a boiler, of a series of water jackets or casings, all communicating with said boiler, and retort-furnaces inclosed in the several water-casings, the furnace of each set of retorts being in communication with the heating-space of the common boiler, substantially as described.

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

LEONARD CHAPMAN.

Witnesses:

WILLIAM SHARP,
*Solicitor, 9 Walbrook, London, E. C.*

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