C. F. JENKINS.

BLAST FURNACE.

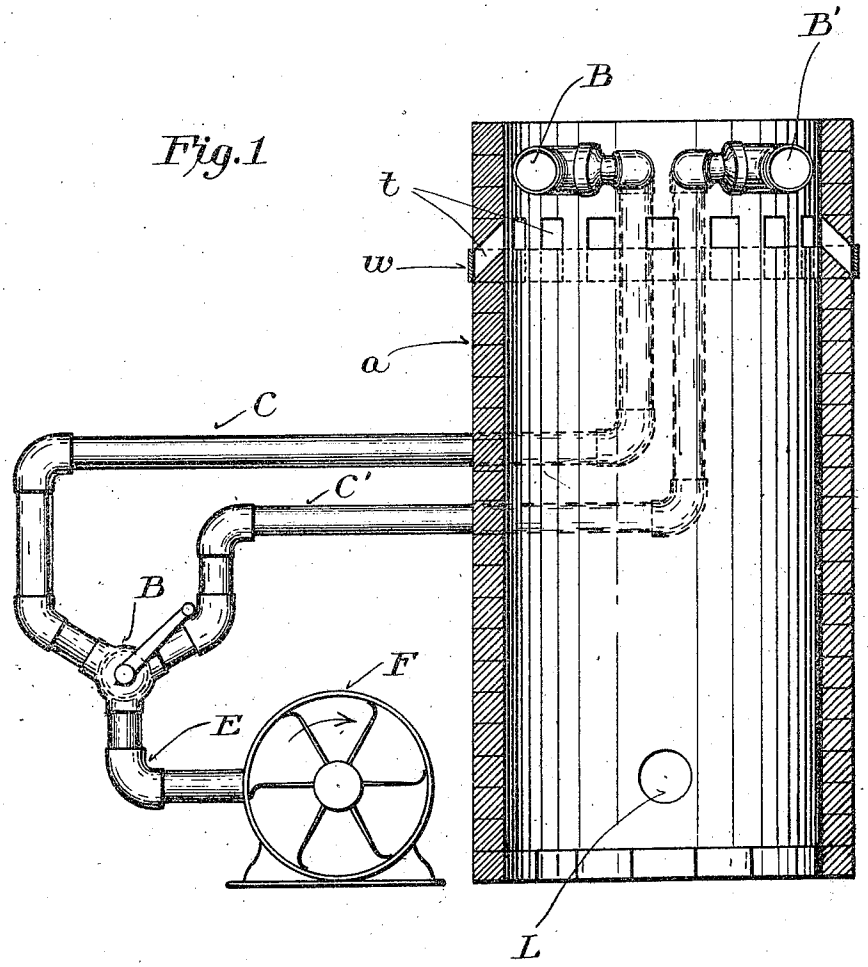
APPLICATION FILED JUNE 25, 1910.

1,010,265.

Patented Nov. 28, 1911.

3 SHEETS—SHEET 1.

Fig. 1



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3 SHEETS—SHEET 2.

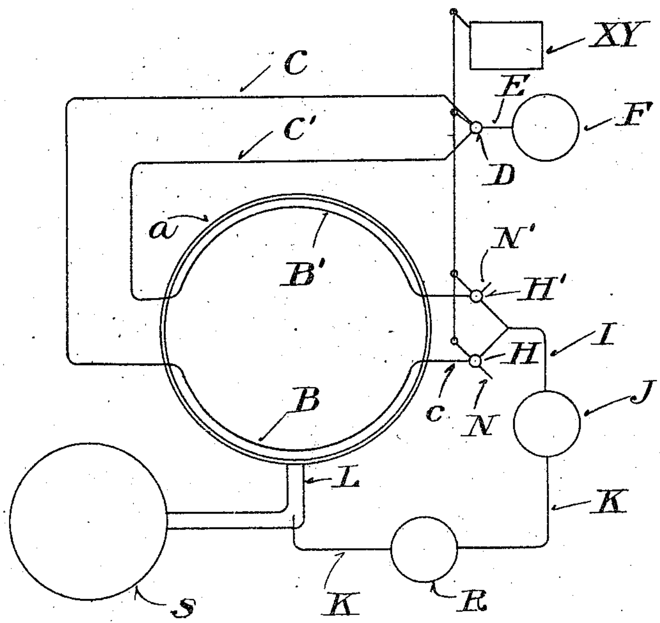

Fig.4

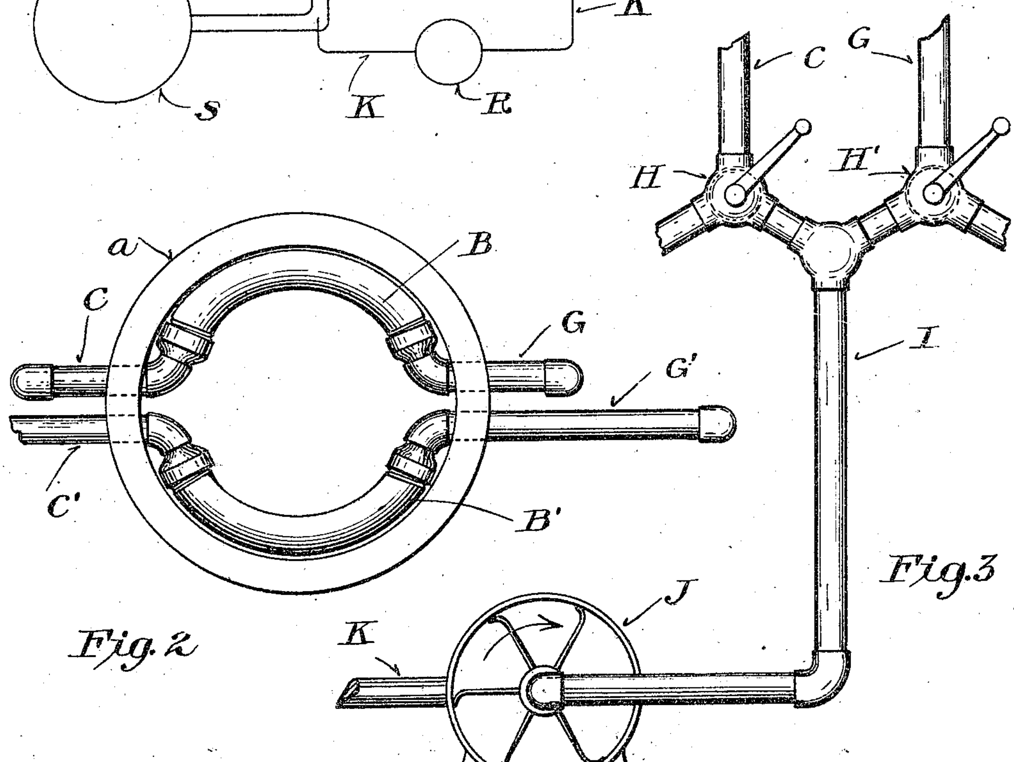

Fig. 2

Fig.3

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3 SHEETS—SHEET 3.

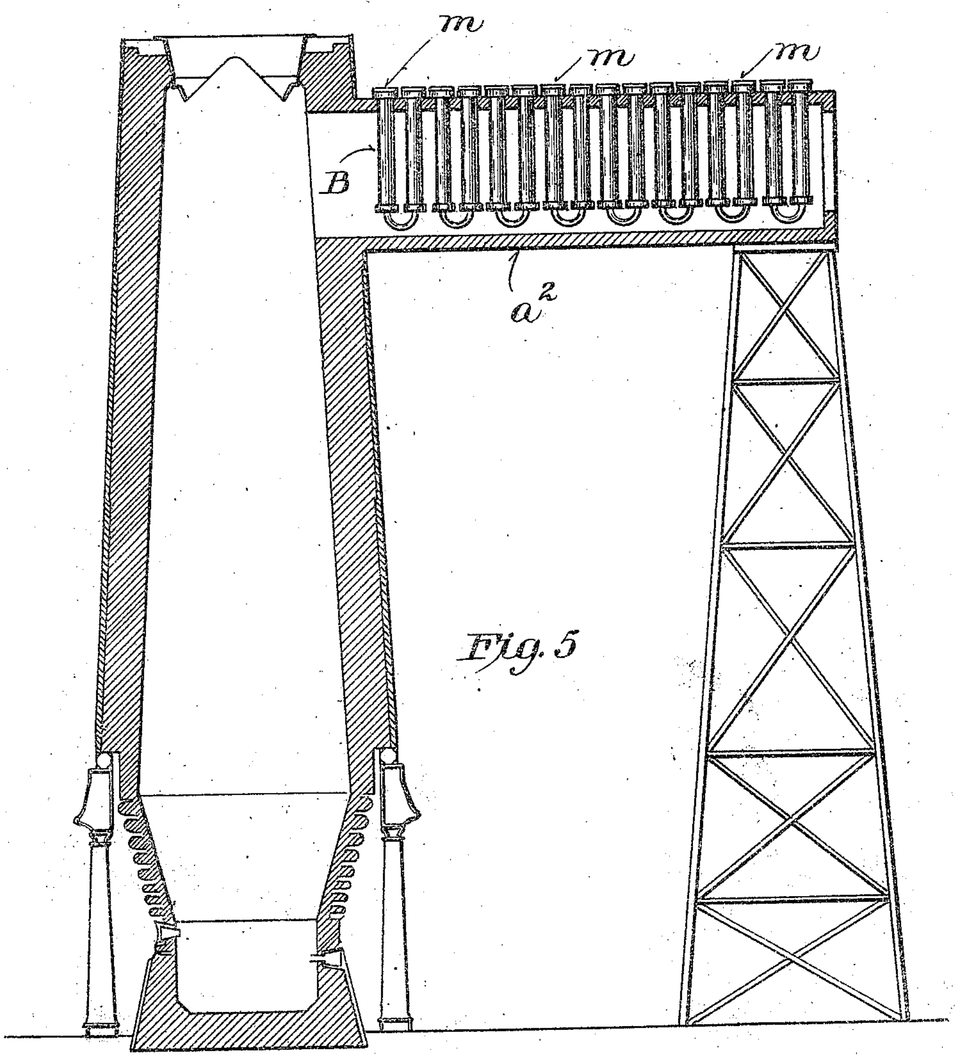

Fig. 5

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UNITED STATES PATENT OFFICE.

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BLAST-FURNACE.

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To all whom it may concern:

Be it known that I, CHARLES FRANCIS JENKINS, citizen of the United States, residing at Washington, District of Columbia, have invented certain new and useful Improvements in Blast-Furnaces, of which the following is a specification.

This invention relates to that class of apparatus known as blast furnaces, and has for its object the enriching of the oxygen content of the blast. This is accomplished by utilizing the waste heat of the furnace gases to produce oxygen for enriching the blast. Practically the whole cost, therefore, is for power required to operate the pumps, and the interest on the investment. Both these charges may, to a considerable extent, be offset by the utilization of the nitrogen byproduct, as explained later herein. In accomplishing this object I may employ any of the commercial processes for the production of oxygen alone, or oxygen-enriched fluid, to be mixed with the blast. A description, therefore, of any of the methods of obtaining oxygen is sufficient to illustrate my invention. Thus, practically all of the oxygen of commerce today, *e. g.*, that used in the oxy-hydrogen jet for "calcium lighting" or the oxy-acetylene jet for autogenous welding, is made by the following process: Barium oxid is heated to a dull redness in a suitable receptacle and air drawn therethrough. The barium oxid takes up oxygen to form barium peroxid. The air flow is then cut off and the barium peroxid subjected to a reduction of pressure, with the result that the oxygen is released, that is, the barium peroxid is resolved into barium oxid and oxygen, the barium oxid having acted as a filter to separate the oxygen from the nitrogen of the air. This process is repeated indefinitely with like results. Twin apparatus is employed and the current of air and the reduced pressure mechanically shifted from one to the other about every ten minutes, which makes the process a continuous one. The yield is approximately one thousand cubic feet every ten minutes for each three thousand pounds of barium oxid employed, and one horsepower is required at the pumps. The barium oxid does not deteriorate, although in practice it is found advantageous to remove it every ten months or so and break it up into smaller lumps again. It is also advantageous to extract the moisture and impurities from the air.

In the drawings accompanying these specifications, Figure 1 shows a vertical section of a simple furnace equipped with this invention; Fig. 2 a top view of the same; Fig. 3 an elevation showing one of the pumps and the three-way valves; Fig. 4 a diagram of the piping, etc., and Fig. 5 a typical blast furnace equipped in the manner probably most suitable for use in the iron and steel industry.

In the drawings like symbols refer to like parts, in which A is a refractory-lined furnace; B and B′ receptacles for containing the barium oxid; C and C′ pipes leading from these receptacles to the valve D common to both; E a pipe leading from the valve to the pump F; from the other end of the receptacles B and B′ two pipes, G and G′ lead off to the valves H and H′ which connect with the common pipe I leading to the pump J; from which latter a pipe K leads to the air-blast intake L.

In Fig. 5 the oxid chambers B are arranged in vertical twin-sections with cap ends extending above a heating chamber A^2 located on the outside of the furnace A. These caps M permit of the convenient charging of the oxid receptacles, the upper ends being properly piped to the pumps, etc.

The operation of the apparatus is as follows: The oxid receptacles B and B′ being charged with barium oxid, the pump F is started which drives air through the pipe E, the valve D, and the pipe C, into the receptacle B where the barium oxid takes up oxygen forming barium peroxid, the nitrogen passing on through pipe G and valve H escaping from pipe N, unless it is desired that this nitrogen be usefully employed. At the expiration of, say, ten minutes, the three-way valves D and H and H′ are thrown over which closes pipe C and directs the flow of air through the pipe C′ into B′ where it oxidizes the charge in that receptacle, while, as before, the nitrogen escapes, through N′. The suction pump J (having been started) a partial vacuum is created in the receptacle B and the peroxid gives up its oxygen which is therefore drawn off passing through the pump (J), the equalization chamber R, and the pipe K, to mix with the air-blast L, the latter being supplied by

the pump S. The valves are shifted every ten minutes (for example, by means of suitable automatic gear, represented by box XY). The pumps do not stop, and the oxygen supply is, therefore, continuous.

Any suitable means may be employed for regulating the heat coming into contact with the oxid receptacles. For example, the wall of the furnace A, in Fig. 1, is shown with openings T therethrough just beneath the oxid receptacles. Inclosing the wall of the furnace is a band which may be moved to cover the openings so that the full value of the heat acts on the oxid receptacles, while if the band is moved to wholly or partially uncover the openings, cool air will be drawn in to deflect the heat more or less away from the receptacles. This can be regulated to provide the required degree of heat. In the furnace shown in Fig. 5 the same variation can be effected by raising the cover of the furnace more or less which would cause less of the furnace heat to pass through the chamber A^2.

An economy of operation can be effected by a commercial utilization of the escaping nitrogen to make nitric acid or nitrate fertilizer, although this is not necessarily a part of this invention.

What I claim, is—

1. In operating a blast furnace, the process which consists in applying waste heat from the furnace to distinct units operated by heat to generate oxygen, and intermittently and automatically discharging the generated oxygen, from the two units alternately, in the combustion zone of the furnace.

2. The combination with a blast furnace, of distinct heat-operated oxygen generators arranged to receive waste heat from the furnace, and automatic means for drawing the generated oxygen from the generators alternately and delivering it in approximately constant flow in the combustion zone of the furnace.

3. The combination with a blast furnace, of distinct heat-operated oxygen generating units, means for intermittently supplying air under pressure to said units alternately, and automatically operated means for withdrawing oxygen from the units alternately while the air supply is cut off and delivering it in the air blast entering the furnace, all said means being thrown into and out of action periodically and automatically.

4. The combination with a blast furnace, of a heat operated unit, without the furnace, adapted to absorb oxygen from air, under pressure, supplied thereto, means for supplying such air, means for meantime conducting away the residual gas, means for then cutting off the air supply, and means for then withdrawing the absorbed oxygen and delivering it in the combustion zone of the furnace.

5. The combination with a blast furnace, of a plurality of heat-operated, oxygen-generating devices placed in the path of the products of combustion passing from the furnace and arranged to discharge oxygen in the combustion space thereof, means for forcing air through a part of said devices toward the furnace, and automatic means for shifting the air periodically back and forth from said part to a different part of said devices.

6. The combination with a blast furnace, of a plurality of independent heat-operated oxygen-generating devices located in the path of waste gases from the furnace and arranged to discharge oxygen in the combustion space of the furnace, means for creating a current of air into said devices, valves controlling the air current in the devices, respectively, and means for periodically opening certain of the valves and simultaneously closing others.

7. The combination with a blast furnace, having a lateral discharge flue for waste gases, of means for controlling the flow in said flue, independent heat-operated, oxygen-generating devices located in said flue, and arranged in two sets, to discharge oxygen into the furnace, and means for automatically throwing the sets into action alternately at predetermined intervals.

In testimony whereof I have affixed my signature in presence of two witnesses.

CHARLES FRANCIS JENKINS.

Witnesses:

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