No. 759,171. PATENTED MAY 3, 1904.

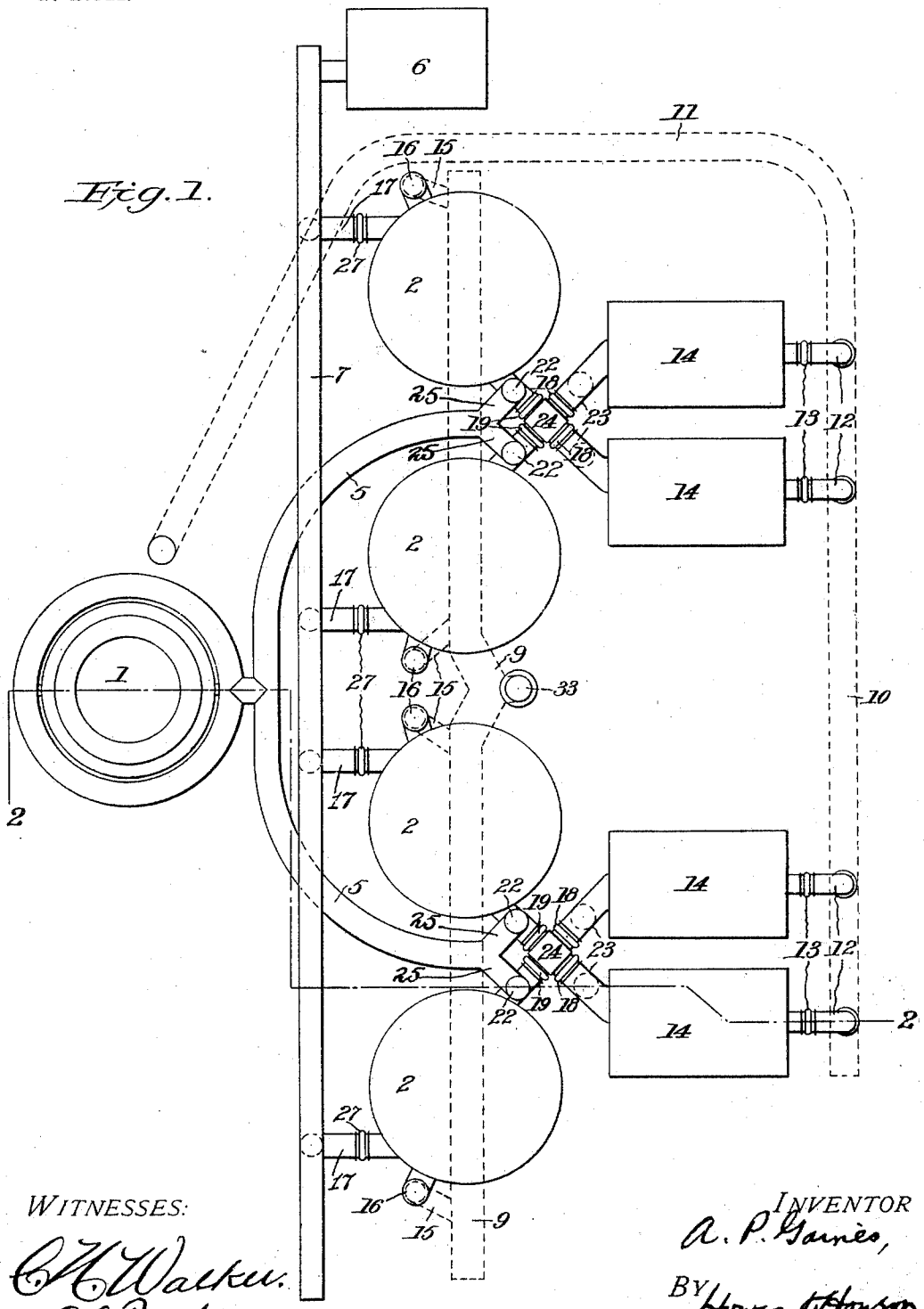
A. P. GAINES.

HOT BLAST APPARATUS FOR METALLURGICAL FURNACES.

APPLICATION FILED JAN. 20, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.

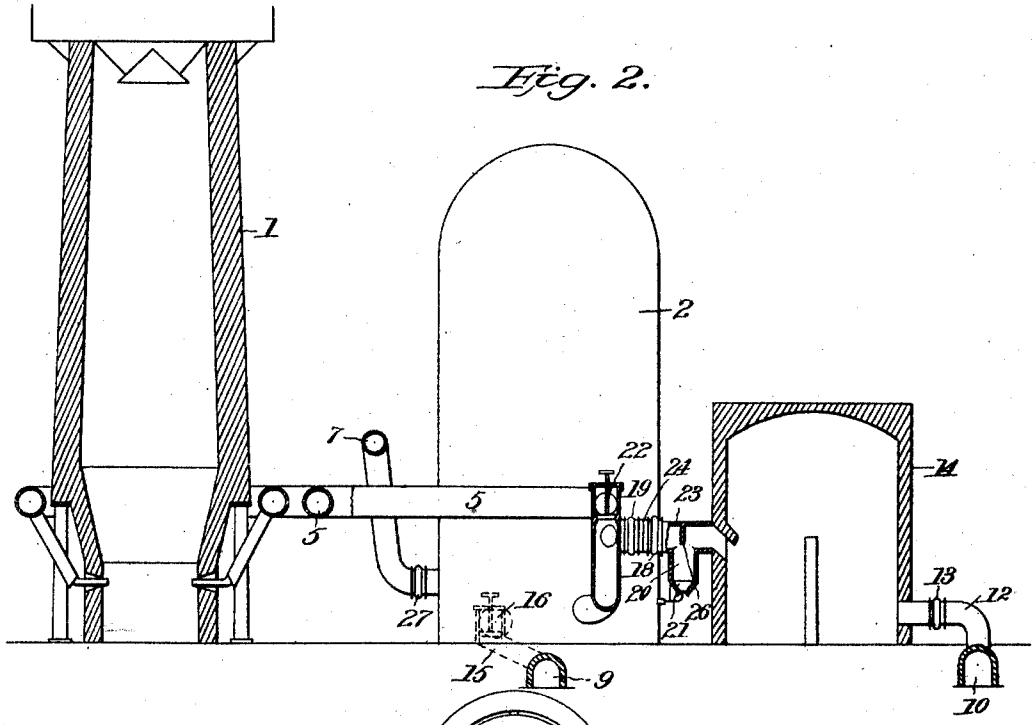
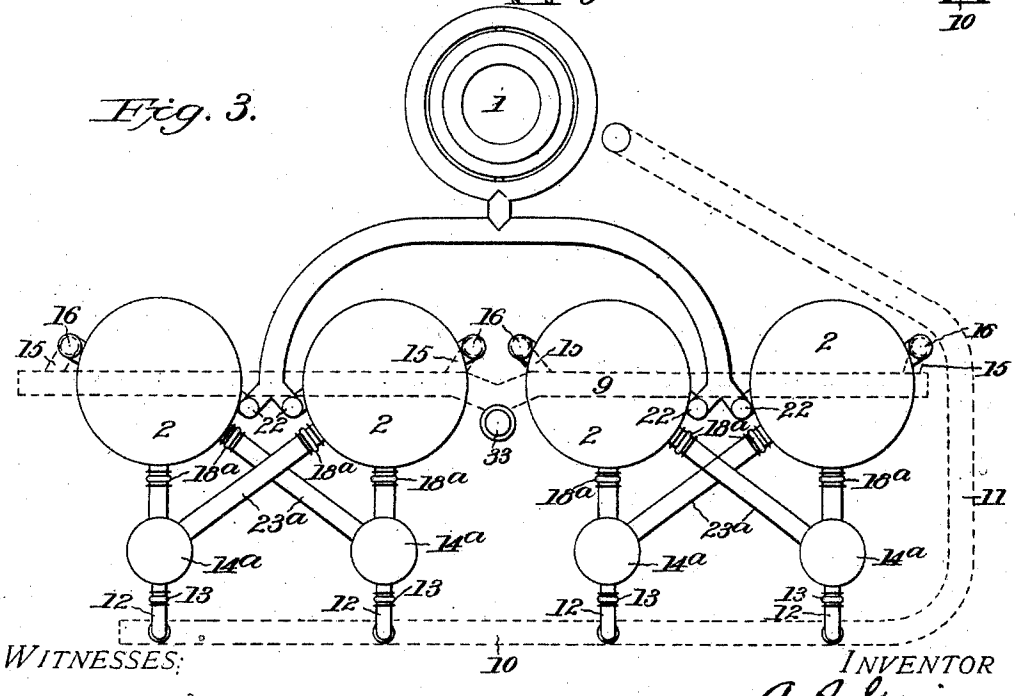


Fig. 3.



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UNITED STATES PATENT OFFICE.

AMBROSE P. GAINES, OF BESSEMER, ALABAMA.

HOT-BLAST APPARATUS FOR METALLURGICAL FURNACES.

SPECIFICATION forming part of Letters Patent No. 759,171, dated May 3, 1904.

Application filed January 20, 1904. Serial No. 189,905. (No model.)

To all whom it may concern:

Be it known that I, AMBROSE P. GAINES, a citizen of the United States, and a resident of Bessemer, county of Jefferson, State of Alabama, have invented certain new and useful Improvements in Hot-Blast Apparatus for Metallurgical Furnaces, of which the following is a specification.

My invention relates to hot-blast apparatus for metallurgical and other furnaces; and my object is to provide an apparatus of this character in which the combustion-chamber shall be entirely separate and independent from the stove or regenerative chamber, so that when the blast is put on the cold-air blast can pass only through the stove and never through the combustion-chamber, whereby such apparatus will be more efficient and durable than those heretofore used.

In hot-blast stoves for furnaces it has been the common practice to form the combustion-chamber within or as a part of the hot-blast stove. In such construction considerable heating area is lost by the opening or space required for the combustion-chamber and for the heavy walls necessary, such chamber or space generally extending the full height of the stove and free of checker-work and diminishing to this extent the heating area of the stove, whereas by providing a separate combustion-chamber the same area of stove will present a considerably greater heating-surface, as this space and the heavy walls can be filled with checker-work. Again, the cold blast of air passing through the combustion-chamber reduces the temperature to a low degree, thereby requiring considerable time to heat the brick or other heating-surfaces in the combustion-chamber sufficiently high to insure perfect combustion of the gas, whereas by my invention the separate combustion-chambers and stoves may be so connected that only one combustion-chamber may be used with two or more stoves at any one time, and consequently when one stove is on blast the other will be on gas, thereby securing continuous passage of gas through the combustion-chamber and maintaining the highest temperature in said combustion-chamber at all times, thus insuring more perfect combustion of the gas, the only loss of heat from the stove being that lost or due to radiation from the walls of the combustion-chamber and gas connection to stoves. Again, as the repairs on the modern hot-blast stoves are required very largely if not entirely in the combustion-chamber the provision of an independent and separate combustion-chamber for each stove with each combustion-chamber connected to two stoves obviates the frequent withdrawal of the stoves from service, because when repairs are needed in a combustion-chamber in active service the extra combustion-chamber can be put in service while the other is being repaired, and hence there will be no interruption to the service of gas through the stove. The frequent necessity of repairs to the combustion-chamber is due to the fact that when the best combustion is attained the temperature is so high as to effect the fire-brick to a certain extent, which action is further increased by the fusing together of the lime-dust and other materials mechanically held in the gas and the fluxing of said fused materials with the fire-bricks of the chamber. When, therefore, such repairs are necessary, it is far less expensive and less difficult on a separate combustion-chamber than on one contained in a stove. Moreover, as the separate combustion-chamber can be provided with means for precipitating dust and dirt carried by the gas before it reaches the stove the stoves are thereby kept practically free from such dust or dirt. The stove itself is left in service longer, and as this foreign matter is a poor conductor or heat-absorber the heating efficiency of the stove is materially increased, and since the blast does not pass through the combustion-chamber the independent combustion-chamber need not be so expensive in construction, for it will not be necessary to inclose it in an air-tight sheet-iron casing capable of retaining a pressure of from fifteen to thirty pounds to the square inch, as in the stove proper; but a simple wall capable of preventing expansion by the high temperature is all that is required combined with simple means to prevent heat radiation. As a result of these essential advantages of my invention a hot-blast apparatus is provided which possesses greater

efficiency in use with consequent greater economy of operation, and the hot-blast stoves are more durable and require less repairs than heretofore, while there will be less interruption in the service of the stoves.

With the object stated in view my invention consists in the combination of a plurality of combustion-chambers with one or more stoves or regenerative chambers, as hereinafter described, with reference to the accompanying drawings, and more particularly pointed out in the claims.

In the drawings, Figure 1 is a diagrammatic top plan view of a blast-furnace plant, showing my invention applied thereto. Fig. 2 is a vertical section on the broken line 2 2, Fig. 1; and Fig. 3 is a diagrammatic plan view of a modification.

Referring to the drawings, in which the same reference characters designate the same or corresponding parts in all the views, the numeral 1 indicates a blast-furnace to which the hot-air blast is delivered from any one of the four stoves 2 through a closable connection, consisting in the present instance of the main hot-blast pipe 5, provided with branches 25, communicating through valved connections 22 with the stoves. Each of the valved connections 22 communicates, by means of branch pipes 23, with each of a pair of separate combustion-chambers 14 through a closable connection, preferably a common chamber 24, having openings communicating with said connections controlled by valves 19 and with said pipes 23, controlled by valves 18. The combustion-chambers communicate, through branch pipes 12, provided with valves 13, with a gas-main 10, which in turn is connected by a pipe 11 with the gas-outlet at the top of the blast-furnace or other source of gas-supply, whereby the hot gases may be supplied to heat said stoves. The cross-sectional area of the pipes 23 should be larger than that of the pipes 12, so as to carry the increased volume of gas due to combustion and expansion in the chambers 14 with minimum friction. For blast-furnace gas the ratio should be about three to one. Any ordinary form of valves in common use for introducing the mixture of air and gas for combustion in the combustion-chambers may be used in connection with the pipe 12, leading from the gas-main 10—as, for example, that disclosed in Patent Nos. 358,500 and 244,746.

A chimney 33 is connected, by means of a main flue 9, with each stove through branch pipes 15, provided with valves 16, so that the hot gases and products of combustion after passing through the stoves from the combustion-chambers may pass off through said chimney.

Interposed in the pipes 23 are dust-collectors 20, consisting of chambers having valved controlled outlets 21, located under baffle-plates 26, which act as deflectors to precipitate the dust and dirt passing from the chambers 14 before it can reach the stoves.

A blowing-engine 6 has its discharge connected by a main 7 with each of the stoves 2 through branch pipes 17, provided with valves 27, so that the cold-air blast may be turned into any of the stoves as desired.

From the foregoing description it will be seen that the apparatus may be operated as follows: With the air-valves at 22 and 27 pertaining to any stove closed and the corresponding gas-valves 13, 18, and 19 and chimney-valve 16 open, gases from the blast-furnace can be caused to flow by way of the main 10, the appropriate branch 12, into the desired combustion-chamber 14, and there be raised to the desired temperature, whence they flow through pipe 23, being deprived of dust and dirt by the dust-catcher or baffle-plate 26 *en route*, through the appropriate valve connections 22 below the valves therein, which are located in said connections above the points of entry of the pipes 23, as shown in Fig. 2, controlled by the valves 18 and 19, into and through the desired stove 2, thence through the chimney-valve 16, pipe 15, flue 9, to chimney, through which they pass to waste. After the stove is suitably heated the valves 13, 18, 19, and 16 are closed and the air-valves 27 and hot-blast valves 22 are opened, whereby the cold-air blast is directed through the stove, where it is heated and passes through the valve connection 22, branch 25, into the main 5, and to the furnace. It will be further seen that when this cycle of operation is taking place in one stove of a connected group the reverse operation may be conducted in one or more of the other stoves of a group—that is to say, one set of valves 18 and 19 may be manipulated to direct the gas from the combustion-chamber to another stove while the blast is on the specified stove, and so on alternately, thus permitting a continuous flow of gas through the combustion-chamber.

While the combustion-chambers are shown connected to the stoves of a group through a common chamber suitably controlled by valves, it may be desirable to have independent and separate double communications between each stove and a combustion-chamber, and such a construction is illustrated in Fig. 3, where each stove 2, which may be of the two-pass form in common use, is connected by pipes 23^a with a combustion-chamber 14^a and having suitable valves 18^a controlling said passages or pipes, and the other pipes or passages are arranged as in the previously-described construction and are lettered the same, so that no detailed description thereof is necessary.

I claim as my invention—

1. In a hot-blast apparatus for metallurgical furnaces, the combination with a furnace, a regenerative stove or chamber, means for supplying a blast of air thereto, and a clos-

able connection between said stove and furnace through which the hot blast passes to the furnace, of a plurality of combustion-chambers separate from the stove, a closable connection between each combustion-chamber and stove through which hot gases and products of combustion pass from the chamber to the stove, and means for supplying gases for combustion in said combustion-chambers, substantially as described.

2. In a hot-blast apparatus for metallurgical furnaces, the combination with a furnace, a plurality of regenerative stoves or chambers, means for supplying a blast of air thereto, and a closable connection between each of said stoves and furnace through which the hot blast passes to the furnace, of a plurality of combustion-chambers separate from the stove, a closable connection between each combustion-chamber and stove through which hot gases and products of combustion pass from the chamber to the stove, and means for supplying gases for combustion in said combustion-chambers, substantially as described.

3. In a hot-blast apparatus for metallurgical furnaces, the combination with a furnace, a group of regenerative stoves or chambers arranged in pairs, a closable connection between each stove and the furnace through which the hot blast passes to the furnace, and means for supplying an air-blast to each stove or chamber, of a group of combustion-chambers separate from the stoves and arranged in pairs, closable connections between each combustion-chamber of a pair and each stove, and means for supplying gas to each combustion-chamber, whereby a single combustion-chamber may serve two stoves alternately and continuous combustion maintained in said combustion-chamber, substantially as described.

4. In a hot-blast apparatus for metallurgical furnaces, the combination with a fuanace, a group of regenerative stoves or chambers arranged in pairs, a closable connection between each stove and the furnace through which the hot blast passes to the furnace, and means for supplying an air-blast to each stove or chamber, of a group of combustion-chambers separate from the stoves and arranged in pairs, closable connections between each combustion-chamber of a pair and each stove, means for supplying gas to each combustion-chamber, whereby a single combustion-chamber may serve two stoves alternately and continuous combustion maintained in said combustion-chamber, and dust-catchers interposed in each connection between a combustion-chamber and stove, substantially as described.

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

AMBROSE P. GAINES.

Witnesses:
W. H. BRANNON,
J. B. FLOYD.