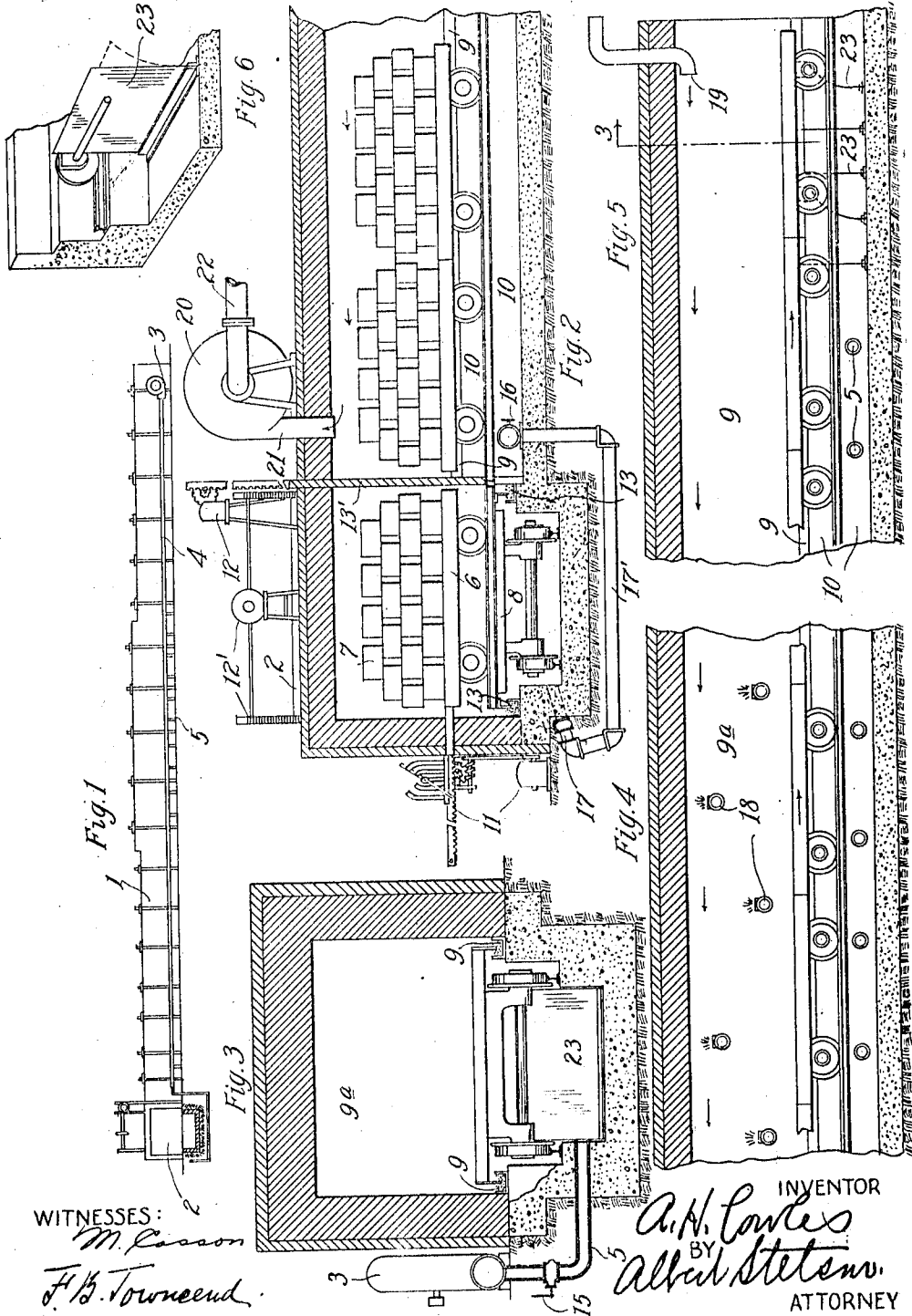


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TUNNEL FURNACE.
APPLICATION FILED AUG. 24, 1911.

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Patented Oct. 8, 1912.



UNITED STATES PATENT OFFICE

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TUNNEL-FURNACE.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ALFRED H. COWLES, a citizen of the United States, and a resident of Sewaren, in the county of Middlesex and State of New Jersey, have invented certain new and useful Improvements in Tunnel-Furnaces, of which the following is a specification.

My invention relates to tunnel furnaces. It relates particularly to a new and improved furnace and to means for protecting portions of the furnace and the conveying device from the action of injurious gases, or liquids, developed during the operation of the furnace.

The invention is particularly adapted for use in connection with the manufacture of hydrochloric acid from clay or aluminous materials.

The object of the invention is to allow the use of tunnel furnaces under conditions where the gaseous products formed in the heated zone above the cars are of an acid nature and such that upon cooling they attack the metal portions of the cars and the concrete parts of the masonry in the tunnel structure.

To carry out my invention I introduce into the portion of the furnace under the cars air, or an inert gas, that is, a gas that does not attack the corrodible parts of the cars or of the furnace, under such pressure as to counterbalance any pressure of the acid fumes tending to force such acid fumes downward and around the cars.

In the drawings accompanying and forming part of this application, are shown, by way of example, means for carrying out my invention, and therein:

Figure 1 is an elevation of a furnace showing one of my attachments; Fig. 2 is a longitudinal section through the feeding end of the furnace and the vestibule; Fig. 3 is a cross-section on the line 3—3 of Fig. 5; Fig. 4 is a longitudinal section near the central and hottest zone; Fig. 5 is a section near the outlet of the furnace, and Fig. 6 is a detail showing an air baffle.

Referring to the drawings; 1 is the furnace provided with the vestibule 2; 3 is a blower forcing air, or an inert gas, through conduit 4 and inlets 5 into the lower part of the furnace 1; 6 are the cars loaded

with briquets 7, and 8 is the transfer car by which the loaded car is brought into the vestibule; 9 is the sand seals for sealing the space above the cars from the space below the same; 11 is the device shown as electrically operated, for imparting to the cars a gradual and forward movement through the furnace; 12 shows means for operating the door 13' between the vestibule and the furnace, and 12' are means for operating the two end doors of the vestibule; 13 are sand seals for sealing two sides of the vestibule pit, the other two sides being provided with sand seals; 15 is a pressure regulating valve inserted in the air inlet pipes 5.

16 and 17 are pressure regulating valves provided at the entrance end of the furnace and vestibule respectively, and 17' is a pipe connecting these two valves; 18 are the oil burner holes and 19 an inlet for steam and air.

20 is the suction fan for drawing the acid fumes from the furnace above the cars through the pipe 21 and conveying them to the acid towers, or other receptacles, through the pipe 22; 23 are air baffles for hindering the exit of the air at the discharge end of the furnace.

The operation is as follows: Assume the portion 9^a of the furnace to be filled with cars loaded with briquets of such a composition that the product to be drawn off by the suction fan 20 is to be hydrochloric acid fumes, mixed with water vapor and products of combustion, and assume a car to be ready to enter the furnace, as shown in Fig. 2. The gas jets 18 having been lighted, steam and air are blown in at 19 over the tops of the advancing cars. The mechanism 12 operates the door 13', and the car enters, urged forward by the electrical pusher 11. As soon as the car 6 has entered the furnace, the door 13' of the vestibule is closed, the side vestibule door opened, and the transfer car 8 enters with a new loaded car ready to be advanced into the furnace.

Shortly after starting the operation acid fumes begin to fill the portion 9^a above the tops of the cars, and these are sucked out by means of the fan 20. These acid fumes (here assumed to be hydrochloric acid fumes) in the state or vapor do not attack the iron, but if cooled below the temperature

at which they condense with water (say at about 220 degrees F.), they readily attack and destroy the iron work of the cars and the furnace and the portion of the masonry containing cement or mortar. It is particularly to prevent this action that I have devised the apparatus set forth in this application. In order that the seal in the furnace portion above the cars and that below them may be as perfect as possible, the abutting ends of the cars are machined off to make an almost gas and air tight joint. The essential thing is to prevent any leakage of the acid fumes downward, and to cause whatever leakage there is to be directed upward from below the points where the temperature is lower than the condensation point of the fumes, and I create a pressure of air or inert gas, upward from beneath the cars equal, or exceeding that downward. The pressure may be produced in one way by a blower 3 delivering air through a pipe 4, arranged on one or both sides of the furnace, through the holes 5 and into the furnace below the cars, the position and number of the holes depending upon the heat and pressure in different parts of the furnace. The air introduced may, under certain circumstances, be hot and thus assist in preventing the lower portion of the furnace from becoming cold, so that the deposition of the acid fumes takes place. Moreover, each of the air inlet pipes may be provided with regulating valves 15, so that the desired pressure may be maintained. There must be means of control, because otherwise too much air might be forced upward through the crevices between and around the cars from below, and the heating gases be unduly cooled or their proper composition interfered with. The ideal to be sought is a balance, or slight upward pressure of the air. It is evident in the specific illustration shown, that the downward pressure will be greatest at a point where the burning gases are hottest and where the gas jets are most closely grouped, and it is for this that I have shown the air inlets 5 most closely grouped in Fig. 4, which indicates the middle of the furnace, or the part where the gas jets are most numerous and hottest. The suction fan for drawing off the acid fumes is shown as located at the entering end, and as the leakage at that end would be naturally upward, I have shown no air inlets at this point. At the outlet end the blowing in of steam through the pipe 19 creates, at that particular spot, a tendency to an upward pressure, on account of the partial vacuum created, but further on in the furnace this entering steam might create a downward pressure. On account of this partial vacuum at the outlet end I have shown few air inlets at that part of the furnace. Of course, as there are regulating

valves attached to each of the air inlets, they may be scattered as thickly from end to end as desired along the furnace, the pressure thus being under absolute control. Great pressure is not needed, especially at the ends. As the furnace is open at the outlet end, and cars are passed out continually, there would be a tendency for considerable air to escape from under the cars at that end. I have therefore devised and herein shown one simple manner of preventing too great escape of air from under the cars. I place crosswire in the pit of the car track a flexible metal sheet, which fills the opening close up to the bottom of the car. The elastic limit of the metal is so chosen that when the advancing car axle meets it and bends it over, as shown in dotted lines in Fig. 6, it resumes its original shape as soon as the car axle has passed. Each axle in passing operates the sheet metal baffle, and by placing several of them grouped closely, as shown in Fig. 5, no great rush of air to or out of that end takes place.

Another way in which the escape of air could be prevented to a very large extent, would be to blow air in under the cars against the air rushing into the outlet end and by the valves shown producing the balance of the two currents. There could also be attached to the sides of the cars or of the furnace means for filling up the space between the sides of the car and the furnace and the space around the wheels, if that were thought desirable to produce a more perfect control of the air at the outlet end of the furnace.

To control the pressure in the vestibule and in the furnace, I have arranged the pressure regulating valves 16 and 17 and the pipe 17¹ connecting the lower part of the furnace and the lower part of the vestibule. When the vestibule door 13¹ is to be lowered so that a new loaded car may be brought in by the transfer car 8, the valve 17 is closed, and thereby the pit is sealed against the escape of air. The vestibule being opened, the pressure therein becomes, of course, that of the atmosphere.

When the vestibule is ready for the door 13¹ to be lifted for a car to be admitted to the furnace, the air pressure is raised to that of the furnace by means of 3, or some other convenient source. The valve 17 is then closed and the door between the furnace and vestibule opened.

I do not herein claim the method which my invention is adapted to carry out, that forming the subject matter of my co-pending application Ser. No. 621,002, filed April 14th, 1911, but

What I claim, is:—

1. An apparatus for making hydrochloric acid comprising a tunnel furnace provided with means for drawing off the injurious

gases produced in the upper part of the furnace above the cars, means for maintaining the gases in the lower portion of the furnace above atmospheric pressure, in combination with means for supplying inert gases to the lower portion of the furnace below the cars, and means for regulating the pressure of said inert gases so as to prevent the injurious gases from reaching the lower part of the furnace.

2. An apparatus for making hydrochloric acid from aluminous material and an alkali chlorid, comprising a tunnel furnace provided with a car track, cars running on said track and dividing the furnace into an upper and lower portion, said furnace being provided above the car tops with a gas heating source and means at the exit end for introducing steam and air, and having, moreover, connected with the top of the furnace near the car entrance a suction device for drawing off the acid fumes, formed in the top of the furnace, in combination with means for supplying inert gas, means for maintaining the inert gas above the atmospheric pressure so as to counterbalance the pressure of the acid fumes downward and keep them from penetrating below the car tops and attacking the corrodible portions of the cars and of the furnace.

3. An apparatus for manufacturing hydrochloric acid, comprising a tunnel furnace open at the exit end, a car track, a car pit, loaded cars located on said track and dividing the pit from the upper portion, said furnace being provided in the upper portion with a supply of steam and air, having, moreover, a suction device connected with the top of the furnace near the car entrance, and means for supplying inert gas

to the pit, all in combination with gas baffles in the pit near the exit end and automatically operated by the moving cars.

4. An apparatus for making hydrochloric acid from aluminous material and an alkali chlorid, comprising a tunnel furnace provided with a car track, a car pit, a suction device connected with the top of the furnace near the car entrance, in combination with a valved pipe located also near the car entrance and in the car pit and adapted to regulate the pressure of the gases in the car pit.

5. An apparatus for making hydrochloric acid, comprising a tunnel furnace having a vestibule provided with a car pit, said pit being provided with sand seals, in combination with a pipe provided with an adjustable valve adapted to control the gas pressure in the vestibule car pit.

6. A tunnel furnace comprising an upper portion and a car pit and having a suction device connected with the top of the upper portion near the entrance, in combination with a regulating valved pipe located also near the entrance and in the car pit.

7. A tunnel furnace comprising a vestibule having a car pit, said pit being provided with sand seals, in combination with a pipe provided with an adjustable valve adapted to control the gas pressure in said pit.

Signed at Sewaren in the county of Middlesex and State of New Jersey this 14th day of August A. D. 1911.

ALFRED H. COWLES.

Witnesses:

ALBERT STETSON,
GEORGE W. CRAWFORD.