No. 651,386. Patented June 12, 1900.

# F. H. RICHARDS.

## CUPOLA FURNACE.

(Application filed Nov. 26, 1898.)

(No Model.)

*Fig. 1.*

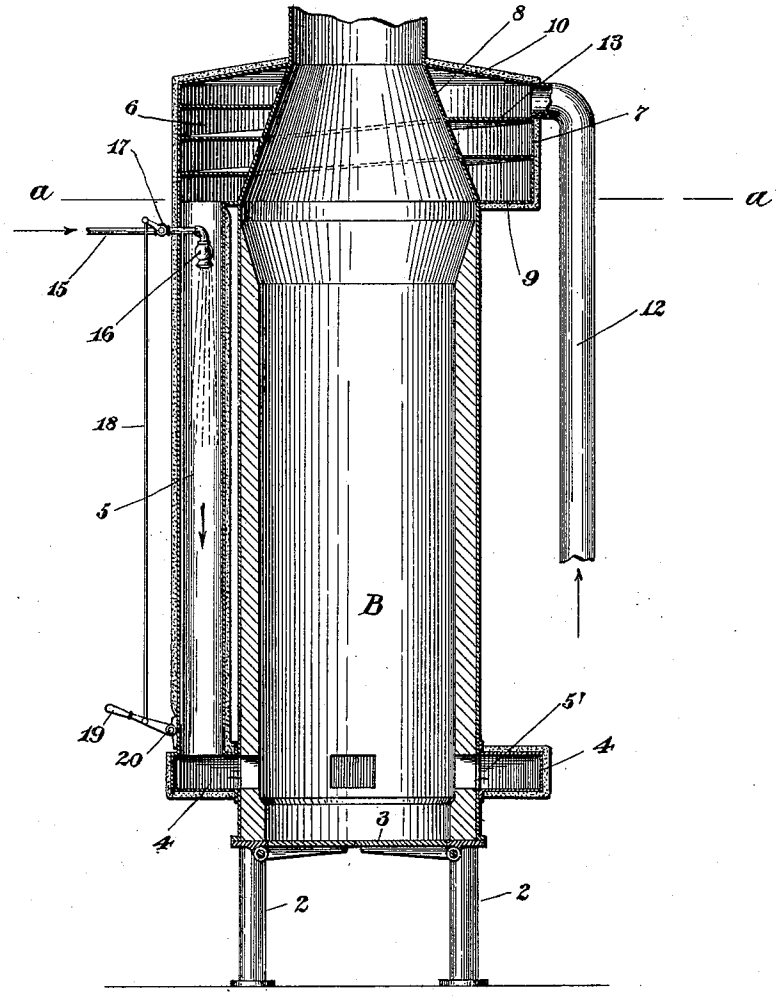
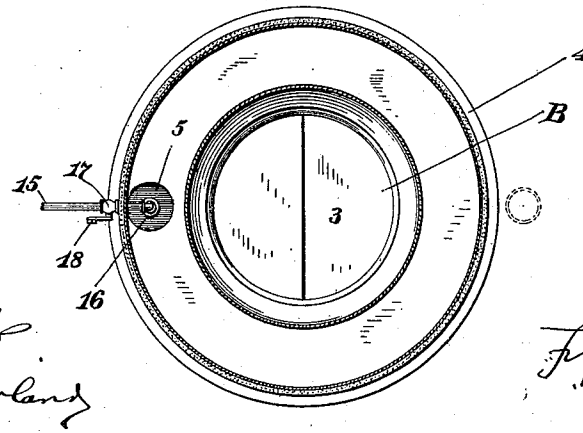



*Fig. 2.*




Witnesses
Chas. F. Schmeltz
Heath Sutherland

Inventor
F. H. Richards.

# UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT.

## CUPOLA-FURNACE.

SPECIFICATION forming part of Letters Patent No. 651,386, dated June 12, 1900.

Application filed November 26, 1898. Serial No. 697,525. (No model.)

*To all whom it may concern:*

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing in Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Cupola-Furnaces, of which the following is a specification.

This invention relates to cupola or analogous furnaces, the objects thereof being to provide a furnace of this kind especially adapted for use in making finer grades of castings and to equip said furnace with means whereby the process of melting iron can be effectively and economically carried out.

In the drawings accompanying and forming part of this specification, Figure 1 is a sectional side elevation of a furnace made in accordance with my present improvements, and Fig. 2 is a sectional plan view on line *a a*, Fig. 1.

Similar characters of reference designate like parts in both figures of the drawings.

In the drawings the furnace is designated by B, is mounted on the usual supports 2, and is provided with a floor 3, wind-chest 4, air-supply chamber 5, and twyers or air-passages between the wind-box and the interior of the cupola, as is usual.

My improvement involves more especially the combination of a heating-chamber, an air-blast pipe communicating with said heating-chamber, a hot-air chamber connected with the heating-chamber and with the furnace, and means for supplying liquid to the air near the top of the hot-air chamber before it enters the furnace.

At the top the furnace B is provided with a heating-chamber 6, constructed with an outer wall 7, lower wall 9, and top wall or plate 10. Within this chamber 6 is a flaring or bell-shaped chamber 8, which constitutes the stack for the furnace and communicates at the top with the atmosphere.

Cold air is brought to the heating-chamber 6 by a supply-pipe 12, entering said chamber at the upper end thereof and above the top portion of a spirally-arranged plate 13, whereby the air will be caused to travel around the chamber 6 and against the wall of the stack 8 therein and will become thoroughly heated before entering the pipe 5, leading to the furnace. The air-supply having been heated in the chamber 6 by reason of its circulation therein, as above stated, is then conducted out of the chamber into the hot-blast pipe 5, which connects with the lower end of the furnace through the twyers 5′.

For the purpose of modifying the character of the air-blast to secure a higher quality of material from the furnace I combine with the hot-blast devices an appliance located in position for delivering water into the hot-blast pipe 5 at a point remote from the place where the hot blast enters the twyer. For this purpose the water-supply pipe 15 is shown extending into the upper part of the longitudinal and vertically-disposed hot-blast pipe 5, said pipe 15 terminating in a rose 16, whereby the water enters in the form of spray at or near the upper end of the descending column of hot air, by reason of which the air will be thoroughly charged with water and the blast delivered to the furnace will be a commingled one of air and entrained particles of water at such a temperature that all danger of chilling or deadening the fire will be avoided.

By means of this improvement, therefore, the furnace may be supplied with a hot-air blast which contains water in such a heated state that the metal in the furnace will not be chilled nor will the fire be deadened, which is the ordinary result when water or steam is introduced in the usual manner, and by the use of my invention the air-blast is brought into a better condition, whereby the formation of gases and the chemical reactions taking place within the furnace are so modified as to create a higher quality of iron in the output, especially when this is run into small castings.

The hot-blast pipe constitutes a chamber in which the water is entrained by the air before the latter enters the furnace, and this chamber may, if desired, be covered externally with non-conducting material M, or it may be made entirely of such material for the purpose of reducing or preventing the radiation of heat.

Obviously one of the incidental advantages of my present improvements is the utilization of a considerable proportion of the heat which is ordinarily carried off from cupola-furnaces in the form of waste gases. For this purpose the wall of the chamber 8 is shown as of flared

or bell-shaped form and is smallest in diameter at its upper end, thereby bringing said chamber into a more favorable position for receiving and transmitting the heat.

In the apparatus shown and described a practical advantage is secured by reason of the fact that the hot-blast pipe or chamber is of considerable length and is also vertically disposed, whereby the hot air passes rapidly downward and moves along with the spray, and the spray will of course naturally fall by the action of gravity, so that the spray and the air pass along together in a substantially-uniform manner. By means of this particular feature of the improvement a higher degree of efficiency in the action of the blast is obtained.

The water-supply pipe 15 may be provided with a valve 17, connected by a link 18 with a hand-lever 19, pivoted, as at 20, to the pipe 5, this organization constituting a convenient means for regulating the quantity of water or other liquid supplied to the said pipe 5, which water or other liquid may be introduced in either a hot or a cold condition, as may be desired.

In the operation of this invention the blast is first turned on, being heated in the hot-air chamber, until the iron begins to melt, and about at the inception of this period the valve 17 is turned to admit a regulated amount of water in the form of spray into the hot-air-blast chamber, near the upper end thereof. The drops or particles of water fall, of course, by gravity, are entrained by the hot-air blast, heated by the same, and are conveyed under the influence of gravity and the blast into the furnace, where the water is decomposed and resolved into its elements—oxygen and hydrogen—nearly all of the impurities contained in the charge of pig-iron and scrap (especially the sulfur) being burned out and eliminated. In this process the hydrogen element of the decomposed water combines with the oxygen of the air-blast to produce what is known as the "oxyhydrogen flame," by which, with the air-blast the impurities, which would result in an inferior product if retained, are not only destroyed, but a large proportion of the carbon contained in the charge is also burned out, the result being a tough homogeneous product having a small percentage of carbon and resembling mild steel or malleable cast-iron.

Having described my invention, I claim—

1. The combination, with a furnace provided with an air-heating chamber, of a hot-blast chamber communicating with said air-heating chamber and with the furnace, and means for supplying liquid to the hot-blast chamber near the upper end thereof.

2. The combination, with a furnace and an air-heating chamber, of a vertically-disposed pipe communicating, respectively, with said air-heating chamber and with the furnace; a cold-air pipe leading into said air-heating chamber; and a spraying apparatus connected with said vertically-disposed pipe at a point remote from the place at which the same connects with the furnace.

3. The combination, with a furnace, of an air-chamber in position to be heated by the waste gases therefrom; means for supplying an air-blast to said chamber; a hot-blast pipe extending from the heating-chamber to the blast-inlet of the furnace, and constituting a hot-blast chamber; and a water supply and spray apparatus located near the end of the air-heating chamber remote from the furnace for charging the hot blast with spray, whereby particles of water at a proper temperature are entrained in the hot blast before it reaches the furnace.

4. The combination, with a furnace, of an air-heating chamber arranged to be heated by the waste gases from said furnace; a cold-air pipe communicating with said chamber; a hot-blast chamber in connection with the air-heating chamber and with the furnace; a liquid-supply device located near the upper end of said hot-blast chamber; and means for regulating the supply of liquid through said device.

5. The combination, with a furnace, of an air-heating chamber arranged to be heated by the waste products discharged from said furnace and containing a spiral plate; an air-blast pipe communicating with the air-heating chamber near the top thereof; a hot-blast pipe connected with the air-heating chamber at its upper end and with the furnace at its lower end; and a spray-nozzle located near the upper end of the hot-blast pipe.

6. The combination, with a furnace, of an air-heating chamber located at the top thereof and having a flared or bell-shaped stack communicating with the furnace and a spiral plate; a cold-air pipe entering said air-heating chamber; a hot-blast chamber communicating with the air-heating chamber at its upper end and with the furnace at the lower end; and a liquid-supply device located near the upper end of said hot-blast chamber.

FRANCIS H. RICHARDS.

Witnesses:
CHAS. T. SCHMELZ,
HENRY BISSELL.