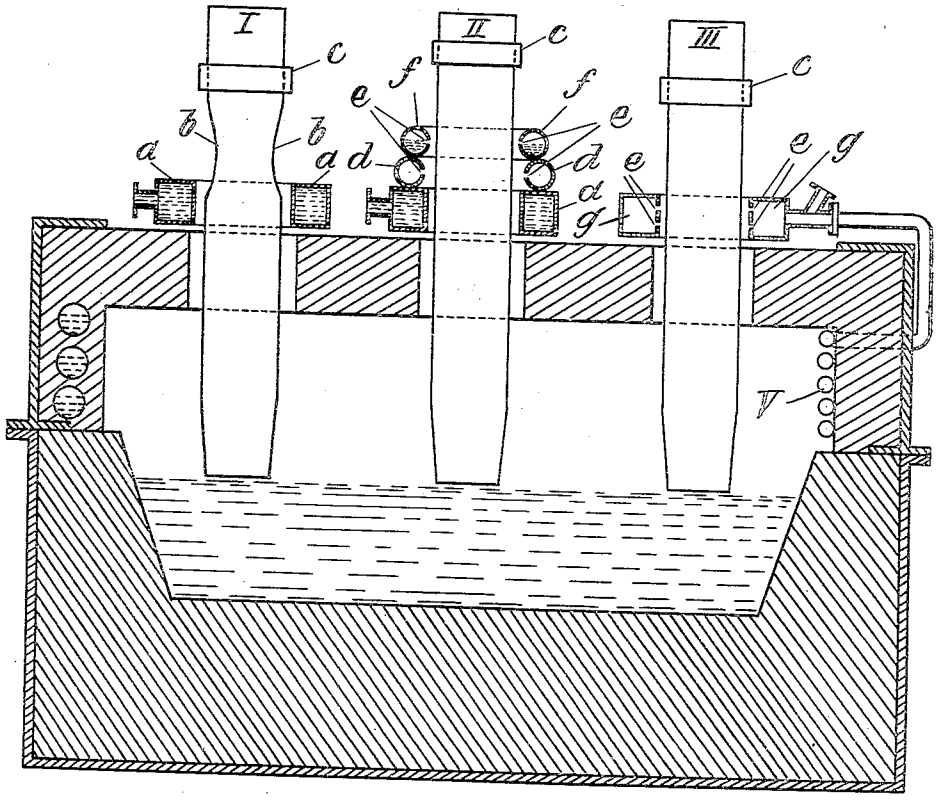
J. I. BRONN & W. SCHEMMANN.

METHOD AND APPARATUS FOR PROTECTING THE ELECTRODES IN ARC FURNACES.

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WITNESSES

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METHOD AND APPARATUS FOR PROTECTING THE ELECTRODES IN ARC-FURNACES.

1,129,377. Specification of Letters Patent. Patented Feb. 23, 1915.

Application filed December 16, 1913. Serial No. 807,103.

To all whom it may concern:

Be it known that we, JEGOR ISRAEL BRONN and WILHELM SCHEMMANN, both citizens of the German Empire, and residents of Rombach, Lorraine, Germany, with the post-office addresses Gartenstrasse 17 and Hüttenstrasse 7, respectively, have invented new and useful Improvements in Methods and Apparatus for Protecting the Electrodes in Arc-Furnaces, of which the following is a specification.

In electric furnaces into which the electrodes project through the arch or walls, the internal dimensions of the apertures through which said electrodes pass must be somewhat greater than those of the sectional area of the electrodes, so that an annular space is left between the electrode and the wall. The inevitable result is that the glowing furnace gases and flames issue through these spaces and heat the exterior portions of the electrodes to such an extent as to cause combustion of the upper portion of the carbon electrodes in the outer air. In this way the sectional area of the electrodes is diminished at the affected parts, and this reduction of section leads to the further overheating of these reduced portions, in accordance with Joule's law of the heat generated by currents. The electrodes are therefore overheated and consumed both within and without at the same time; and their sectional area may be reduced to such an extent that the carbon breaks off. In order to remedy this drawback it is the general practice to use a hollow metal ring through which water is passed, as shown at *a* in the case of electrode I in the accompanying drawing which shows a sectional elevation of a furnace.

Since the internal diameter of this cooling ring must be kept somewhat greater than the diameter of the electrode, in order to insure reliable working and also because of the inequality existing between individual electrodes, a free space of about 10 to 15 millimeters in width is unavoidable between the electrode and the cooling ring. On this account, although the use of the cooling ring *a* diminishes considerably the drawback in question, it cannot prevent it entirely and the electrodes are burnt away as at *b* (see electrode I of the drawing), even when the cooling rings are used. Now, when an electrode is advanced farther into the furnace to compensate for the consumption of its lower extremity, the cooling ring surrounds that part of the electrode which is reduced in diameter and the free space becomes much wider and the flames from the furnace may endanger, or at least injure, not only the carbon electrode but also the current leads *c*. Moreover, the use of packings and devices of the stuffing-box type have failed to act in the long run. On the other hand the measures described below and illustrated in connection with the electrodes II and III on the accompanying drawing, have been found very effective. In order to prevent the furnace flame from issuing through the free space between the cooling ring and the electrode, a hollow circular body, for example an annular tube *d*, is arranged above the cooling ring *a*, which hollow body need not surround the electrode very closely. This hollow body *d* is provided on its inner wall with numerous openings or nozzles *e*, from which an incombustible gas of any kind, such for instance as nitrogen, carbon dioxid, smoke or flue gases and water vapor are directed, under pressure, against the electrode. The resulting excess pressure over that within the furnace (which excess may be very small) created around the electrode prevents the escape of the furnace flames and thus completely obviates the drawbacks in question.

Remarkably enough, it has been found that atmospheric air can be used in place of the inert and incombustible gases mentioned above, without any injury to the carbon of the electrodes, and the fear that a current of air directed against the carbon electrodes (which are very hot in consequence of the heat of the furnace and of the passage of the current therethrough) might oxidize, or even burn, the electrodes at this point, has been found to be ill-founded. The absence of the dreaded injurious action of the air is probably due to the intense cooling of the compressed air, as the result of its sudden expansion on issuing from the nozzles. On the other hand, the favorable effect may also be facilitated, by the fact that the furnace flame is cooled down quickly by the relatively large volume of cold gas, or is to some extent extinguished when water vapor is used.

In many cases the cooling ring *a*, hitherto

generally used, may be dispensed with entirely and, in place of this, as is the case with electrode III, one of the specified gases, or mixtures of same is caused to impinge against the electrode from the hollow body *g* provided with nozzles or slits.

Instead of providing an excess pressure around each electrode, such excess pressure may be provided about the entire arch of the furnace, and therefore also about all the free spaces surrounding the electrodes, by allowing compressed air, etc., to issue from nozzles situated in the vicinity of the furnace, and thus preventing the flame from escaping through the free spaces in question.

Should the contents of the furnace, a bath of molten metal for instance, have a tendency to oxidize and therefore need to be protected therefrom, it is advisable, when using air, carbon dioxid, water, or water vapor, as described above, to cover the bath of molten metal with a layer of coke breeze or the like to make sure of preventing oxidation by keeping the oxygeniferous gases from acting on the bath.

If no steam boiler is available in the vicinity of the electric furnace, or when the available steam is too "wet," the considerable quantities of heat which are radiated from the walls of the electric furnace and would otherwise be wasted, can be utilized for the production of dry steam. This may be done, for example, by providing in the furnace walls, tubes W in which the water may be raised to boiling temperatures, or tubes V for superheating the steam. In several forms of furnace the iron shell of the furnace may be wholly or partially arranged as a jacket.

Now what we claim and desire to secure by Letters Patent is the following:

1. The method of protecting exposed loose-fitting electrodes of electric arc furnaces from the action of furnace gases tending to escape through the openings surrounding the electrodes, which consists in generating and maintaining a flow of fluid about the electrodes adjacent said openings, under pressure in excess of that generated in the furnace.

2. The method of protecting exposed loose-fitting electrodes of electric arc furnaces from the action of furnace gases tending to escape through the openings surrounding the electrodes, which consists in generating and maintaining a flow of gas about the electrodes adjacent said openings, under pressure in excess of that generated in the furnace.

3. The method of protecting exposed loose-fitting electrodes of electric arc furnaces from the action of furnace gases tending to escape through the openings surrounding the electrodes, which consists in generating and maintaining a flow of incombustible gas about the electrodes adjacent said openings, under pressure in excess of that generated in the furnace.

4. The method of protecting exposed loose-fitting electrodes of electric arc furnaces from the action of furnace gases tending to escape through the openings surrounding the electrodes, which consists in generating and maintaining jets of gas about the electrodes adjacent said openings, under pressure in excess of that generated in the furnace.

5. The method of protecting the electrodes in electric furnaces consisting in causing steam to impinge against the electrodes at the points where the electrodes enter the furnace and using the heat radiating from the furnace to generate the steam.

6. The method of protecting the electrodes in electric furnaces consisting in causing steam to impinge against the electrodes at the points where the electrodes enter the furnace and using the heat radiating from the furnace to overheat the steam.

7. Means for protecting the electrodes in electric-arc furnaces, said means consisting of a hollow body adapted to surround the electrodes above the points where said electrodes enter the furnace, said hollow body being formed with apertures at the inner side thereof and means for supplying gaseous medium to said hollow body.

In testimony, that we claim the foregoing as our invention, we have signed our names in presence of two witnesses, this 2nd day of December, 1913.

JEGOR ISRAEL BRONN.
WILHELM SCHEMMANN.

Witnesses:
ALBERT TEICHMÜLLER,
LOUIS VANDORY.