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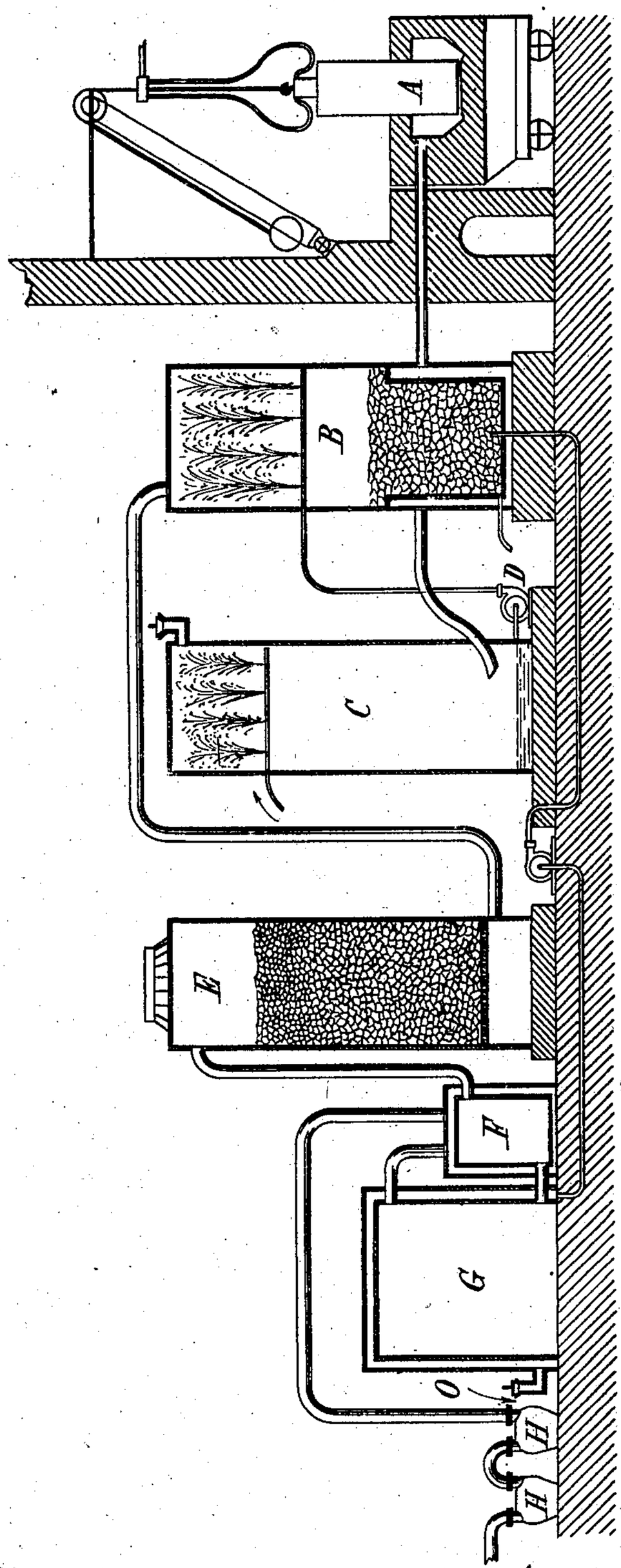
G. GIN.

ELECTRICAL MANUFACTURE OF IRON ALLOYS.

APPLICATION FILED JULY 7, 1902.

NO MODEL.



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No. 753,875. Patented March 8, 1904.

UNITED STATES PATENT OFFICE.

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ELECTRICAL MANUFACTURE OF IRON ALLOYS.

SPECIFICATION forming part of Letters Patent No. 753,875, dated March 8, 1904.

Application filed July 7, 1902. Serial No. 114,661. (No specimens.)

To all whom it may concern:

Be it known that I, GUSTAVE GIN, a citizen of the French Republic, and a resident of Paris, France, have invented certain new and useful Improvements in the Electrical Manufacture of Iron Alloys, with the Simultaneous Production of Alkaline Oxids and Alkaline Earths, of which the following is a specification.

The present invention has for its object the electrical production of iron alloys, such as ferrosilicon or ferromanganese, with the simultaneous production of alkaline oxids or alkaline earths.

In the first place, respecting ferrosilicon, my process consists in treating by silicic acid in the presence of a suitable proportion of carbon the sulfate of the metallic iron or the oxid of iron that it is desired to combine with silicon in such a manner as to form a silicate of this oxid alkaline or earth-like alkaline while it disengages itself from the sulfurous anhydrid and carbonic oxid. The alkaline silicate or alkaline earth is introduced into a second electric furnace after having had added to it in calculated proportions carbon and oxid of iron or metallic iron. Ferrosilicon is formed at the same time that the alkaline oxid or alkaline-earth oxid is set free. It can be recovered in the form of scoria or by sublimation if it is volatile at the temperature of the reaction.

If in the preceding operations the silicic acid is replaced by dioxid of manganese, it is expedient in the case of volatile alkaline oxids not to employ electric heat for the first operation and to substitute for the alkaline sulfate the corresponding sulfid.

In order that my invention may be the better understood, I shall now proceed to describe how I operate in the particular cases of ferrosilicon and baryta.

To effect the formation of barium silicate, I introduce into an electric furnace adapted for the smelting and casting of founding materials a mixture of broken quartz or non-clayey sand, barium sulfate, and charcoal in the proportions determined by the following equation:

$$SiO_2+SO_4Ba+C=SiO_3Ba+SO_2+CO.$$

The reaction is very rapid and presents no difficulties. In order not to vaporize too great a proportion of the baryta by the production of an excessive temperature, it is necessary to limit the expenditure of energy to between forty and fifty watts per square centimeter of transverse section of the electrode.

The production of the barium silicate can be effected in an ordinary glass-blower's furnace, and this method is recommended when electric energy is expensive. The barium-slag is reduced on a second electric furnace after being mixed with a proportion of oxid of iron or wrought or cast iron according to the amount of silicon to be obtained in the iron alloy and of a quantity of carbon regulated according to the quantity of oxygen to be eliminated, but not sufficient to reduce the baryta and form carbid of barium. To obtain, for example, ferrosilicon containing about twenty per cent. of silicon, one will operate on the mixtures according to the following equations:

$$SiO_3Ba+Fe_2O_3+5C=Fe_2Si+BaO+5CO$$

or, what is better with metallic iron,

$$SiO_3Ba+2Fe+2C=Fe_2Si+BaO+2CO.$$

The operation is readily effected with a current having a tension of between twenty-five and thirty-five volts and a limitation of expenditure of energy of between fifty and sixty watts per square centimeter of section of the electrode. Under these conditions only an insignificant quantity of carbid of barium is produced and the volatilization of the baryta is not great. However, to prevent loss the furnace's gases are directed to a chamber where one can recover the volatile or trapped materials. These materials can be treated with boiling water, and one can separate by crystallization the baryta in the form of hydrate. The course followed for ferromanganese is identical. If it is desired to produce it at the same time as the baryta, one introduces into a convenient electric furnace a mixture of dioxid of manganese and sulfate of barium in such a manner as to produce the oxid mangano-barium according to the following formula:

$$MnO_2+SO_4Ba+2C=MnO,BaO+SO_2+2CO.$$

One thus realizes the electrical reduction as explained and according to the formula:

$$S(MnOBaO)+4C=Mn_3C+3BaO+3CO.$$

If one has in view the production of oxid of sodium or an analogous volatile oxid in an electric furnace, one can carry out the first operation in a muffle-furnace having a magnesia body and by substituting for the sulfate the corresponding sulfid according to the following equation:

$$9MnO_2+Na_2S=3Mn_3O_4+2Na_2O+2SO_2.$$

This latter reaction is exothermic and is carried out in any ordinary furnace. The electrical reduction is effected according to the following formula:

$$3Mn_3O_4+2Na_2O+17C=3Mn_3C+2Na_2O+14CO.$$

When it is desired to produce an iron alloy at the same time as oxid of sodium, this oxid is volatilized in an electric furnace and can be collected by sublimation in a dust-chamber or by means of steam. The condensed product is recovered, which possesses very great purity.

All the operations ought to be carried on in closed furnaces, for the dust of the oxids of the alkalies and of the alkali earths are irritating to the respiratory organs and in some cases are poisonous.

It will be understood that what has been described with regard to baryta and oxid of sodium applies equally to alkali or alkali-earth oxids.

In order to render the invention more clear, a general view of the apparatus used for simultaneously carrying out the various operations, as herein described, is shown in the accompanying drawing.

The electric reduction takes place in the furnace A. The sulfurous gases escape from the furnace through a pipe, through which they pass into an apparatus B, adapted to change the temperature and in which they are cooled. They are then passed into a dissolution-chamber C, where they are dissolved in cold water injected through an atomizer. The solution is sucked up by the pump D and passed into the apparatus B, where it is first atomized in order to subsequently pass through a mass of coke into which hot air is forced. Under the simultaneous action of the furnace heat and injected air a mixture of air and sulfurous anhydrid is disengaged from the solution and passes into the chamber E, where it is dried by contact with the sulfuric acid. It is then passed into an apparatus F, adapted to change the temperature, in which it is heated by contact with the oxidated gases coming from the catalytic apparatus G. It passes subsequently into the latter apparatus, where the sulfurous anhydrid is transformed into sulfuric anhydrid, which is collected in a suitable condenser, (indicated in the drawings at H H.) These arrangements are chosen in the present case; but it is clear that they may be modified and that other means can be used for the production of the sulfuric acid.

Having now fully described my invention, what I claim, and desire to secure by Letters Patent, is—

The herein-described process for electrically producing an alloy of iron with the simultaneous production of oxids of alkalies, consisting of mixing a silicic acid with the sulfate of the alkali, adding carbon to the mixture heating the same in an electric furnace with the production of the silicate of the alkali, then introducing this alkali silicate into a second furnace, adding an oxid of iron, and carbon thereto, heating the same with the production of ferrosilicon and oxid of the alkali, and collecting the oxid of the alkali in the form of a sublimate of the same, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two witnesses.

GUSTAVE GIN.

Witnesses:

ADOLPHE STURM,

EDWARD P. MACLEAN.