

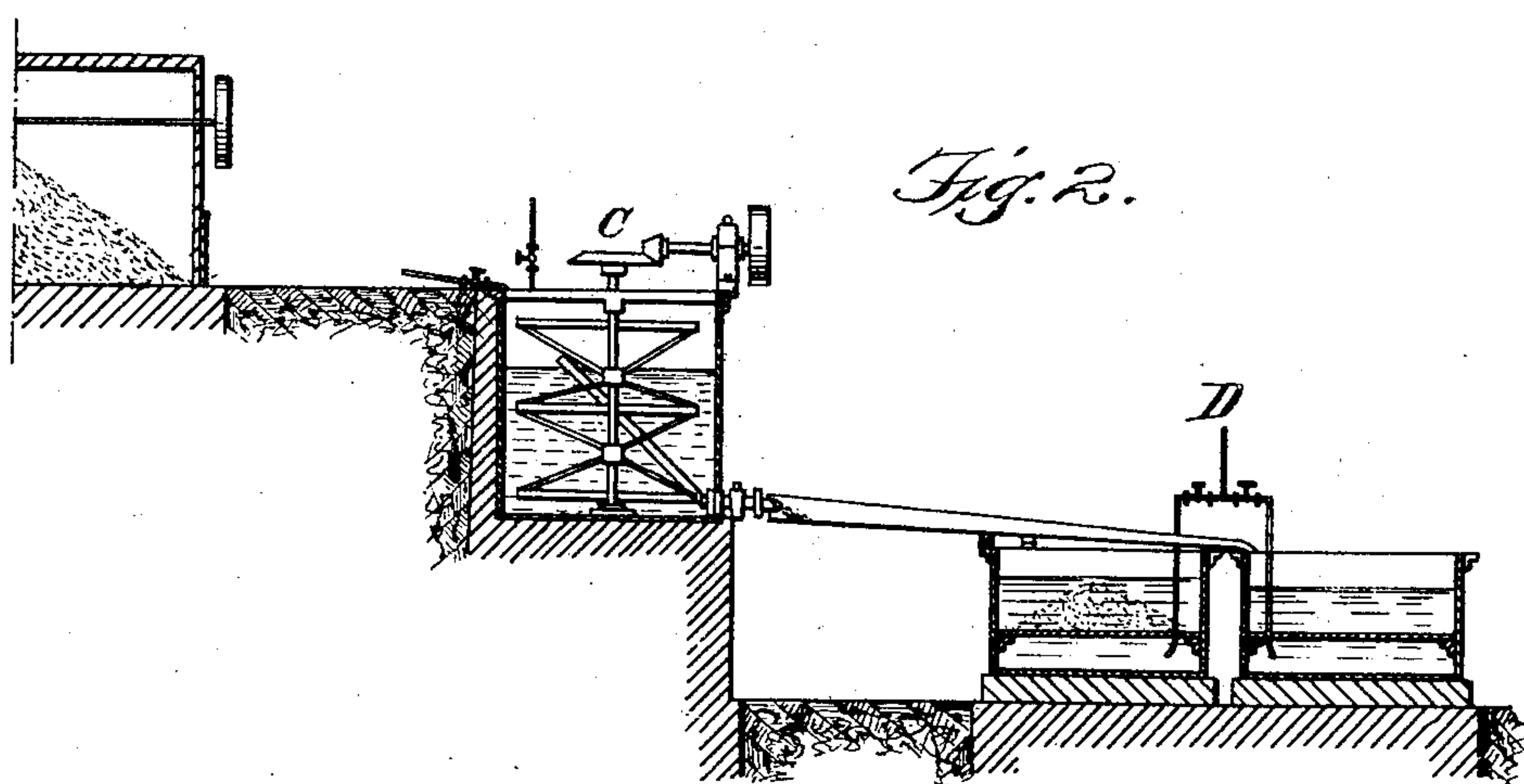
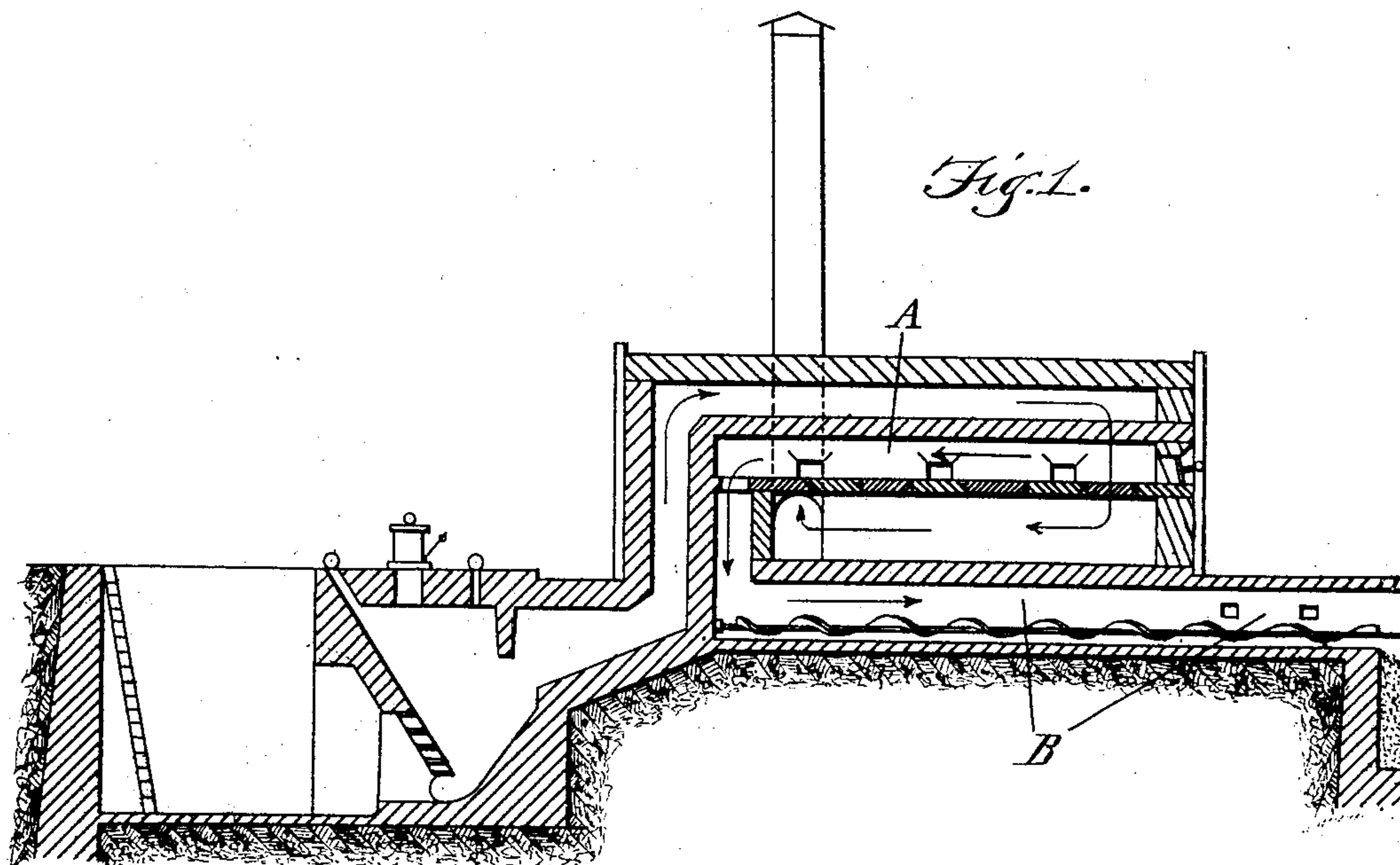
No. 765,000.

PATENTED JULY 12, 1904.

G. GIN.
PROCESS OF MAKING COPPER SULFATE.

APPLICATION FILED MAR. 5, 1903.

NO MODEL.



Witnesses:
L. Waldman
R. Winter

Inventor
Gustave Gin
by *P. Singer* Attorney.

UNITED STATES PATENT OFFICE.

GUSTAVE GIN, OF PARIS, FRANCE.

PROCESS OF MAKING COPPER SULFATE.

SPECIFICATION forming part of Letters Patent No. 765,000, dated July 12, 1904.

Application filed March 5, 1903. Serial No. 146,371. (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 Processes of Manufacturing Sulfate of Copper by the Direct Sulfatation of the Ores or Mattes, of which the following is a specification.

This invention relates to certain improvements in the treatment of sulfurous ores of copper or mattes resulting from the various ores of this metal.

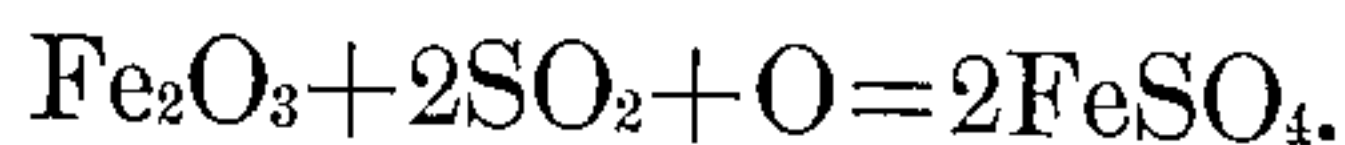
This process is preferably carried out in an apparatus such as shown in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional view through a roasting-furnace provided with a cooling-passage. Fig. 2 is a vertical sectional view through the apparatus for lixiviating the sulfated ores and the digesting-pans.

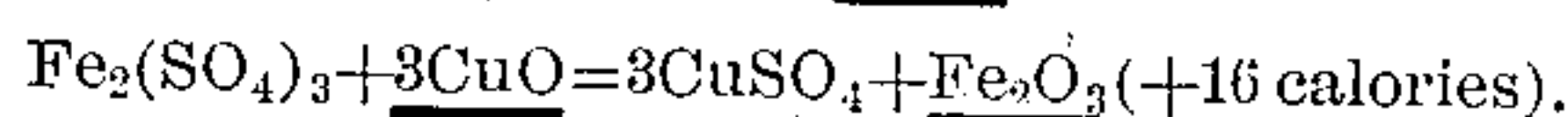
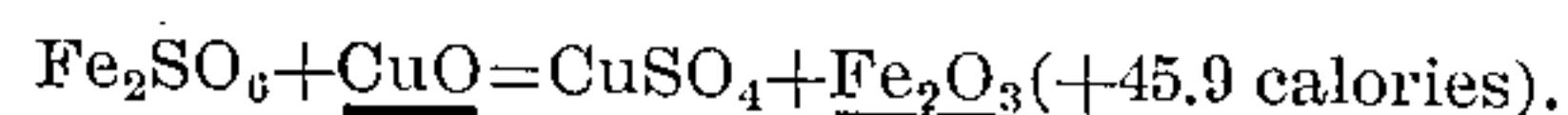
As shown in Fig. 1, A represents a furnace in which the ore is roasted, and B represents a cooling-passage to which the ore is transferred from the furnace after the roasting is completed. The apparatus for lixiviating the sulfated ores is designated as a whole by the letter C and is preferably provided with mixing devices which are adapted to be driven in any suitable manner. The solution from the lixiviating apparatus is drawn off into the digesting-pans D, where it is heated, and made to pass over ore that has been roasted to complete oxidation.

Under my invention when the ore or matte has been properly pulverized it is put into a muffle-furnace A and subjected to roasting in an oxidizing atmosphere in order that the whole of the sulfur in the copper may be transformed into oxid or sulfate. This result is attained after complete dissociation of the ferrous sulfate and the partial decomposition of the sulfate of copper that is formed. When the operation is complete, the ore is transferred from the sole of the muffle-furnace to the floor of a cooling-passage B, into which are directed the sulfurous gases arising from the roasting, with the addition of a suitable quantity of air. These gases travel with the ore, which is gradually shoveled along toward the end of the cooling-passage farthest from the roasting-

furnace. As a result of the lowering of the temperature there occurs a series of chemical changes between the ore and the sulfurous gases that end in reactions which are substantially the inverse of those which occur during the roasting. Thus a mixture of sulfurous anhydrid and of air is brought into the presence of the calcined ore, which owing to the well-known catalytic action of peroxid of iron and of sulfate of copper forms sulfuric anhydrid, which rapidly transforms first the oxid of copper, then the peroxid of iron, into sulfates. The transformation of the sulfurous anhydrid into sulfuric anhydrid is effected as soon as the temperature falls below 750° centigrade, and the rapidity of this reaction is at its maximum between 440° and 400° centigrade; but in practice it is advisable not to go below 500° centigrade, so as to avoid the formation of ferrous sulfate according to the reaction:



Above 500° there can be formed only basic ferric sulfate, (Fe_2SO_6) and that is a very important point for the result of the operations. It is advisable not to limit the proportion of this sulfate, but, on the contrary, to get as much of it as possible, for, as will be seen, it serves as a vehicle for converting the copper of another mass of ore into sulfate. When the mass that has been converted to sulfate is lixiviated, it gives a solution containing sulfate of copper and basic ferric sulfate. This solution is then heated to about 90° centigrade and made to pass over another mass of ore that has been roasted to complete oxidation and that consequently contains all its copper as cupric oxid, in the presence of which the peroxid of iron is precipitated according to the exothermic reactions:



By cooling, a part of the sulfate of copper that has been dissolved—about three-fourths—is isolated, and the mother-waters are recovered and heated in order to serve for new lixiviation. In regulating and limiting the degree of cooling I also use certain known properties with regard to the stability of certain sulfates

and the instability of others at determined temperatures. I am not unaware that the utilization of these properties of the sulfates has already been protected by an American
5 patent, No. 692,008, the object of which is the separation of metals from their ores; but I wish to observe that if I take advantage of the differences of stability of sulfates of iron at different degrees of oxidation it is for quite
10 a different purpose than that aimed at in the above-mentioned patent. As a matter of fact, my aim is not to get rid of the ferric sulfate by dissociation in order to leave behind only the sulfate of copper. On the contrary, I wish
15 to keep along with the sulfate of copper the largest possible quantity of ferric sulfate, which is intended to serve as a vehicle for the sulfuric acid. This latter it carries to the cupric oxid of another mass of ore, while at
20 the same time the peroxid of iron is precipitated.

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

The process of obtaining sulfate of copper 25 from sulfur ores or mattes, which consists in roasting the ores in an oxidizing atmosphere until the sulfur is dispelled from the ore, cooling the roasted ore in contact with the gases from the roasting to form sulfate of copper 30 and ferric sulfate; lixiviating the mass thus formed, then digesting the solution with ore previously roasted to complete oxidation whereby sulfate of copper is formed and per-
35 oxid of iron is precipitated.

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

GUSTAVE GIN.

Witnesses:

ADOLPHE STURM,
J. ALLISON BOWEN.