

UNITED STATES PATENT OFFICE.

FREDERICK WILLIAM MARTINO, OF SHEFFIELD, ENGLAND.

PROCESS OF MANUFACTURING ALLOYS OF NICKEL WITH OTHER METALS.

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To all whom it may concern:

Be it known that I, FREDERICK WILLIAM MARTINO, a subject of the Queen of Great Britain, residing at Sheffield, England, have
5 invented certain new and useful Improvements in the Process of Manufacturing Alloys of Nickel with other Metals; and I do hereby declare that the following is a full, clear, and exact description of the invention,
10 which will enable others skilled in the art to which it appertains to make and use the same.

Alloys of nickel and copper are used for making ammunition and for various other purposes and alloys of nickel and iron and of
15 copper, nickel and iron are used in the manufacture of steel and in the manufacture of iron and steel castings. These alloys are generally made by melting the metals together. This method of manufacture is costly and the
20 results are uncertain.

The object of my invention is to manufacture the said alloys economically and with great certainty of composition, and in a form convenient for use in large furnaces, such as
25 the Siemens-Martin furnace and consists in making the said alloys directly from ores containing them or some of them in the manner hereinafter described instead of first reducing the metals separately from ores containing
30 them and afterward melting together the metals so obtained.

I will first describe my invention in connection with the manufacture of an alloy of copper and nickel.

35 I take the sulphides or matte of commerce which are obtained from the Lake Superior mines or the ores from New Caledonia. If the latter are used I convert them into sulphides or matte by smelting them with sulphur or
40 with materials containing sulphur such for example as soda waste or gas lime. The matte from Lake Superior contains copper, nickel and iron in the state of sulphides. The matte produced from New Caledonia ores contains
45 more frequently only nickel and iron as sulphides. The Lake Superior matte has an average composition of twenty-five parts by weight of copper; twenty-five parts by weight of nickel; fifteen parts by weight of iron and
50 thirty parts by weight of sulphur. These proportions may however vary considerably.

The matte is reduced to powder by means of crushers and rollers and passed through fine meshed sieves. It is then mixed with quartz-sand and sulphate of baryta, if this latter
55 can be obtained cheap, otherwise with sulphate of soda or Glauber salts which can either be made or obtained at a very low price, preferably in the following proportions: One hundred parts by weight of powdered
60 matte, sixty parts by weight of quartz-sand, one hundred and thirty-four parts by weight of sulphate of baryta or sulphate of soda. These proportions are suitable for matte of
65 an average composition but the amount of quartz-sand and sulphate of baryta or sulphate of soda must be increased if the matte is richer in iron and sulphur than matte of the average composition as hereinbefore given.

I melt the mixture described in a reverberatory furnace. The sulphur of the iron is
70 oxydized into sulphurous acid and passes off by the chimney. The iron becoming ferrous oxide combines with the silica forming silicate of iron which rises to the surface as a slag
75 leaving the sulphides of nickel and copper as a molten mass which when the separation is complete can be tapped, the slag having been previously drawn off. The slag may however
80 be drawn off with the sulphides of nickel and copper and separated from the sulphides when the mass has cooled. The solidified sulphides of nickel and copper are crushed and powdered and the fine powder is roasted in a
85 calcining or roasting furnace or in a set of furnaces of graduated heat until the whole has been converted into oxide of nickel and copper. These oxides are then mixed with
90 charcoal in pieces of about the size of hazel nuts together with charcoal in fine powder and moistened with coal tar and water, with
95 which a little burnt lime and clay have been mixed, so as to form a paste. This paste is pressed in forms of desirable size into briquets. This briquetting is done by briquetting
100 machines of the ordinary kind. The briquets are afterward slowly dried and are when quite dry, placed in converters and exposed to a bright red heat. They are then ready for the smelting operation which I will now describe.

The composition of the briquets is ascer-

tained by melting a weighed sample and by analysis of the metallic product obtained whereby the ratio of nickel and copper is ascertained.

5 In order to obtain an alloy having the definite composition required I proceed as follows: I melt in a Siemens-Martin converter or in a reverberatory furnace such an amount
10 or copper as will, together with the copper in the oxide of nickel and copper obtained in the manner herein before described from the matte, bring the proportion of copper to nickel up to the proportion required in the alloy to be produced, allowance being made for loss
15 of copper in melting. To prevent the copper during the melting process from absorbing oxygen I add thereto anthracite or charcoal in small pieces and when the copper is in a liquid state I add gradually the briquets of
20 nickel and copper. I rake or rabble the molten mass in the furnace from time to time, adding occasionally more anthracite or charcoal until the whole is thoroughly reduced and afterward add sufficient flux consisting of a
25 mixture of finely ground fluor spar and borax to clean the metallic bath. The slag may now be drawn off and the alloy which consists of nickel and copper in the definite proportions desired run off into ingot molds.

30 If thought desirable samples of the alloy may be taken from the furnace as the process last described proceeds and submitted to analysis and if the alloy is found not to consist of the metals in the desired proportion more copper or more briquets of the
35 prepared oxides of nickel and copper may be added so as to rectify any error in the composition of the alloy before the charge is tapped.

I will now describe that part of my invention which has for its object the manufacture
40 of an alloy of iron and nickel which alloy of iron and nickel I shall hereinafter refer to as ferro-nickel.

I prefer to employ in the manufacture of
45 ferro-nickel the nickel ore known in commerce as New Caledonian ore which consists essentially of oxides of nickel and iron in varying proportions. When, however, ores consisting essentially of sulphides of nickel,
50 copper and iron, such as the Lake Superior ores, are used in the manufacture of the said ferro-nickel, the copper has to be separated from the other constituents of the ore by the well known process of precipitation or cementation which I do not consider it necessary to describe.

The oxides of nickel and iron, whether natural or artificially produced, are operated on in the following manner. I mix the said oxides
60 with charcoal in small pieces together with charcoal in powder with coal tar and water containing lime and clay and press the whole into briquets as hereinbefore described in treating the oxides of copper and
65 nickel. The briquets are slowly dried and then exposed to a bright red heat in a converter. An analysis is made of the reduced

briquets and the exact proportions of the two metals present ascertained.

In order to obtain an alloy of ferro-nickel
70 having a certain definite proportion of nickel and iron I melt such an amount of pig iron as will, together with the iron in the oxide obtained in the manner last described bring the proportion of iron to nickel up to that
75 desired. When the said pig iron is melted I gradually add the oxide of nickel and iron in the form of briquets until the whole is reduced to a molten condition, flux of the kind hereinbefore described being added to separate
80 oxidized metallic and earthy matters from the alloy. The charge is tapped and run into ingot molds. The ferro-nickel obtained in the manner described will be of the desired composition.

85 If an alloy of nickel, copper and iron in definite proportions be required the matte containing these three metals, is roasted to remove the sulphur and to convert them into oxides. They are then mixed with charcoal
90 in small pieces together with powdered charcoal and formed into a pasty mass with coal tar and water containing lime and clay. The pasty mass is pressed into briquets, and is dried and heated in a converter as already
95 described. The briquets are then added to the molten iron and copper in the requisite proportion, in a Siemens-Martin converter or in a reverberatory furnace and an alloy of the required standard is thereby produced.

100 In making alloys of nickel and copper and of nickel and iron and of nickel, copper and iron, the processes I have described may be modified as follows: Instead of adding the prepared briquets to melted copper or melted
105 pig iron or to melted copper and pig iron to obtain the required standards I proceed as follows.

In the manufacture of ferro-nickel after having ascertained by analysis the exact percentage
110 of the two oxides obtained from the roasted matte, I add more oxide of nickel or more oxide of iron, till the required standard is reached. The whole is well mixed in a rotatory mixing pan, and is then briqueted
115 as hereinbefore described, dried and calcined at a red heat. This process yields the ferro-nickel in the form of carbides with a metallic luster and this compound when broken up may in some cases be preferable to the molten
120 product, as for instance for Siemens' furnaces of large caliber where it would assist in the converting process of pig iron into steel by rendering unnecessary a certain amount of "spiegel" or ferro-silicon - manganese now
125 in use.

The same method of adding oxides of copper for making cupro-nickel or cupro-ferro-nickel may be employed.

By my invention alloys of nickel and copper or of nickel and iron, or of nickel, copper and iron of any required composition can
130 be readily and with certainty obtained.

Having now particularly described and as-

certained the nature of my invention and in what manner the same is to be performed, I declare that I claim as my invention of improvements in the manufacture of alloys of nickel and copper and of alloys of nickel and iron and of alloys of nickel, copper, and iron—

5 The process of manufacturing alloys which consists in treating ores containing one or more or all of the metals constituting the alloy, that is to say, treating the powdered oxides obtained from the sulphides contained in the ores by mixing them with charcoal, tar,

lime and water in which clay is suspended, briquetting the said mixture, drying the same and roasting preliminary to reduction into 15 metals or alloys, and introducing such a quantity of the roasted briquets into a bath of molten metal to bring the alloy produced to the definite proportion desired, substantially as described.

FREDERICK WILLIAM MARTINO. [L. S.]

Witnesses:

GEORGE SHAW,
RICHARD SKERRETT.