

UNITED STATES PATENT OFFICE.

HEINRICH OSTERMANN AND CHARLES LACROIX, OF GENEVA, SWITZERLAND, ASSIGNORS TO THE USINE GÉNEVOISE DE DÉGROSSISSAGE D'OR, OF SAME PLACE.

METHOD OF RENDERING NICKEL AND NICKEL ALLOYS NON-MAGNETIC.

SPECIFICATION forming part of Letters Patent No. 404,220, dated May 28, 1889.

Application filed December 20, 1888. Serial No. 294,219. (No specimens.)

To all whom it may concern:

Be it known that we, HEINRICH OSTERMANN, chemist, and CHARLES LACROIX, director of the Usine Gènevoise de Dégrossissage d'Or, of Geneva, Switzerland, have invented an Improved Method of Rendering Nickel and Nickel Alloys Non-Magnetic, of which the following is a specification.

The invention consists of a method of rendering nickel and the nickel alloys non-magnetic—that is to say, rendered indifferent to the magnetic influences—and at the same time said nickel or nickel alloyages become suitable to replace iron or steel, especially with regard to their degree of dilatation and to their specific gravity and malleability. This is of a great importance, for instance, in manufacturing watches, and especially compensation balance-wheels and spiral springs for watches.

Nickel can be alloyed with copper, silver, lead, tin, zinc, aluminium, cadmium, wolfram, gold, platinum, and metals of the platinum series (palladium, rhodium, and iridium,) or with alloys of two or more of those metals. If one alloying metal is of little dilatation—as, for instance, gold, platinum, and metals of the platinum series with nickel—the resulting alloys will be magnetizable; but they may be made indifferent to the magnetic influences by addition of copper, silver, lead, tin, zinc, aluminium, or of combinations of those metals. The alloys produced will answer the purpose specified above with regard to the degree of dilatation and malleability, but not at all with regard to the specific gravity, which will be different from the specific gravity of iron or steel.

Alloys of copper, silver, lead, tin, aluminium, zinc, and cadmium may be made to possess the same specific gravity as iron; but their coefficient of dilatation is much greater than that of iron. Alloys of wolfram, gold, platinum, and the metals of the platinum series may have approximately the same coefficient of dilatation as iron and steel; but their specific gravity is very much greater than the specific gravity of iron or steel. If those metals are alloyed the one with the other, the linear

dilatation of the alloy will be exactly proportional to the linear dilatation of the different metals which have been alloyed together, while the specific gravity of said alloy will be only approximately proportioned to the specific gravities of the metals which have been combined together. Alloys of nickel with ten to twenty per cent. gold or wolfram, or with thirty to forty per cent. platinum, palladium, or rhodium, would have approximately the same coefficient of linear dilatation and the same specific gravity as iron or steel; but as those alloys, except those of nickel and wolfram, would be more energetically influenced by magnetic influences than pure nickel, one should be obliged to combine them with a larger quantity of metals having a high coefficient of dilatation, (as, for instance, copper, silver, zinc, &c.) as it would be the case of pure nickel in view of having the resulting alloy not magnetizable. The nickel begins to grow non-magnetizable by an addition of twenty per cent. copper, twenty per cent. zinc, or twenty per cent. silver, or ten per cent. tin, or thirty per cent. lead, or five per cent. aluminium. To render alloys of nickel and gold, nickel and platinum, nickel and palladium or rhodium, nickel and manganese, or alloys of nickel with combinations of those metals, unmagnetizable, one would therefore be obliged to add a large quantity of metals having a high coefficient of dilatation, and the resulting alloy would have a higher coefficient of dilatation than iron or steel. It appears, therefore, that it is not possible to obtain with the help of the above-specified metals an unmagnetizable alloy the main part of which would be nickel. Now, our proceeding consists of rendering pure nickel or combination of nickel with gold, with platinum, or with metals of the platinum series, or with manganese, very easily and durably unmagnetizable by melting or alloying the same with chromium. Chromium does not increase the linear dilatation nor the specific gravity of the alloy, but lowers the same a little, and the alloys obtained by this way are completely suitable to replace iron or steel. Such alloys of chromium with little additions of gold,

platinum, or of metals of the platinum series, or of manganese, possess a very high elasticity and hardness. They may be improved with regard to their malleability by means of an addition of lead, tin, copper, or zinc without increasing their coefficient of dilatation, as one may add a proportional quantity of chromium. A suitable combination of metals would be, for instance, the following one: eighty per cent. nickel, four per cent. platinum, 0.60 per cent. lead, 0.20 per cent. tin, and 0.20 per cent. zinc. Nickel begins to grow unmagnetizable by an addition of three per cent. chromium, and is completely unmagnetizable by an alloy of ten per cent. It is possible to alloy up to thirty per cent. chromium with nickel; but such an alloy would be too hard and difficult to work. An addition of ten per cent. chromium to a magnetizable alloy of nickel and gold, platinum, or metals of the platinum series, makes the same, as well as pure nickel, unmagnetizable. If those alloys contain copper, silver, zinc, tin, or lead, it will be sufficient to add smaller quantities of chromium. The melting and alloying of nickel and chromium are easily obtained by throwing first pure chromium, or chromium with a small addition of borax, into the crucible and over it the corresponding quantity of nickel, and eventually of the other metals, as above

specified. Then the crucible is placed into a blast-furnace until the melting is obtained. If other metals are to be added to the alloy of nickel and chromium, it may be preferable to melt first only nickel and chromium and to add the other metals when those two metals are alloyed with one another. If the nickel contains too large quantities of iron or cobalt, a larger quantity of chromium will be necessary to be combined with it to render it unmagnetizable. Such alloys will then be too hard.

Having thus fully described our invention, we claim—

The method herein specified of rendering nickel and its alloys non-magnetizable and suitable for use in place of iron and steel in watches, consisting in melting chromium with such nickel in the proportion of less than thirty per cent. of chromium, substantially as set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

HEINRICH OSTERMANN.
CHARLES LACROIX.

Witnesses:

E. IMER SCHNEIDER,
LYELL T. ADAMS.