Feb. 23, 1932. A. BURKHARDT 1,847,044

PROCESS FOR THE IMPROVEMENT OF NICKEL

Filed March 16, 1931

FIG. 1.

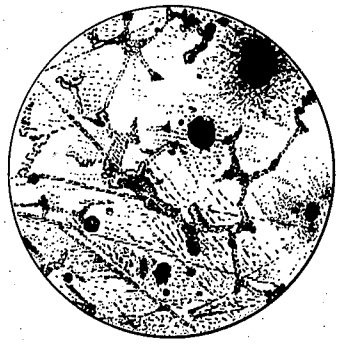


FIG. 2.



Inventor:
Arthur Burkhardt,
By Byrnes Townsend & Cotter,
Attorneys.

Patented Feb. 23, 1932 1,847,044

UNITED STATES PATENT OFFICE

ARTHUR BURKHARDT, OF FRANKFORT-ON-THE-MAIN, GERMANY, ASSIGNOR TO AMERICAN LURGI CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

PROCESS FOR THE IMPROVEMENT OF NICKEL

Application filed March 16, 1931. Serial No. 523,158.

The invention relates to a process for the improvement of nickel and nickel-containing alloys. The process is especially adapted to increase the tensile strength and elongation of pure nickel and nickel-containing steel alloys, so that bars and castings can be produced therefrom easily amenable to treatment when warm.

The process consists of a method of binding the sulphur that is present in the metal by addition of an agent. It is known that even a very low percentage of sulphur produces extreme brittleness in nickel and nickel containing alloys. This sulphur is present when the nickel is stiffened in the form of little strings bordering the nickel crystals. Heretofore it has been proposed to desulphurize the nickel by the addition of magnesium before casting. It was believed that the addition of the magnesium affected a degasification of the molten mass, which is not correct. The magnesium does indeed combine with the sulphur and is retained in the form of globules of magnesium-sulphide in the interior of the nickel crystals; see, for instance, Figure No. 1. By this addition of magnesium, the sulphur is removed from the crystal boundaries but the relatively large globules in the interior of the worked piece are unfavourable to the mechanical treatment of the bars and castings. The segregation of such large particles is especially objectionable in the drawing of nickel sheets, because the round nests of the magnesium-sulphide inclusions are drawn to thin dark streaks.

Now if the nickel or nickel alloys are treated when fused with small quantities of lithium, a lithium-sulphide is formed, and remains in the nickel as very tiny point-like inclusions. The tensile strength, elongation, compressibility of the metal are thus improved.

The best way of adding the lithium is in combination with magnesium. This addition is successful if a lithium magnesium alloy of, say, 15% lithium is prepared and then added to the fused nickel. By this method a considerable saving in the consumption of lithium is attained without changing the favorable distribution of the precipitated sulphur compound in the form of very small inclusions. A greater improvement as to the mechanical qualities of the nickel is achieved by the lithium magnesium alloy than would be the case with pure lithium. Figure No. 2 shows nickel when treated with the lithium magnesium alloy. For example, nickel containing .08% sulphur shows a hardness when treated with magnesium alone of 102, and when treated with an alloy of magnesium containing 15% lithium a hardness of 118. The compressibility of nickel containing .08% sulphur after the addition of .01% lithium is 36%, and after addition of .1% of an alloy of magnesium containing 15% lithium the compressibility is increased up to 45%. The quantity of lithium required will vary widely dependent upon the character or purity of the metal treated. The quantity should be adjusted so that as little as possible of lithium or magnesium remains unconsumed and alloyed with the nickel. The quantity required cannot really be determined by analysis but is best determined by test upon small batches of the metal under treatment, using different amounts until the desired effect is obtained. It may be said that the addition of lithium in quantities of the order of .0001% to .05% of lithium and to .3% magnesium have been found to be suitable.

If the nickel has a high content of oxygen in addition to the content of sulphur, deoxidation can be effected before adding lithium. This deoxidation can also be obtained either by the lithium or magnesium lithium alloy, or to economize this medium by other deoxidizers, such as phosphorous or silicon which are known per se.

I claim:

1. Process for the improvement of the mechanical qualities of nickel and nickel alloys containing sulfur which comprises adding thereto while in the molten state an agent comprising lithium which serves to bind the sulfur content thereof.

2. Process for the improvement of the mechanical qualities of nickel and nickel alloys containing sulfur which comprises converting the strings of sulfur at the crystal

boundaries thereof into minute globular inclusions by the addition to the molten metal of an agent comprising lithium.

3. Process for the improvement of the mechanical qualities of nickel and nickel alloys containing sulfur as defined in claim 1 in which the agent is an alloy of lithium and magnesium.

4. Process for the improvement of the mechanical qualities of nickel and nickel alloys containing sulfur as defined in claim 1 in which the agent is an alloy of lithium and magnesium containing about 15% of lithium.

5. Process for the improvement of the mechanical qualities of nickel and nickel alloys containing sulfur as defined in claim 1 in which the agent is an alloy of lithium and magnesium in such proportions to each other and is added to the metal in such quantity that about .0001% to .05% of lithium and up to about .3% of magnesium are supplied.

6. Process for the improvement of the mechanical qualities of nickel and nickel alloys containing sulfur as defined in claim 1 in which the agent is an alloy of lithium and magnesium and is added to the metal in such amount that no substantial quantity thereof is left in the metal after reaction thereof with the sulfur content of the metal.

In testimony whereof, I affix my signature.

ARTHUR BURKHARDT.