

UNITED STATES PATENT OFFICE.

MATTHEW A. HUNTER, OF TROY, NEW YORK.

ELECTRIC-RESISTANCE MATERIAL.

1,168,074.

Specification of Letters Patent.

Patented Jan. 11, 1916.

No Drawing.

Application filed May 21, 1915. Serial No. 29,589.

To all whom it may concern:

Be it known that I, MATTHEW A. HUNTER, a subject of the King of Great Britain, residing in the city of Troy, county of Rensselaer, and State of New York, have invented certain new and useful Improvements in Electric-Resistance Materials; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to electric resistance materials and involves the production of a new alloy for use in the manufacture of electric resistance elements of various kinds.

In accordance with the invention, an alloy is produced which may be used at relatively low cost in the production of electric resistance elements possessing to a marked degree the two primary requisites of such resistances, namely, high electrical resistivity and low temperature coefficient of resistance. The new alloy is also specially adapted for use in resistance elements for the reasons that it has a high melting point, will not corrode when worked hot and has a low thermo-electromotive force against copper. The new alloy made in accordance with the invention consists of nickel, copper and chromium, the proportion of nickel being large relatively to the proportion of copper and chromium.

Alloys of nickel and chromium have been used heretofore as a resistance material and the results thus obtained are very good. I have discovered, however, that by properly alloying nickel, copper and chromium, a resistance material may be produced which is much more efficient and desirable. I have found that though the addition of chromium to copper has but little effect upon the electric resistance thereof, the addition of chromium to an alloy of copper and nickel in the proper proportions increases the resistance of the alloy far beyond that to which the resistance of nickel is raised by alloying chromium therewith. Furthermore, the addition of chromium effects a reduction in the temperature coefficient of resistance of the alloy. Otherwise stated, I have found that the addition of a small proportion of copper to an alloy of chromium and nickel results in materially increasing the resistivity of the alloy. It is important, however, that the proportion of copper should be small

as compared to the nickel, since increases in the proportion of copper beyond a critical point result in lowering the resistance of the alloy below what it would be if no copper were present.

In the alloy which I have found to be most suitable for general use as a resistance material, the nickel and copper are in the proportion of 75 to 95 parts of nickel to 25 to 5 parts of copper. Good results may be obtained outside this range of variation, especially when but little chromium is used, but I find this relation of the nickel and copper elements to be best. As the proportion of nickel is increased beyond 95 parts of nickel to 5 parts of copper and as it is decreased below 75 parts of nickel to 25 parts of copper, a marked decrease occurs in the resistivity of the alloy. The amount of chromium added to the mixture is small compared to the nickel; preferably it is from fifteen to twenty-five parts by weight of chromium to one hundred parts of nickel and copper. The higher proportions of chromium have a beneficial effect in increasing the resistivity, but then practical difficulties in the mechanical treatment of the material become more pronounced. An amount of chromium less than that above named as being best would increase the resistance of a given copper-nickel mixture and is especially desirable when the proportion of copper is made larger than that above indicated for any reason, but the resistance of the material thus produced would be less than that obtained by employing the larger amount of chromium in combination with nickel and copper in the proportions above indicated.

I have had particularly good results with an alloy consisting of 85 parts of nickel to 15 parts of copper, with 20 parts of chromium to 100 parts of nickel and copper. Such an alloy has been found to have a resistivity of about 113 microhms per centimeter cube at 20° C. and to have at that temperature a temperature coefficient of resistance of about 0.000078 ohms per degree centigrade per ohm.

What I claim is:

1. An electric resistance material consisting of an alloy of nickel, copper and chromium, the nickel and copper being in the relation of 75 parts to 95 parts of nickel to 25 parts to 5 parts of copper; substantially as described.

2. An electric resistance material consist-

ing of a large proportion of nickel, a small proportion of copper, and chromium amounting to from 10 parts to 25 parts to 100 parts of the nickel and copper; substantially as described.

3. An electric resistance material consisting of an alloy of nickel, copper and chromium, the copper and nickel being in the proportion of from 5 to 25 parts of copper to 95 to 75 parts of nickel and the chromium being in the proportion of from 10 to 25 parts of chromium to 100 parts of nickel and copper; substantially as described.

4. An electric resistance material consist-

ing of an alloy of nickel, copper and chromium, the copper and nickel being in the proportion of approximately 15 parts of copper to 85 parts of nickel and the chromium being in approximately the proportion of 20 parts of chromium to 100 parts of nickel and copper; substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

MATTHEW A. HUNTER.

Witnesses:

FREDERICK M. SEBAST,
W. J. WILLIAM.