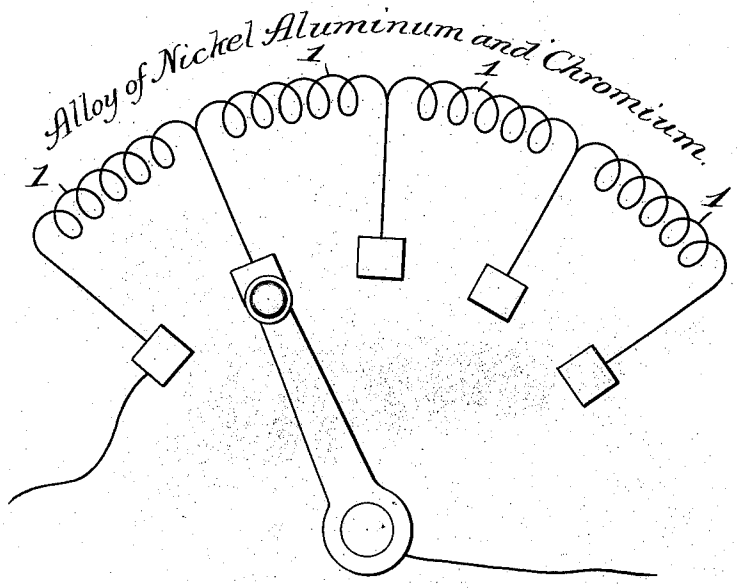
No. 859,608.

PATENTED JULY 9, 1907.

A. L. MARSH.

ELECTRIC RESISTANCE ELEMENT.

APPLICATION FILED FEB. 18, 1907.



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UNITED STATES PATENT OFFICE.

ALBERT L. MARSH, OF LAKE BLUFF, ILLINOIS, ASSIGNOR TO THE HOSKINS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

ELECTRIC RESISTANCE ELEMENT.

No. 859,608. Specification of Letters Patent. Patented July 9, 1907.

Application filed February 18, 1907. Serial No. 358,004.

To all whom it may concern:

Be it known that I, ALBERT L. MARSH, a citizen of the United States, residing at Lake Bluff, in the county of Lake and State of Illinois, have invented a new and useful Improvement in Electric Resistance Elements, of which the following is a specification.

My object is to provide, as an improved electric resistance material, a metal which has the property of being particularly low in electric conductivity, has a melting point exceeding that of pure copper, and may be drawn or otherwise shaped to form particularly durable, efficient, and desirable strips, strands, or filaments suitable for use in the various connections where electric resistances are desirable.

I have discovered that when comparatively small proportions of certain metals having refractory oxids are added to nickel or cobalt, or to either of these metals alloyed with a metal of the chromium group, as defined in Letters Patent No. 811,859, granted to me Feb. 6, 1906, the durability under high temperatures of the alloy so produced is augmented. For example, an alloy of nickel and chromium containing about ten per cent. chromium, when heated, in the atmosphere, to a white heat, becomes coated with a black oxid; and that when about four per cent. of aluminium is added to this alloy, the scale so formed is thinner, tougher and more adherent and affords a better protection against further or destructive oxidation than is afforded by the black oxid of the first mentioned or simple alloy. A wire of the alloy containing aluminium has been heated to incandescence at a temperature so high as to actually melt the metal or core within the film or shell of oxids formed under lower temperature upon the wire, which effectively protected the core against further or destructive oxidation, by reason of its tough or coherent properties, which maintain it intact.

While such metals as aluminium, tin, silicon, and manganese increase the electrical resistance of nickel, or nickel alloyed with a metal of the chromium group, their principal advantage consists in the deoxidizing action they exert on the metal or alloy to which they are added and the protecting property of the oxid film formed from the alloy; though nickel containing about three per cent. aluminium has a resistance of about .53 ohms per foot of wire of .40 mm. diameter, whereas the nickel from which the alloy was made has a resistance of only about .26 ohms per foot of wire of like diameter, so that the addition of the three per cent. aluminium doubles the resistance.

A very good alloy for a resistance element having the oxidizing property set forth, and one which may be rolled or drawn into wire, is composed of adout eighty-eight per cent. nickel, about eight per cent. chromium and about four per cent. aluminium. This alloy drawn into wire .40 mm. in diameter has a resistance of about 2.2 ohms per foot, which is about fifty times that of pure copper. Moreover the chromium increases the melting point of the metal.

The accompanying drawing shows a rheostat of well-known type, in which the coiled wires 1 are resistance elements formed of a metal alloy, consisting of eighty-eight per cent. nickel, eight per cent. chromium and four per cent. aluminium.

Though, so far as I am at present aware, aluminium is the most desirable metal for my purpose, as an addition to nickel or its alloys, my invention is intended to include any metal more electropositive than nickel and having a refractory oxid with a melting point of 1200° C., or higher.

I am aware that aluminium, manganese, silicon and other metals have hitherto been added to nickel and other metals to produce sound castings, but it was hithero unknown that the resultant alloys would produce electric resistance elements having the surface oxidizing property with the protecting advantage hereinbefore explained.

Either nickel, or cobalt which has similar properties, is suitable for my purpose when alloyed with aluminium in, substantially, the proportions specified, or with any metal herein referred to as the equivalent of aluminium, with or without the member of the chromium group as an element of the alloy. Where I mention in the appended claims a metal having the properties of nickel or cobalt, I wish to designate only the metals nickel and cobalt, which have properties that are the same for my purpose, but which cannot both be classed under any single term of which I am aware.

What I claim as new, and desire to secure by Letters Patent is—

1. An electric resistance element composed of an alloy consisting of metal having the properties of nickel and cobalt, and a relatively small proportion of another metal more electropositive than nickel and having a refractory oxid with a minimum melting point of about 1200° C.

2. An electric resistance element composed of an alloy consisting of metal having the properties of nickel and cobalt, and a relatively small proportion of aluminium.

3. An electric resistance element comprising a strip, strand or filament formed of an alloy of nickel and aluminium.

4. An electric resistance element formed of a metal alloy consisting of nickel and a member of the chromium group and a third metal more electropositive than nickel and having a refractory oxid with a minimum melting point of about 1200° C.

5. An electric resistance element formed of a metal alloy consisting of nickel in the proportion of about eighty-eight per cent. of the element, chromium in the proportion of about eight per cent. of the element and aluminium in the proportion of about four per cent. of the element.

ALBERT L. MARSH.

In presence of—
R. A. SCHAEFER,
J. H. LANDES.