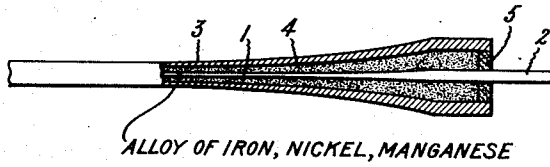


J. A. CAPP.
RESISTANCE ELEMENT.
APPLICATION FILED APR. 18, 1916.

1,279,252.

Patented Sept. 17, 1918.



Inventor:
John A. Capp,
by *Albert S. Davis*
His Attorney.

UNITED STATES PATENT OFFICE.

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RESISTANCE ELEMENT.

1,279,252.

Specification of Letters Patent. Patented Sept. 17, 1918.

Application filed April 18, 1916. Serial No. 92,037.

To all whom it may concern:

Be it known that I, JOHN A. CAPP, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Resistance Elements, of which the following is a specification.

My invention relates to resistance elements or the like, and more especially to resistance elements in which the resistance wire is inclosed in a metallic sheath, with an intervening layer of heat conducting and electric insulating material between the two.

Resistance elements of this character have hitherto been proposed which are made from an ingot comprising a metal tube of steel or other material, a central core of suitable material which for heating work and the like should have a high specific electric resistance, and a layer of powdered refractory heat conducting and electric insulating material compacted between the core and the sheath. After the ends of the ingot are stopped with washers or plugs, the whole is swaged or rolled to a size to give to the core wire the required resistance. The details of manufacture of sheathed wire of this character are fully set forth in a patent issued to

Chester N. Moore, August 11, 1914, Serial No. 1,107,233, and need not here be more fully discussed, except to explain that between each few passes it is necessary to thoroughly anneal the wire; otherwise the core wire becomes so hard that further reduction becomes impractical. Many of the best resistance materials require a considerable amount of annealing, and as this is a rather expensive process, it adds materially to the cost of the process, and hence to the expense of the finished sheathed wire.

My present invention has for its object the provision of sheathed wire of the general character discussed above, in which the core wire is made of a material that is particularly well suited to undergo the operations necessary for its manufacture without an excessive amount of annealing, and which has at the same time a high specific resistance, so that the material is particularly applicable to heating and other work where a high resistance is required. I have found that an alloy containing, or composed of, iron, nickel, and manganese is particularly well suited for this purpose. Alloys of iron

and nickel have hitherto been used as resistance elements, and manganese has commonly been present in such alloys in small proportions, for example one per cent. or less, and in such proportions it has the effect of hardening the alloys. I have found, however, that when the manganese is present in such alloys in substantial proportions, that it not only raises the resistance of the alloy, but that it has the unexpected result of increasing their malleability and ductility so that, because of their malleability, they do not require an excessive amount of annealing between the successive passes in the rolling or swaging machine in order to prevent their becoming unduly hard, and because of their ductility they may be extended to the required length and be kept substantially uniform in cross-section. At the same time, the manganese imparts to the alloys greatly increased electric resistance, which makes the same particularly suitable for heating and other high resistance work. I have found the following composition satisfactory for the core wire:

Iron	55%
Nickel	35%
Manganese	10%

It will be understood, however, that while I have given the composition that I prefer in practice, that the percentage of the various constituents may vary and still come within the scope of my invention.

Referring, now, to the drawing, the figure shows, partly in longitudinal section and partly in side elevation, a section of sheathed wire, embodying my invention and provided with a terminal. The core wire is indicated by the numeral 1, and is formed at the end with an enlarged terminal 2 of the character shown in Whitney Patent #1,095,502, which was issued April 14, 1914. The core wire is inclosed by a tubular metallic sheath 3, with an intervening layer 4 of compacted refractory insulating material such as magnesium oxid, between the core wire and the sheath. If desirable, a seal of any suitable character such, for example, as a cement of ground flint and silicate of soda as shown in Read Patent #1,127,280, which was issued February 2, 1915, may be inserted at the enlarged end of the terminal, as at 5, between the sheath and the core wire.

This material, of which the core wire is

made, is rather readily oxidized when exposed to the atmosphere at high temperatures, and is, therefore, unsuitable for heating device, and other resistance work where the resistance element is run at a red heat and exposed to the atmosphere. When the material, however, becomes the resistant element of sheathed wire, this property of rather readily oxidizing is of no consequence, since the atmosphere is excluded from the resistance element.

In accordance with the provisions of the patent statutes, I have described my invention, together with what I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

20 What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. A reduced sheathed wire comprising a high resistance core wire including in its composition iron, nickel and manganese, a

tubular metallic sheath inclosing said core wire, and an intervening layer of compacted powdered insulating material within which the resistance element is embedded.

2. A reduced sheathed wire comprising a high resistance core wire including in its composition iron and nickel, and manganese in excess of one per cent., a tubular metallic sheath inclosing said core wire, and an intervening layer of compacted powdered insulating material within which the resistance element is embedded.

3. A reduced sheathed wire comprising a high resistance core wire composed substantially of iron fifty-five per cent., nickel thirty-five per cent., and manganese ten per cent., a tubular metallic sheath inclosing said core wire, and an intervening layer of compacted powdered insulating material within which the resistance element is embedded.

In witness whereof, I have hereunto set my hand this 17th day of April, 1916.

JOHN A. CAPP.