

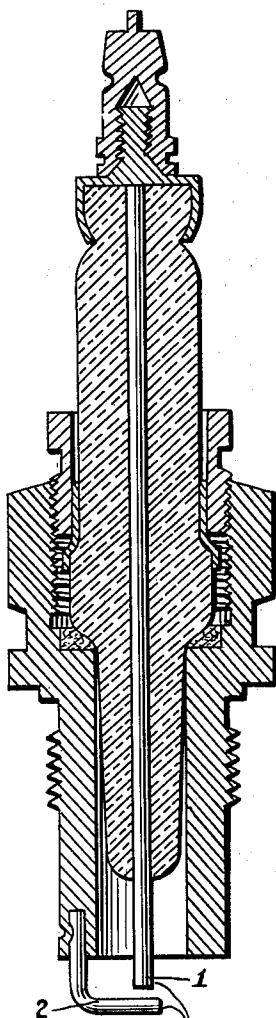
Feb. 23, 1937.

J. McNEIL

2,071,645

ELECTRODE AND ELECTRICAL CONTACT

Filed Jan. 3, 1935



*Nickel Alloy containing 0.1 to 8.0% Aluminum
or 0.1 to 8.0% Aluminum up to 20% Chromium*

Inventor,

John McNeil

By A. H. Keller
Attorney

UNITED STATES PATENT OFFICE

2,071,645

ELECTRODE AND ELECTRICAL CONTACT

John McNeil, London, England, assignor to The International Nickel Company, Inc., New York, N. Y., a corporation of Delaware

Application January 3, 1935, Serial No. 241
In Great Britain December 29, 1933

2 Claims. (Cl. 123-169)

The present invention relates to electrical contacts or electrodes subjected in use to the action of electric sparks, especially in corrosive atmospheres, and more particularly, to electrodes for spark plugs for internal combustion engines.

It is well known that electrodes subjected to the action of electric sparks when used at high temperatures deteriorate rapidly, especially in the presence of corrosive atmospheres. Thus, in the case of internal combustion engines and high duty engines, especially of the high compression type, the deterioration of the electrodes of the spark plugs, particularly the central electrode, is sufficiently rapid to necessitate frequent renewals, especially for good efficiencies. As yet the exact cause of this rapid deterioration has not been fully explained, but it appears to be due to a combination of the disintegrating effects of the spark and the corrosive action of the surrounding atmosphere at the high temperature of working. In particular, in the case of doped fuels, the deterioration may be accelerated on account of the presence of lead compounds including lead bromide, lead sulphide and lead sulphate. Heretofore, the electrodes of spark plugs have been chiefly made from nickel, manganese-nickel alloys, nickel-chromium alloys, or a heat-resisting steel, since these materials have been found to give the longest life. Although prior investigators have endeavored to improve the prior electrodes and electrical contacts, no attempt, as far as is known, has been wholly satisfactory and successful in improving the foregoing materials.

It has been discovered that improved results may be obtained by incorporating critical amounts of aluminum in electrodes and electrical contacts constituted of nickel and nickel alloys.

It is an object of the invention to provide an improved electrode or electrical contact constituted of nickel or nickel alloys and containing critical amounts of aluminum.

It is a further object of the invention to provide an improved electrode or electrical contact containing aluminum which has superior resistance to the action of electric sparks in corrosive atmospheres and/or at high temperatures.

The invention also contemplates the provision of an improved electrode or electrical contact constituted of nickel or nickel alloys and containing 0.1 to 8% aluminum whereby increased resistance is exhibited towards deleterious actions, especially those present in high compression

internal combustion engines using doped fuels.

Other objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawing which depicts an illustrative embodiment of the present invention.

According to the present invention, increased life is obtained from electrodes and electrical contacts constituted of an alloy containing from 0.1 to 8% aluminum together with nickel or nickel alloyed with one or more of the metals comprising chromium, manganese and iron. When any substantial proportion (i. e. about 2% to about 80% or so) of iron is present, the aluminum may be wholly or in part replaced by silicon. With the lower contents of nickel, relatively low aluminum contents have been generally found to be desirable. Thus, with alloys containing about 15% nickel, the aluminum content should be kept below about 4%.

In the manufacture of a spark plug electrode, a binary aluminum-nickel alloy may be employed. Thus, an alloy may be used containing, besides aluminum and nickel, only the normal amounts of impurities that are found in metallic aluminum and malleable nickel, respectively. For instance, satisfactory results have been obtained with an alloy comprising approximately 96% nickel and 4% aluminum.

Ternary alloys of special composition have also been found to give new results when used as electrodes or electrical contacts. Thus, a nickel-manganese alloy containing for instance, about 93% nickel, about 4% manganese, and about 3% aluminum has given satisfactory results. An electrode of the foregoing composition has a superior and increased resistance to the type of action which heretofore has caused rapid deterioration with the known alloys containing 96% nickel and 4% manganese.

In the case of the nickel-chromium alloys, it has been found that the chromium content should not exceed 30%, while the permissible aluminum content is limited to 6%. An example of this class of alloy is one comprising about 77% nickel, about 20% chromium and about 3% aluminum which is superior to prior alloys containing 80% nickel and 20% chromium which have been used as electrodes.

Other alloys embodying the present invention that may be employed as electrodes and electrical contacts are nickel-iron alloys containing from about 2% up to 80% iron and complex alloys, such as, nickel-chromium-iron alloys, containing

from about 8% to about 95% nickel, from about 2% to about 30% chromium, and from about 2% to about 75% iron. In these ferrous alloys, the aluminum may, as mentioned hereinabove, be wholly or partly replaced by silicon.

The accompanying drawing illustrates a standard spark plug. Reference characters 1 and 2 designate electrodes which are constituted of my improved nickel alloy set forth hereinabove. It is to be observed that the electrode in the illustrative embodiment is a round rod or wire. As those skilled in the art can readily understand, an electrode will have the same or substantially the same composition throughout its cross section from the most interior region to the most exterior region. It is to be understood that no claim is made for the structural features of the standard spark plug illustrated in the drawing as such structural features are old in the art.

Generally speaking, in all of the present alloys, there may be present other elements which would not deleteriously affect the life or render the working of the material impracticable. In particular, if desired the alloys may contain small quantities of molybdenum, titanium, zirconium, tungsten, vanadium, tantalum, copper and beryllium not only without deleterious effect but with improvement of the properties of the alloys in particular directions, while the non-ferrous alloys may contain small quantities of iron. The presence of small quantities of carbon with or without other elements such as tungsten is sometimes desirable for purposes of hardening and strengthening the alloy. In general, the amount of carbon added for this purpose should not exceed about 0.25%.

It is to be observed that any of the additions commonly made to alloys for the purpose of improving their properties may be included. Calcium is of especial value on account of its desulphurizing properties and consequent power of increasing the forgeability of the alloy. The other alkaline earth metals, barium and strontium, may also be used for this purpose. As examples of other additions which may be made may be mentioned lithium, which is of value in fluxing non-metallic inclusions and thereby improving the quality of the alloy.

What is claimed is:

1. As an article of manufacture, a spark plug electrode adapted to resist corrosion and having improved resistance to erosion by the electric arc in the presence of corrosive products of combustion and constituted of a nickel alloy comprising about 0.1% to about 8% of aluminum diffused throughout the alloy, and the balance consisting essentially of nickel, said electrode having substantially the same composition throughout its cross section from the most interior region to the most exterior region.

2. As an article of manufacture, a spark plug electrode adapted to resist corrosion and having improved resistance to erosion by the electric arc in the presence of corrosive products of combustion and constituted of a nickel alloy comprising about 0.1% to about 8% of aluminum diffused throughout the alloy, an effective amount up to about 20% chromium, and the balance consisting essentially of nickel within a range of about 77% to about 95%.

JOHN McNEIL.