

H. K. SANDELL.
METAL COMPOSITION.
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1,223,002.

Patented Apr. 17, 1917.

Fig. 1.

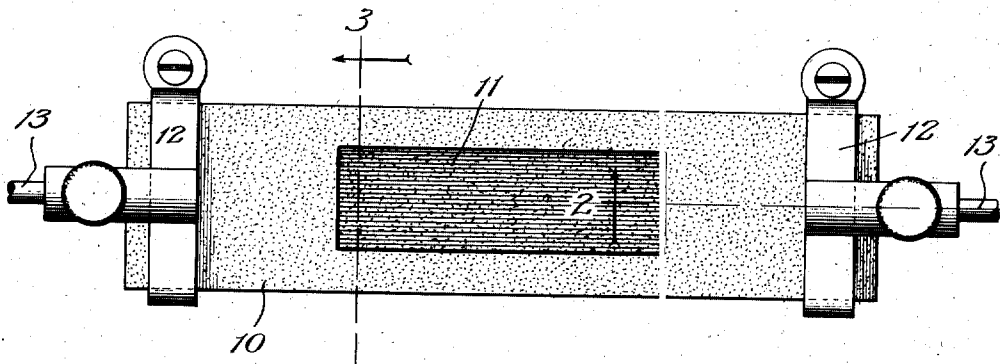


Fig. 2.

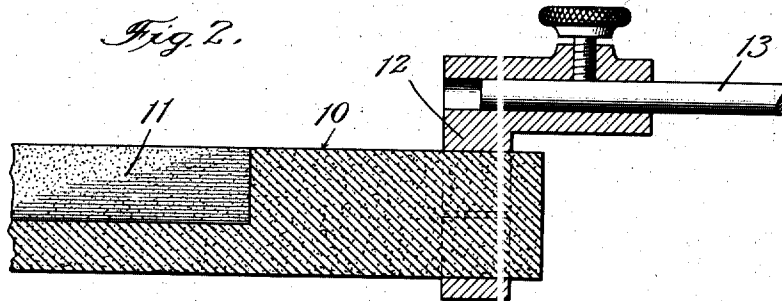
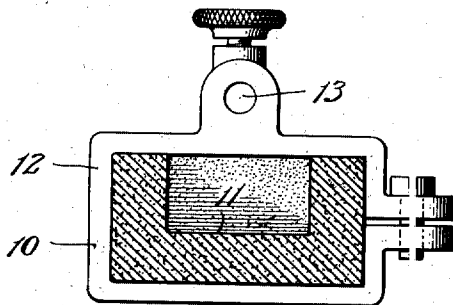


Fig. 3.



Witnesses:

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UNITED STATES PATENT OFFICE.

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METAL COMPOSITION.

1,223,002.

Specification of Letters Patent.

Patented Apr. 17, 1917.

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To all whom it may concern:

Be it known that I, HENRY K. SANDELL, a citizen of the United States, residing at 221 South Green street, Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Metal Compositions, of which the following is a specification.

My invention relates to improvements in metal compositions and methods of producing the same. More particularly the invention is concerned with a metallic substance, which may either be a single metal or an alloy, and containing a considerable percentage of carbon. I find that such a body has peculiar properties which render it desirable for certain technical uses.

As is well known, there is difficulty in obtaining satisfactory service from metallic contact points for opening and closing electrical circuits. The arcing or sparking between such points proves quickly destructive of the finished surfaces thereof, not only volatilizing the surfaces to cause pitting of the same but also oxidizing these surfaces, thereby increasing the contact resistance and proportionately increasing the heating effect of the current at the contact. Through this increased resistance and heating effect further destructive pitting and oxidizing is set up. This destructive action is therefore self-perpetuating, being in the nature of a vicious circle, and limits the life of the contact points to such an extent that only a very few metals, such as platinum, and, in some special services, tungsten, are regarded as at all serviceable.

I find, however, that the commoner and less expensive metals, or alloys thereof, exhibit such properties when combined with a relatively large proportion of carbon as to arrest the destructive action referred to. The result of such a mixture of carbon with the metal is to render the metallic body practically infusible as a body, though it is quite probable that the metallic constituents of the body do, in fact, fuse. It is believed that the explanation of this property lies in the fact that the carbon present forms a spongy or porous mass within the interstices or pores of which the metal is carried and held, whether in a solid or liquid form, the outward appearance and general physical properties of the mass being apparently unaffected by subjection to temperatures, in

themselves sufficient to fuse the metal constituents. Whether this be a true explanation of the phenomenon or not, it is nevertheless certain that the apparent melting point of metals, such as nickel and nickel-iron alloys, is raised above any temperatures which I have been able to obtain by the use of an electric furnace or an oxy-acetylene flame.

A further property of my metal composition which renders it peculiarly valuable as a contact metal is its resistance to oxidation under sparking or arcing conditions. I attribute this property to the fact that the arcing or sparking volatilizes the carbon present to create a reducing atmosphere which effectively prevents oxidation of the metal of the contacting face, whether this metal be, in fact, in the liquid or solid state.

In order to produce a metal composition carrying a relatively high percentage of carbon, I find it advantageous to employ an apparatus of the form illustrated in the accompanying drawing, in which—

Figure 1 is a plan view of my crucible; Fig. 2 is a section thereof on line 2 of Fig. 1; and Fig. 3 is a section on the line 3 of Fig. 1.

Referring more particularly to the drawing, numeral 10 designates a carbon bar which is illustrated as rectangular in cross-section and provided with a recess 11 which serves as the crucible. To the ends of the bar are fixed clamps 12 to which the conductors 13 are attached.

To make my new metal composition by the use of this apparatus, the metal, for instance shot nickel, is introduced into the crucible aperture 11 in the bar and the conductors 13 are then placed in circuit with a suitable source of electric power (preferably alternating current), the current is turned on and regulated in strength until the bar 10 reaches a temperature sufficient to melt the nickel. It should be noted that the construction of the crucible is such that the metal therein serves as a conductor, this condition giving rise to a peculiar phenomenon, i. e., the molten metal body lying in the bottom of the crucible divides itself in the center to form separated pools which continuously reunite and again separate. As soon as the metal is thoroughly melted I add to the molten mass finely divided carbon, which I stir into the mass as it is added, preferably by the use of a carbon stirring-rod. I also

find it of advantage to interrupt the current through the crucible at intervals. Within a very few minutes the molten mass within the crucible solidifies or sets. The process is now
 5 at an end, and the current may be turned off, the crucible permitted to cool and the block of metal composition removed therefrom. This block may then be machined, ground or otherwise fabricated to produce contact
 10 points adapted for use in any form of make and break electrical apparatus, as, for instance, buzzers or spark-coils.

Although I prefer to stir in finely divided amorphous carbon during the heating
 15 of the metal within the crucible, this is not essential to the success of the process, since I find that the crucible walls themselves are eaten away during the process, the carbon required for the composition being thus supplied to a large extent by the crucible itself.

I find that by the process above described I am able to produce a metal composition which appears to be homogeneous throughout its mass and which upon analysis shows
 25 a percentage of carbon (by weight) of from $2\frac{1}{2}$ to 7 per cent. in the case of nickel and nickel-iron alloys. The best results which I have secured have been by the use of comparatively pure shot nickel, in which I have
 30 succeeded in incorporating by this process approximately 7 per cent. of carbon. Practically all of this carbon seems to be present as graphite, there being only traces of combined carbon and amorphous carbon. It
 35 appears therefore, that not only is the carbon incorporated and homogeneously mixed in the metal, but that in the process this carbon becomes converted into graphite.

By reference to the table of specific gravities of metallic nickel and graphite it appears that 7 per cent. (by weight) of carbon would represent approximately 30 per cent. of volume or bulk of this constituent. It
 40 appears, therefore, that my new metal composition contains a sufficient percentage of graphitic carbon to distinctly differentiate it from any known metals or alloys.

As before stated, I have been able to secure the best results by the use of relatively
 50 pure nickel as a metallic constituent of my composition. I find, however, that a serviceable composition may be produced by the

use of a nickel-iron alloy containing upward of 70 per cent. of nickel and approximately $3\frac{1}{2}$ per cent. of carbon. My composition presents the general appearance of
 55 a metallic body, taking a good polish, and retaining its brightly polished surface for a considerable period of time.

By comparative tests I find that contact
 60 points made of my new metal composition, retain their efficiency for substantially the same time as do platinum points, under normal loads, while under overload conditions my composition seems to be superior to
 65 platinum, being capable of carrying greater currents and withstanding the arcing set up by the passage of heavy currents with less disastrous effects than the platinum.

While I have described in considerable detail one specific process of manufacturing
 70 my new metal composition, together with the preferred constituents entering into the same, and one particular use to which my composition seems to be peculiarly fitted, it
 75 will be understood that my invention is not to be regarded as limited to these details, except in so far as such limitations are included within the terms of the following
 80 claims, in which it is my intention to claim all novelty inherent in my invention, as broadly as is permissible, in view of the prior art.

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

1. A contact point for making and breaking electrical circuits and comprising a
 85 metal composition including upward of 70 per cent. of nickel and upward of 3 per cent. of uncombined carbon.

2. A contact point for making and breaking electrical circuits and formed of a metal
 90 composition comprising substantially pure nickel, carrying upward of 3 per cent. of uncombined carbon.

3. A cast metal contact point for making and breaking electrical circuits and comprising
 95 upward of 70 per cent. of nickel and upward of 3 per cent. of graphitic carbon.

4. A cast metal contact point for making
 100 and breaking electrical circuits and comprising substantially pure nickel, carrying upward of 3 per cent. of graphitic carbon.

HENRY K. SANDELL.