April 30, 1946. W. L. CARLSON ET AL 2,399,466

METALWORKING

Filed Jan. 8, 1942

Fig. 1

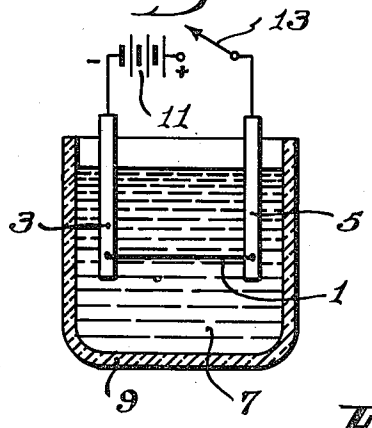


Fig. 2.

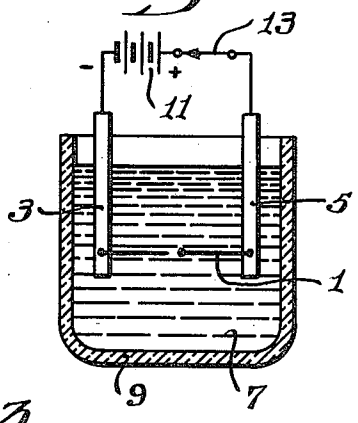


Fig. 3.

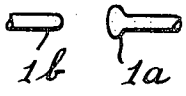


Fig. 4.

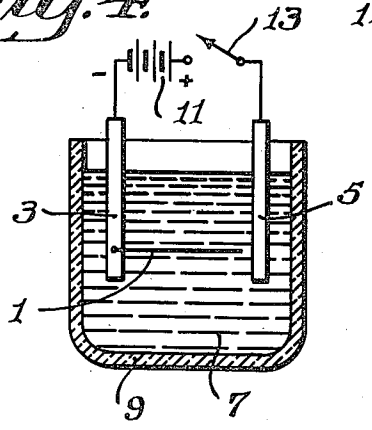


Fig. 5.

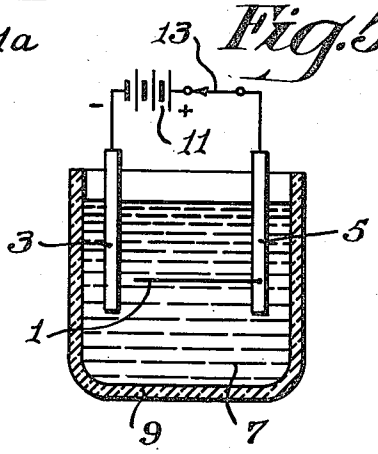


Fig. 6.



Inventors
Wendell L. Carlson
& Robert L. Harvey

By J. Huff

Attorney

Patented Apr. 30, 1946

2,399,466

UNITED STATES PATENT OFFICE

2,399,466

METALWORKING

Wendell L. Carlson, Haddonfield, and Robert L. Harvey, Collingswood, N. J., assignors to Radio Corporation of America, a corporation of Delaware

Application January 8, 1942, Serial No. 425,984

3 Claims. (Cl. 219—1)

This invention relates to metal working and particularly to a method of forming rounded and globular or beaded terminals on metal wires, rods, ribbons, etc.

Metal elements having rounded terminals find useful application in numerous arts and for various reasons. By way of example: It is well known that electrical contacts having rounded terminals are less subject to arcing and consequent deterioration than those possessing unsymmetrical or jagged contours. Similarly, in the art of rectifying currents of radio frequency by means of a crystal detector, much better physical and electrical stability is ensured when the end of the contact or "cat whisker" which is presented to the jagged crystalline face of the detector element is provided with a rounded instead of a pointed or angular surface. Other electrical, mechanical and indeed decorative advantages recommend the use of rounded or globular beaded metal parts in other arts and it is to be understood that the scope of the invention herein described is not in any wise limited by the particular use to which the finished metal object or part may be put.

The principal object of the present invention is to provide a simple, reliable and trouble-free method of forming rounded or globular or beaded terminals on metal wires, rods, ribbons, etc., and one which dispenses with the necessity of the expensive swaging, grinding, lapping and polishing procedures heretofore employed in the manufacture of such metal elements.

The foregoing and other objects are simply achieved in accordance with the invention by immersing the wire, rod, ribbon or other metallic part to be treated in a coolant such as water or other cooling liquid, then subjecting the said part to an electric current of an intensity sufficient to cause localized thermal softening and virtual flow of the metal of which the said part is constituted, and then permitting the softened metal to harden in said coolant.

In the accompanying drawing: Figures 1 and 2 are sectional views of one form of an apparatus which may be used in forming, simultaneously, two rounded metal contacts; Figure 3 is an enlarged fragmentary elevational view of two rounded metal terminals or contacts formed, in accordance with the invention, with the apparatus of Figure 1; Figures 4 and 5 are sectional views of an apparatus similar to that shown in Figures 1 and 2 but operated in a different way to provide a single rounded metal terminal member; and Figure 6 is an enlarged fragmentary view of a rounded terminal member formed by the apparatus of Figures 4 and 5.

The apparatus of Figs. 1 and 2 is arranged to simultaneously form two rounded or globular metal contacts from a single rod or wire 1. To this end, referring now to Fig. 1, the wire or other part 1 is connected between two electrodes 3 and 5, respectively, and immersed in water or other liquid coolant 7 contained in a suitable receptacle 9. The electrode 3 is connected to the negative (−) pole of a source of direct current exemplified by the battery 11 and the other electrode 5 is connected through a switch 13 to the positive (+) pole of said D. C. source. When the switch 13 is closed, as shown in Fig. 2, the source 11 supplies a heating current of sufficient intensity to melt and break the wire 1 intermediate its ends. This localized melting is accompanied by a slight flow of the metal adjacent its newly formed ends causing them to assume a rounded or globular contour which is permanently "set" by the cooling action of the liquid in which the said ends are immersed. The exact point at which the wire 1 will be broken when it is subjected to the heating current may be fixed by filing, nicking or otherwise reducing the cross-sectional area of the wire at that point. Obviously, when the wire 1 is broken by the gap resulting from flow of molten metal, the circuit to the battery 11 is automatically broken and the apparatus is ready for use again.

The quantity of current supplied by the source 11 will depend not only upon the size and material of the object to be treated but will also depend upon the desired size and contour of the finished terminals. In this latter connection, it has been observed that that terminal which remains connected to the electrically positive electrode 5 will usually comprise a bead or globule or metal, such for example, as shown at 1a, Fig. 3, while the end of that section of the wire 1 originally connected to the negative terminal may simply be rounded, for example, as shown at 1b, in Fig. 3, and 1c, in Fig. 6.

When the object 1 comprises a wire of very fine gauge, (e. g. .007" diameter) the current supplied by a two volt battery will be found sufficient to provide the desired effect upon the metal. Wires of larger gauge require heavier heating currents which should be chosen with regard to the resistance and melting temperatures of the metals of which they are comprised.

It has previously been pointed out in connection with Figs. 1–3 that that section of the wire or other object 1 which remains connected to

the positive electrode of the direct current source 11 will ordinarily assume a globular or rounded spatulate shape, such, for example, as shown at 1a in Fig. 3, whereas the other or negative terminal of the wire will assume a rounded contour, as shown at 1b, Fig. 3, without any appreciable increase in its diameter. This difference in size and shape of the newly formed terminals 1a and 1b may be accounted for simply by the fact that the molten metal particles flow in the same direction as the current, i. e. from negative to positive. This phenomenon enables the operator to form either a globular or simple rounded contact element at will. Thus, referring to Figs. 4 and 5, if the wire 1 is to be provided with a simple rounded end, similar to that shown at 1c, Fig. 6, the said wire should be connected only to the negative electrode 3 and the circuit thereafter completed by bringing the end to be treated into contact with the positive electrode 5. Conversely, if the said wire is to be provided with a globular terminal, it should be connected to the positive electrode and subsequently be brought into contact with the negative electrode. In either event the part to be treated should preferably be subjected to but momentary contact with the electrode through which the circuit is closed, since otherwise too much of the metal may be melted. It is not necessary to actually move the object away from the electrode at the instant of contact since the circuit is automatically broken by reason of the gap which is formed between the said points of contact when the desired quantity of metal has been melted.

What is claimed is:

1. Method of working an elongated metal object which comprises immersing said metal object in a non-conductive liquid, connecting said object to a source of direct current of a value sufficient to melt and to break said object intermediate its points of connection to said direct current source, passing said direct current longitudinally through said object, and then permitting the now discrete parts of said object to harden in said liquid, whereby the portion of said object on the electrically positive side of said direct current source is provided with a terminal of globular contour and the portion of said object on the electrically negative side of said direct current source is provided with a rounded terminal of a diameter smaller than that of said globular terminal.

2. The invention as set forth in claim 1 and including the step of reducing the cross-sectional area of said elongated metal object adjacent to the point where it is to be broken.

3. Method of providing a metal object with an enlarged terminal surface of globular contour, said method comprising connecting said object to the positive terminal of a direct current source of sufficient power to produce localized melting of said metal, immersing the part of the object to be treated in a non-conductive liquid, and then momentarily completing the circuit between the positive and negative poles of said direct current source through said object beneath the surface of said liquid.

WENDELL L. CARLSON.
ROBERT L. HARVEY.