July 2, 1940. L. C. CONRADI ET AL 2,206,662

FABRICATING ARTICLE OF BERYLLIUM COPPER

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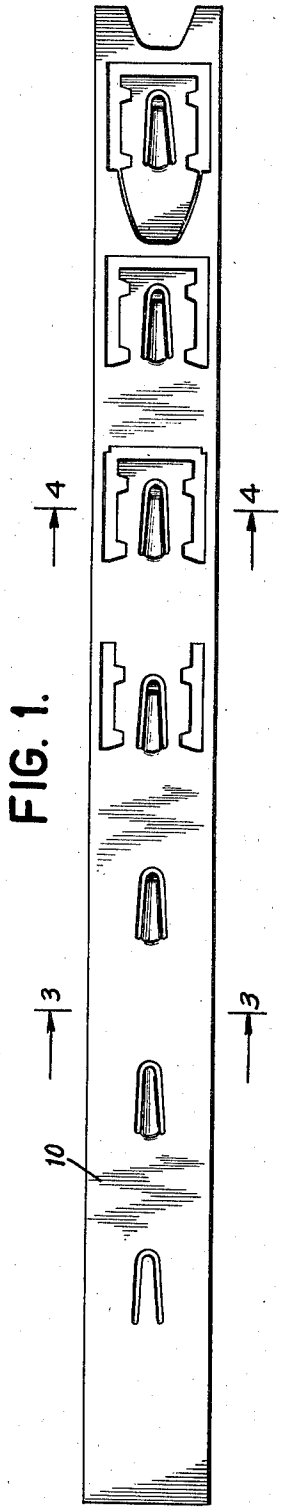

FIG. 1.

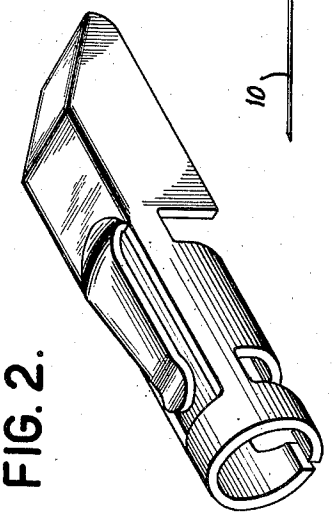

FIG. 2.

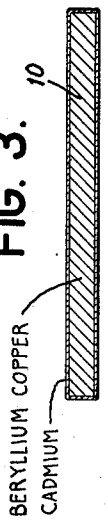

FIG. 3.

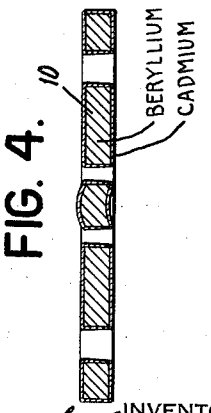

FIG. 4.

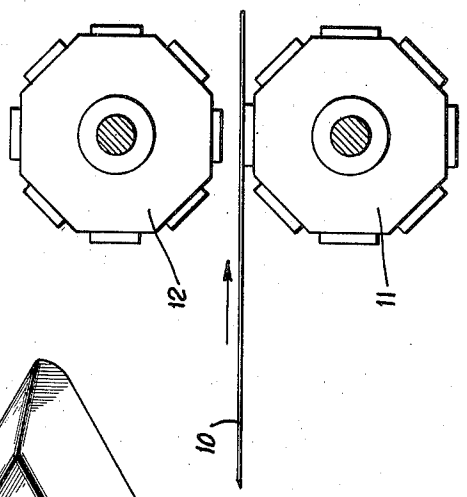

FIG. 5.

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FABRICATING ARTICLE OF BERYLLIUM COPPER

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Application February 1, 1938, Serial No. 188,080

2 Claims. (Cl. 29—155.55)

This invention relates to a method of preparing metals which are to be fabricated into articles of manufacture by cutting, forming, stamping or like operations. More particularly, the invention relates to the preparation of the metal known as "beryllium copper" whose hardness renders it difficult to fabricate and machine. Beryllium copper having a beryllium content of from 2.0% to 2.25% is commonly referred to as a refractory alloy, because of the difficulty with which it is fabricated and machined. This difficulty is encountered in mills where the cast material is fabricated into bar, tube, sheet and strip form and also in the fabricating processes which the manufacturer of articles employs, such as blanking, forming, swaging, shaving and shearing. In all of these manufacturing processes, whether used by the mill or factory, the wear and tear on tools and dies when processing these alloys is far greater than when ordinary commercial free-cutting brass is processed.

Generally speaking and arbitrarily taking the machinability of commercial free-cutting brass as 100, the machinability of the refractory alloys such as phosphor bronze and nickel silver may be classed as 20. The machinability of beryllium copper may be classed as under 20 which classes it as even more refractory than phosphor bronzes and nickel silvers.

While beryllium copper has qualities such as strength, wear resistance, conductivity and corrosion-resistance which make it very desirable for use in the manufacture of various articles, the difficulty encountered in working the metal, resulting in excessive wear on the tools, overbalances the advantages derived from its better qualities and has threatened to force discontinuance of its use in the manufacture of particular articles because of the high cost incident to the frequent replacement of tools and dies.

It is accordingly proposed to prepare the beryllium copper stock before processing operations are performed thereon with a coating of a softer ductile metal which will act as a lubricant during the processing operations.

More specifically, it is the object of the invention to prepare a beryllium copper strip by applying thereto a coating of cadmium of uniform thickness which will prevent direct contact between the beryllium copper and the tool and serve as a lubricant between the two.

Various other objects and advantages of the invention will be obvious from the following particular description of a method of procedure embodying the invention as applied to the manufacture of a selected article or from an inspection of the drawing.

In the drawing:

Fig. 1 represents a strip of beryllium copper coated with cadmium and illustrating the various steps of fabricating.

Fig. 2 is an isometric view showing the completely fabricated article.

Fig. 3 is an enlarged cross-sectional view of the coated strip, the section being taken on lines 3—3 of Fig. 1.

Fig. 4 is a similar view taken on lines 4—4 of Fig. 1 showing the manner in which the cadmium coating is drawn over the surfaces of the base material by the forming tools.

Fig. 5 is a diagrammatic representation of a multiple-tool machine through which a strip of metal is fed.

In Fig. 2 there is shown at a greatly enlarged scale a small part which has been fabricated automatically from a strip of material. A multiplicity of these parts is mounted on a panel of insulating material termed a "plug board panel" and employed in the well known electric accounting machines. Such a panel is described and illustrated in the copending application of Clair D. Lake, Serial No. 10,299, filed March 9, 1935, and allowed September 17, 1937, for a Plug board.

The use of beryllium copper in the production of these parts is highly desirable because of the corrosion resistance properties of the metal and its excellent electrical conductivity.

It has been found under actual production conditions that the tools and dies used to fabricate this part required replacement after the making of about fifteen thousand pieces. In other words, the abrasive effect of the beryllium copper on the tools was so great that the use of the metal for this purpose was economically unsound.

As indicated in Fig. 1, the strip 10 is subjected to seven distinct operations in the cutting, forming and blanking of a single part from the strip after which the blank is bent and rolled to complete the article. In Fig. 5 is shown a turret type of machine with a die portion 11 and a tool-carrying turret 12, although other types of machine may be employed in which the tools are arranged in tandem for concurrent operation.

In carrying out the invention the beryllium copper strip 10 in the form of a continuous web, after the usual cleaning processes, is cadmium plated in either individual still tanks, semi-automatic tank or full tank equipment, or full automatic equipment may be used throughout for the cleaning as well as the plating and subsequent

rinsing operation. Best results have been obtained when the coating of cadmium is deposited with a thickness between a minimum of two ten-thousandths and a maximum of five ten-thousandths of an inch. In Fig. 3 is shown a cross-section of the coated beryllium copper with an even distribution of cadmium. As the coated strip is worked, the cadmium acts as a lubricant avoiding intimate contact between the tool and the beryllium copper and because of its ductility, as the tool pierces the strip, the cadmium is drawn by the tool into the pierced sections and coats the newly formed inner surfaces so that a section, such as shown in Fig. 4, would disclose cadmium on the inner surfaces though of a lesser thickness than on the surfaces to which it was initially applied. In other words, the great ductility and malleability of the cadmium permits the coating to be stretched and dragged over the cut and formed edges, thus maintaining a film of the metal between the tool and the edge of the strip being cut.

As a result the completed article shown in Fig. 2, when it leaves the machine, has the original coating on its outer and inner surfaces and in addition the narrow edges have also a thinner coating of cadmium. The cadmium coating having served its purpose may thereafter be removed in a suitable bath, leaving an article of bright beryllium copper. The lubricating effect of the coating has in actual production increased the life of the tools and dies from fifteen thousand pieces to one hundred and sixty thousand pieces or, in other words, it has increased the life of the tools over ten and a half times so that the use of beryllium copper in the production of small parts has been rendered more economical and satisfactory.

Although one method for obtaining the improved results has been set forth and described, it is obvious that various changes may be made in the separate steps thereof without modifying or changing the essential features and characteristics of the method employed and that such methods remain substantially the same, although slight modifications may be made in the physical and chemical characteristics of the metals used.

What is claimed is:

1. The method of forming an article of beryllium copper which consists in coating a strip of beryllium copper with cadmium to a thickness of approximately .00035 of an inch and then operating upon the coated strip with cutting, pressing and stamping tools so the cadmium is drawn by the tool over the cut edges of the strip.

2. The method of forming an article of a metal having a substantial hardness of beryllium copper which consists in coating a strip of said metal with cadmium to a thickness between .0002 and .0005 of an inch and then operating upon the coated strip with a cutting tool so the cadmium is drawn by the tool over the cut edges of the strip.

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