Dec. 30, 1947. G. DURST 2,433,687

ELECTRICAL CONTACT

Filed Sept. 27, 1943

FIG. 1.

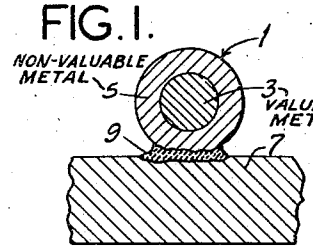


FIG. 2.

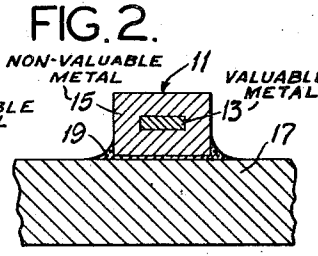


FIG. 3.

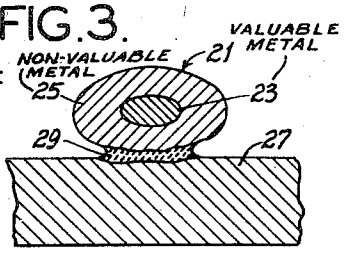


FIG. 4.

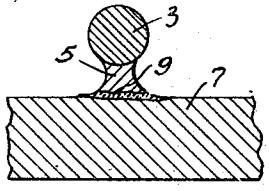


FIG. 5.

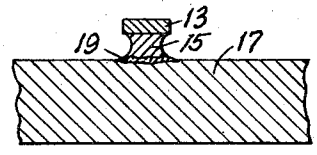


FIG. 6.

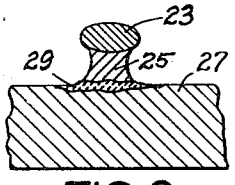


FIG. 7.

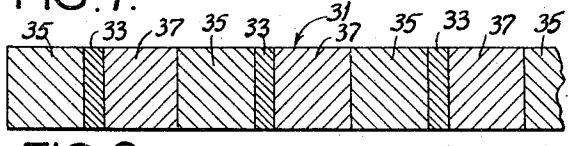


FIG. 9.

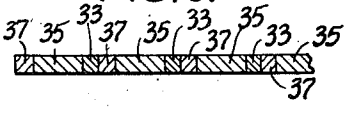


FIG. 8.

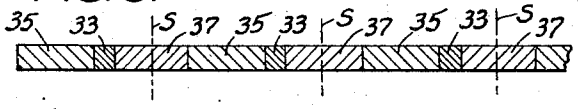


FIG. 10.

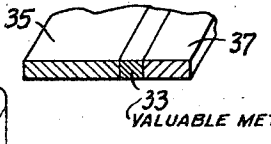


FIG. 11.

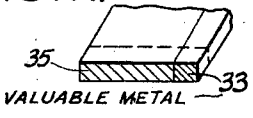


FIG. 12.

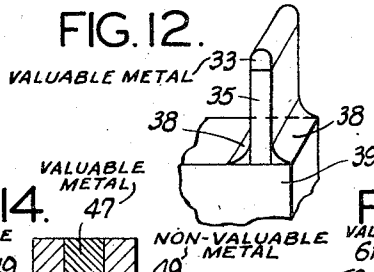


FIG. 13.

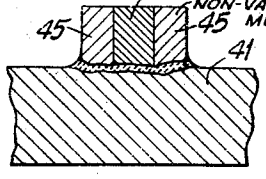


FIG. 14.

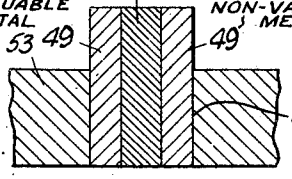


FIG. 15.

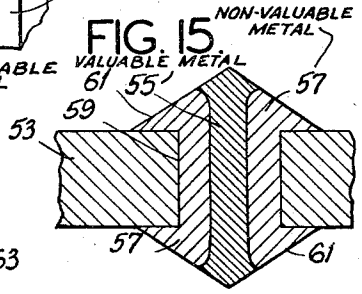


FIG. 16.

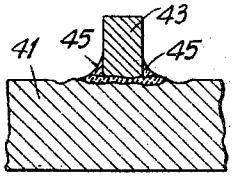


FIG. 17.

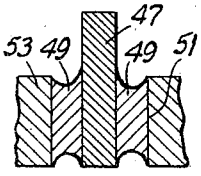
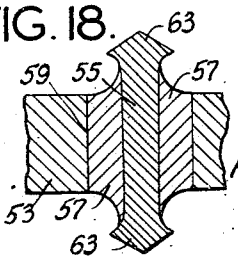


FIG. 18.



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Patented Dec. 30, 1947

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UNITED STATES PATENT OFFICE

2,433,687

ELECTRICAL CONTACT

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Application September 27, 1943, Serial No. 504,079

4 Claims. (Cl. 200—166)

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This invention relates to contacts and the like, and with regard to certain more specific features to electrical contacts composed of the more costly metals.

Among the several objects of the invention may be noted the provision of a new form of contact which employs at the point of engagement of the contact only very little costly metal ordinarily used for the purpose; the provision of a contact of the class described in which the desired contact metal per se is exposed in definite relief and which at the same time is very strongly and rigidly supported on the remainder of the contact assembly; the provision of a process for economically making said contacts; and the provision of a construction of the class described particularly applicable to small contact structures such as used in radio, telephones, relay applications et cetera. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, the proportions thereof, steps and sequence of steps, features of construction, composition and manipulation, and arrangements of parts which will be exemplified in the structures, substances, products and methods hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which are illustrated several of various possible embodiments of the invention,

Figs. 1, 2 and 3 are much enlarged cross sections showing three different types of one form of my invention;

Figs. 4, 5 and 6 respectively show the constructions of Figs. 1, 2 and 3 after a subsequent construction step;

Fig. 7 is an enlarged section showing an alternative scheme for carrying out my invention;

Fig. 8 shows a subsequent operation performed in connection with the Fig. 7 form of the invention;

Fig. 9 is a view similar to Fig. 8 showing an alternative feature;

Figs. 10 and 11 are perspective views of results of operations subsequent to those of Figs. 8 or 9;

Fig. 12 shows an example of a final product made from the process and structure illustrated in Figs. 7–11;

Figs. 13, 14 and 15 are enlarged sections showing first steps in carrying out alternative embodiments of the invention; and

Figs. 16, 17 and 18 are respectively subsequent steps of those shown in Figs. 13, 14 and 15.

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Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Certain valuable metals and alloys form extraordinarily good electrical contacts, such as for example, platinum, platinum-iridium, gold-platinum, palladium, etc. However, due to their high cost, it is desirable to limit the use of such metals only to the precise locations where they are needed, namely, in the case of electrical contacts where current-carrying contact is actually made. Hereinafter the metals above specified will be called valuable metals in the sense that they need to be conserved for one reason or another. The differentiating adjectives will be non-valuable or less valuable to designate more economical metals such as iron, steel, copper, brass, et cetera.

Heretofore difficulties had been encountered in reducing the amount of valuable metal used because the smaller the mass of metal becomes, the more difficult it is to handle and to attach to the adjacent base or metal support. For example, it has been heretofore proposed electrically to weld a plain platinum wire to a metal base and to use the surface of the wire as the contact region. The difficulty with this is that it requires a size of wire that can be handled, and the larger the wire, the more is the cost. In addition, even for small wires this method produces a metal contact ridge which is lower than desired in some applications.

The present invention produces a relatively high ridge of valuable-metal contact strongly anchored, which employs an electrically determined minimum of the valuable metal. An incidental advantage is the use that can be made of certain of the old apparatus for welding plain platinum wire to backing materials.

A basic material used in the invention will first be described. This is a wire similar to Wollaston wire. A Wollaston wire is a very fine (usually valuable such as platinum) wire, ordinarily prepared by first incasing a wire core in a cylindric sheath of less valuable metal and drawing the whole down to a small size. Then the sheath is dissolved off, leaving the inner wire for ultimate use. While some Wollaston wire is made so small as to be useful as cross hairs in telescope eye pieces, etc., the present invention contemplates the use of somewhat larger sizes than these and wherein there is a metallic fused or welded bond between the core and sheath. These are now produced by known methods. But it is to be understood that the dimensions used are essentially small being variable to suit the size of contact

desired. Hereinafter the organization of the bonded Wollaston type of wire in its sheath subsequent to drawing but prior to dissolving off the sheath will be called a composite bonded Wollaston wire. It is this that forms one raw-material element for the invention.

Referring now more particularly to Fig. 1, there is shown at numeral 1 a round composite bonded Wollaston wire prior to the time that its incasement is dissolved away. This consists in this case of a platinum core 3 with a more readily soluble shell 5, preferably of steel in the present application. The assembly 3, 5 is then drawn down to a size, for instance .012 inch in outside diameter in which the core is about .006 inch in diameter. This composite bonded Wollaston wire 1 is then welded as at 9 to a brass support 7 (when steel is used for the incasement 5). Electrical welding is preferable.

Next, the organized assembly shown in Fig. 1 is inserted into a suitable pickling bath which will remove the steel shell 5 without attacking the platinum, or brass. A satisfactory material in the above example would be dilute sulfuric or hydrochloric acid. This pickling material will not attack the platinum wire 3 nor the non-ferrous support 7. It will be seen that the weld 9, being in a re-entrant pocket under the wire, will be much more slowly eaten away than the exposed upper and side arcuate surfaces of the shell 5. The final appearance is diagrammed in Fig. 4 wherein only the platinum core 3 is left with a small portion of the original steel incasement 5 beneath it which joins it to the backing 7 through the substantial remains of the weld 9. Electric contact welding at 9 involves no additional material at that region, but if fusing processes are resorted to requiring additional material, it should preferably, though not necessarily, be such as to resist attack entirely by the pickling fluid. The point in any event is that the upper surface of the wire 3 is entirely etched off and exposed long before the wire 3 is disconnected from the support 7, and it is a simple matter to time the pickling operation to cease when the wire 3 is exposed and before the disconnection occurs.

It will be understood that the choice of materials and pickling baths is wide within the principles above set forth. For example, the bonded Wollaston type wire may have a platinum core 3 with a silver or copper alloy incasement, in which case a steel support 7 would be preferable in order that the pickling agent which attacks the incasement will not attack the base. The principle is to have a wire core and base which are not subject to attack by the pickling agent which will then selectively remove the upper part of the incasement from the wire.

For removing the sheath 5, if it is silver and the base is steel, then the commonly known anodic etching may also be used, in which case the contact to be etched away is made the positive pole in a cyanide solution.

In Fig. 2 a modification is shown in which a rectangular-drawn composite bonded Wollaston type wire 11 is used. Hence there is a rectangular core 13 and a flat walled incasement 15. This is attached to the backing base or support 17, by welding or the like 19, and then etched away as shown in Fig. 5. It will be understood that a rectangular cross section is useful for certain purposes and is more economical of valuable metal.

In Figs. 3 and 6 is shown a third modification in which elliptical composite bonded Wollaston type wire 21 is used having an elliptical core 23 with an elliptical incasement 25 held as at 26 to a base 27. This form is also more economical than that of Fig. 1.

It will be clear that the Fig. 2 and Fig. 3 forms of the invention employ more or less flat Wollaston type wires, whereas Fig. 1 does not.

It is to be understood in connection with all of the forms of the invention thus far shown that the welding may be accomplished without additional metals if electric welding be resorted to, in which event the metals of the sheaths and the bases 7 will be interfused per se at point of contact, but any desired additional welding or brazing material may be used. The results will be similar to those above described, because with or without additional metal at the point of attachment between the base and the composite bonded Wollaston type wire, the etching operation is not very effective in a corner or screened position and therefore proceeds slower at such a point. The screening is provided by the support and core which sandwiches the supporting material.

It will be noted from Figs. 4, 5 and 6, that there is a pyramidal outline at the point of attachment between the platinum wire and the base which provides a very strong support and relief of the core for use as an electrical contact. Thus, even though the core 3 is quite small, it may reach or be reached by the opposing contact (not shown). At the same time, the base 7, 17 or 27, as the case may be, may be made as heavy as desired for strong and reliable organization with the remainder of the switch gear.

In Figs. 7 to 12 is shown another form of the invention in which so-called "fancy" composite wire is formed and used instead of the composite bonded Wollaston type wire. Referring to Fig. 7, this is produced with any desired thinness of platinum or similar component layer as follows:

A composite plate 31 is welded up from valuable strips 33, for example of platinum. The left side of each strip 33 is a strip of non-valuable metal 35, such as for example, a non-ferrous metal. On the other side of each strip 33 is a strip of other non-valuable metal (mild steel 37 for example). All strips are welded. Then this assembly is rolled out into a thin sheet which of course elongates. This sheet is cut longitudinally as shown at S. The cutting needs not to be particularly accurate and may be done by any suitable machining operation such as shearing, sawing, milling, shaping or otherwise. This provides a strip such as shown in Fig. 10 wherein a thin strip of platinum 33 is sandwiched in between two thin strips of non-ferrous material 35 and steel 37. Finally, said assembly of Fig. 10 is pickled to remove the steel strip 37, as illustrated in solid lines in Fig. 11, thus leaving the base 35 with the valuable metal edge 33. The "fancy" wire thus obtained may be drawn or rolled to round off one edge. The strip 33, 35 is then cut into pieces for attachment to a base 39 if desired, as shown in Fig. 12. In Fig. 12, the strip 35 is welded as shown at 38 to the base 39.

Fig. 11 illustrates a segment of the "fancy" wire which takes the place of the composite Wollaston type wire shown in Figs. 1 to 6. It is different however, in that it has a relatively large mass of base material 35 admitting of direct welding without the necessity after attachment has been made for subsequent removal of material from over the precious material.

The slitting operation of Fig. 8 may be omitted by directly pickling the assembly shown in Fig. 9,

in which event the strips 37 are etched away from between the strips 33 and 35. In this case the etchable strip is made narrower in order to save weight and material in the original assembly. This is illustrated in Fig. 9 at 37. The other numerals 33 and 35 in Fig. 9 designate parts corresponding to those already mentioned in connection with Figs. 7 and 8. Or it is possible simply to make up an assembly of parts 33, 35 and 37 without further assembling these to make up a larger plate. That is to say, a sub-assembly such as shown at 33, 35 and 37 at the left of Fig. 7 may be dealt with separately, in which case the separating operation will not be required.

Instead of using the wire shown in Fig. 11 as shown in Fig. 12, it may be cut up into shorter segments as indicated by the dotted lines in Fig. 11 to produce stem-like contacts. That is to say the contacts are chopped off from the pieces of "fancy" wire. They may then be spot-welded into position or staked into position in whatever structures they are desired. They may also be used as square rivets or swaged round and are attached by a heading or riveting operation.

In Figs. 13–18 are shown other modifications. In Fig. 13 one end of a segment of a relatively heavy composite Wollaston type wire (bonded or not bonded) is butted against and spot welded to the support 41. Such a segment is more easily handled and welded, because of its size, than would be a similar segment consisting only of the platinum core 43. The effect of etching the assembly, according to the principles above set forth, is shown in Fig. 16, in which the platinum core 43 remains while most of the surrounding metal sheath 45 has been removed, with the exception of a portion of the sheath 45 forming a collar which supports the core 43.

In Fig. 14 a longer segment of the wire having a valuable metal core 47 and non-valuable sheath 49 is pressed or staked into an opening 51 in a support 53 and after etching appears as shown in Fig. 17. The portion of the sheath 49 remaining after etching forms a collar fixed in opening 51 for mounting the wire 47 therein.

In Fig. 15 a composite wire with a valuable core 55 and non-valuable sheath 57 has been inserted into an opening 59 and upset or swaged at both ends as indicated at 61. Then by etching the construction of Fig. 18 results, wherein the valuable-metal core extends as indicated at 63.

Cross-reference under Rule 43 is made to applicant's copending divisional applications Serial Nos. 669,284 and 669,285, filed May 13, 1946.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. An electrical contact comprising a length of a fine wire of valuable electrically conductive metal, said wire, in order to conserve said valuable metal, being of such small cross section that it would be difficult to handle unless encased in a sheath, an electrically conductive base carrying said wire, said wire being mounted on said base in electrically conductive relation with respect thereto by means of an intermediate wire-supporting member of a non-valuable electrically conductive metal with at least a portion of said wire spaced outward from said base for engagement with another contact, characterized in that said electrical contact is formed by attaching the length of wire to the base while encased in a sheath of non-valuable electrically conductive metal so that it may readily be handled, and etching away a part of the sheath to expose said portion of the wire spaced outward from the base, said base being formed of a metal which is resistant to etching by at least one etching agent which will etch the non-valuable metal of said sheath so that the base is not substantially etched away during the etching of said sheath, the portion of said sheath remaining after the etching thereof constituting said intermediate wire-supporting member.

2. An electrical contact comprising a length of a fine wire of valuable electrically conductive metal, said wire, in order to conserve said valuable metal, being of such small cross section that it would be difficult to handle unless encased in a sheath, an electrically conductive base carrying said wire, said wire being mounted on said base in electrically conductive relation with respect thereto by means of a collar of non-valuable electrically conductive metal surrounding a portion of said wire and attached in electrically conductive relation to said base, the remainder of said wire projecting out of said collar and being spaced outward from said base for engagement with another contact, characterized in that said electrical contact is formed by attaching the length of wire to the base while substantially wholly encased in a sheath of non-valuable electrically conductive metal so that it may readily be handled, and etching away a part of the sheath to expose said remainder of the wire, said base being formed of a metal which is resistant to at least one etching agent which will etch the non-valuable metal of said sheath, the portion of said sheath remaining after the etching thereof constituting said collar.

3. An electrical contact comprising a length of a fine wire of valuable electrically conductive metal, said wire, in order to conserve said valuable metal, being of such small cross section that it would be difficult to handle unless encased in a sheath, an electrically conductive base carrying said wire, said wire being mounted on said base in electrically conductive relation with respect thereto by means of a collar of a non-valuable electrically conductive metal surrounding a portion of said wire and fixed within an opening in said base in electrically conductive relation thereto, the remainder of said wire projecting from said collar outward from said base to provide a contact surface spaced outward from said base for engagement with another contact, characterized in that said electrical contact is formed by fixing the length wire in the opening in the base while encased in a sheath of non-valuable electrically conductive metal so that it may readily be handled, the wire and sheath projecting from the base, and etching away the part of the sheath projecting from the base to expose said remainder of the wire, said base being formed of a metal which is resistant to etching by at least one etching agent which will etch the non-valuable metal of said sheath, the portion of the sheath remaining after the etching thereof constituting said collar.

4. An electrical contact comprising a length of a fine wire of valuable electrically conductive

metal, said wire, in order to conserve said valuable metal, being of such small cross section that it would be difficult to handle unless encased in a sheath, an electrically conductive base carrying said wire, said wire being mounted on said base in electrically conductive relation with respect thereto by means of a collar of a non-valuable electrically conductive metal surrounding a portion of said wire, said collar and wire being butt-welded to said base, the exposed portion of said wire projecting outward from said base to provide a contact surface spaced outward from said base for engagement with another contact, characterized in that said electrical contact is formed by butt-welding the length of wire and a sheath therefor of a non-valuable electrically conductive metal to the base, the sheath enabling the wire readily to be handled, and etching away a part of the sheath to expose said exposed portion of the wire, said base being formed of a metal which is resistant to etching by at least one etching agent which will etch the non-valuable metal of said sheath, the portion of the sheath remaining after the etching thereof constituting said collar.

GEORGE DURST.

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