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V. H. SANDERS

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SWITCH CONTACT

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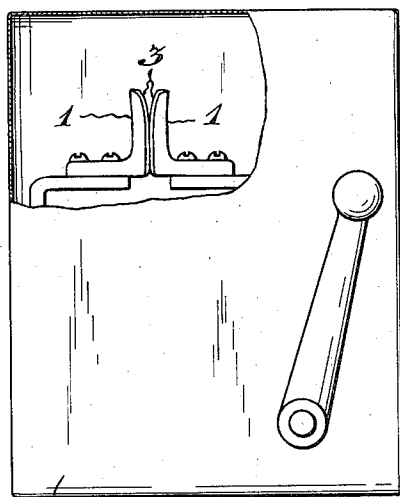


Fig. 2.

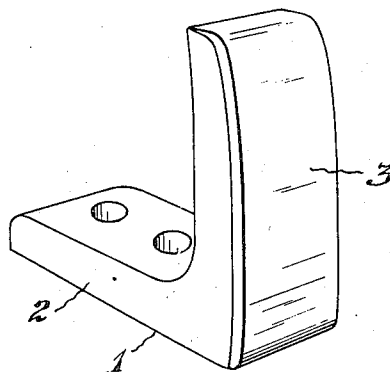


Fig. 1.

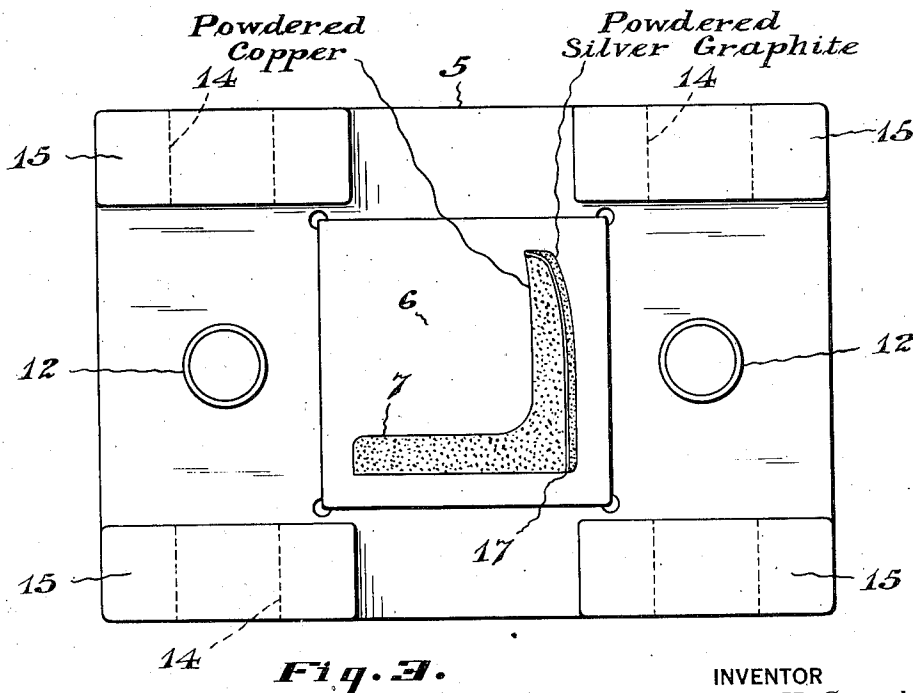


Fig. 3.

INVENTOR
Vernon H. Sanders
BY *Evans & McCoy*
ATTORNEY

UNITED STATES PATENT OFFICE

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SWITCH CONTACT

Vernon H. Sanders, St. Marys, Pa., assignor to
Stackpole Carbon Company, St. Marys, Pa., a
corporation of Pennsylvania

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9 Claims. (Cl. 200—166)

This invention relates to improvements in contact elements for electrical switches and the like and particularly to contact elements molded from powdered material.

5 Contact elements of silver and graphite, or mixtures of silver, silver and nickel, silver and tungsten, silver and copper or copper and nickel with carbon preferably in the form of graphite, have heretofore been proposed for uses where
10 the expense of such elements is of secondary importance. Contact elements of these materials are generally known and hereinafter referred to as "silver-graphite" materials. Contact elements formed in their entirety of these materials
15 are too expensive for general industrial uses.

Copper contact elements are used for general industrial purposes, although the operating characteristics of the copper contact elements in the majority of such uses are much inferior to
20 the operation of the silver graphite contact elements. For instance, it is common knowledge that a coating of copper oxide frequently forms between the contact faces of a pair of switch jaws and causes objectionable contact losses in the switch. This interferes with the proper
25 functioning of the switch, and also results in overheating and possible welding together of the switch jaws and otherwise in unsatisfactory operation.

30 The present invention contemplates a contact element having a body portion of copper or like relatively inexpensive and rugged material, and a contact surface of silver graphite or like material that is intimately joined to the contact
35 body during the operation of forming the contact element from powdered materials. This provides a contact element having all of the advantages of silver graphite together with the ruggedness and inexpensive characteristics of a
40 copper contact element. A contact element of this character is adapted to many industrial uses to which contact elements of previously proposed constructions were unsuited.

45 One object of the present invention is to provide a composite metallic contact element molded from powdered ingredients.

Another object is to provide an inexpensive contact element, particularly for switch contacts, having a relatively thin contact face composed of one of the above mentioned non-welding materials and made integral with the material forming the body of the contact element.

55 Another object is to provide a contact element molded from powdered material which is faced with silver, silver graphite, silver nickel graphite

or copper graphite formed integrally with the metal that constitutes the main body of the contact element.

A preferred embodiment of the invention is shown in the accompanying drawing forming a part of this specification, wherein

Figure 1 is a perspective view of a contact element embodying the invention;

Fig. 2 is a front elevation of a switch assembly with a portion of the casing broken away to show the contact elements;

Fig. 3 is a plan view of the lower section of a mold employed in forming the contact element;

The contact element 1 of the present invention, illustrated in Figs. 1 and 2 of the accompanying drawing, comprises a body portion 2 and an integral face portion 3 of silver graphite.

The body portion 2 of the contact element is formed of copper or such other metal or metal compound as will meet the particular use for which the contact element is intended. Since the contact element is shaped from molded powdered materials, in a manner later to be described, it can be of such form and dimension as to best meet the particular requirements for which it is intended.

The copper body portion of the contact element is of sufficiently rugged character and of proper material to adequately support the relatively thin layer of facing material 3 so that it will not be broken up or loosened from the body portion because of mechanical strains or the transmission of electrical currents there-through. The body portion also is a good conductor of electricity and is in such intimate contact with the facing material as to provide very good electrical and mechanical connection between the two materials, even when the facing material is relatively thin.

The silver graphite facing material 3 extends over the entire contact face and well over onto the tip portion of the contact element, so that electrical arcs formed between two such contact elements will break from the protected faces of the elements rather than from exposed portions of the copper body of the elements.

The facing material is formed of a metal-graphite or metal-carbon compound, comprising a preponderant proportion of silver, nickel, tungsten, or mixtures of these metals as the metallic ingredient that is used in association with graphite or carbon. A preferred composition for the contact face comprises ninety percent of

powdered silver and ten percent of powdered graphite.

Because of the high current-carrying capacity of contact elements made in accordance with this invention, such contact elements may be used for electrical machinery requiring the transmission of heavy currents.

In addition, contact elements embodying the invention may be applied to delicate apparatus in which high conductivity between engaging silver graphite surfaces is desired. In such applications the contact pressure that is used may be relatively small as compared with the required pressure for copper contact elements. Such contact elements are also suitable for use where they are subjected to hot electrical arcs experienced in the transmission of relatively high currents.

Contact elements of the type herein proposed may also be made up in slab form and later separated into individual contact elements.

The body and facing material of the contact element are simultaneously formed from powdered materials in a suitable mold next to be described, so that the facing material is integrally joined to the body portion throughout its entire area and somewhat intermixed therewith at the juncture of the materials. This produces an inexpensive contact element of improved conductivity and superior operating characteristics.

The use of contact elements embodying the invention is illustrated in a conventional switch structure shown in Fig. 2 of the drawing wherein the housing 4 of the switch mechanism is broken away to more clearly show the contact elements.

A suitable mold for forming contact elements of the above character is shown in Fig. 3 of the drawing. The mold there shown comprises a bottom section 5 that preferably has a removable mold block 6 mounted therein. The mold block 6 has a suitable molding cavity 7 formed therein. The mold cavity 7 has a removable partition member 17 positioned therein, so that it is substantially parallel with the side wall of the mold cavity that serves to form the contact face of the contact element 1 that is shown therein. This partition member 17 is preferably formed of thin sheet metal and is spaced a sufficient distance from the side wall of the mold cavity to provide the desired thickness of contact facing material.

The bottom section 5 has upstanding pins 12 on which a top mold section may be centered and guide posts 15, provided with holes 14 to receive wedges for locking the mold sections.

In the molding operation, material to form the body of the contact element, such as powdered copper, is introduced into the larger compartment of the mold cavity on one side of a partition 17, as shown in Fig. 3. Silver-graphite also in powdered form and preferably of substantially the same fineness, is introduced into the mold cavity upon the opposite side of the partition 17. The partition 17 is then withdrawn, permitting the powdered material on opposite sides thereof to settle and occupy the space left by the partition, whereby the two powdered materials are brought into intimate contact and are somewhat intermixed along their juncture by removal of the partition 17. The top mold section is then placed in position and the mold subjected to relatively high pressure in a hydraulic or other form of press. A pressure of seven tons per

square inch has been found satisfactory. The mold sections are then locked together. If a heated mold is not used, the mold is removed from the press and placed in an oven which is held at a suitable baking temperature that is determined by the particular powdered materials used. The mold is subjected to this temperature for a few minutes. For the material here suggested 300° F. has been found satisfactory. The material within the mold is then again subjected to compacting pressure, such as ten tons per square inch, the mold wedges are driven more firmly into place and the mold assembly is heated to a materially higher temperature, such as 900° F., for a period of about one-half hour, depending upon the materials used. After the second baking of the contact body under pressure at this elevated temperature, the mold is removed from the oven and, if desired, the mold assembly may again be subjected to hydraulic pressure to further consolidate the material of the contact element. The contact element or slab of contact elements is then removed from the mold in substantially completed form.

In the above-described process of manufacture, the preliminary and final baking operations may be carried on in the same mold or, if desired, two mold units may be used so that the powdered material is compacted in the first mold unit by the application of about seven tons per square inch pressure and heated for about three minutes in this mold at 300° F. The element may then be transferred to a second mold, where it is baked for about thirty minutes at 900° F., or until the element is properly baked. The element is then further compacted by a pressure of about ten tons per square inch in the mold in which it was last baked. The above procedure produces a particularly rugged contact element.

If a slab of material from which contact elements are to be cut is to be made, then powdered copper is spread evenly over the bottom of the mold cavity, a thin layer of silver graphite is spread evenly over the layer of copper, and the materials are compressed and baked by either of the above methods. Such a contact slab may be cut into a plurality of transverse sections for making a plurality of contact elements from the one slab.

It will thus be seen that I have provided a contact element having all the advantages of a silver-graphite element, but which can be manufactured at much less cost.

It will also be noted that the composite contact element is composed of parts integrally united with each other and not subject to separation in service.

It will also be apparent to those skilled in the art that this composite body is capable of many modifications and adaptations in both form and composition to meet different needs. It is to be understood that the particular apparatus shown and described, and the particular procedure set forth are presented for purposes of explanation and illustration of the invention and that various modifications of said apparatus and procedure can be made without departing from the invention as defined in the appended claims.

What I claim is:

1. An integrally molded contact element having a metallic body and a contact face of different material composed of a mixture of metal and carbon in which the carbon is in the form of

finely divided particles uniformly interspersed in the metal.

comprising a thin layer of metal or metals mixed with graphite.

2. A contact element having a metallic body portion, and a contact face consisting of a thin layer of material integrally united to the body and composed principally of silver.

7. A molded composite contact element composed of a metal body and a thin layer of a different composition forming a contact face integrally united to the body.

3. A contact element having a metallic body portion, and a contact face composed of silver having finely divided particles of carbon uniformly interspersed therein.

8. A composite integrally molded contact element comprising a body portion formed of powdered metal, and a contact face portion formed of powdered silver and graphite, the materials of the body portion and of the face portion being intermixed along the juncture of the materials.

4. A contact element having a metallic body portion and a contact face of different composition formed of graphite and metallic powder.

9. A circuit interrupter contact comprising a composite contact member made of a layer of finely divided particles of copper and a layer of finely divided particles of an anti-flux and silver compressed into a solid composite mass.

5. An integrally molded contact element comprising a copper body portion and a contact face of silver graphite so disposed as to cover all arcing and contacting faces of the element.

6. An integrally molded contact member having a body portion of copper and a contact face

VERNON H. SANDERS.