April 27, 1965 J. F. WALDORF 3,180,961

ELECTRICAL CONTACT WITH MATING SURFACE AREA HAVING AN INTEGRAL FRUSTO-CONICAL NIB THEREON

Filed June 13, 1962

Fig. 1

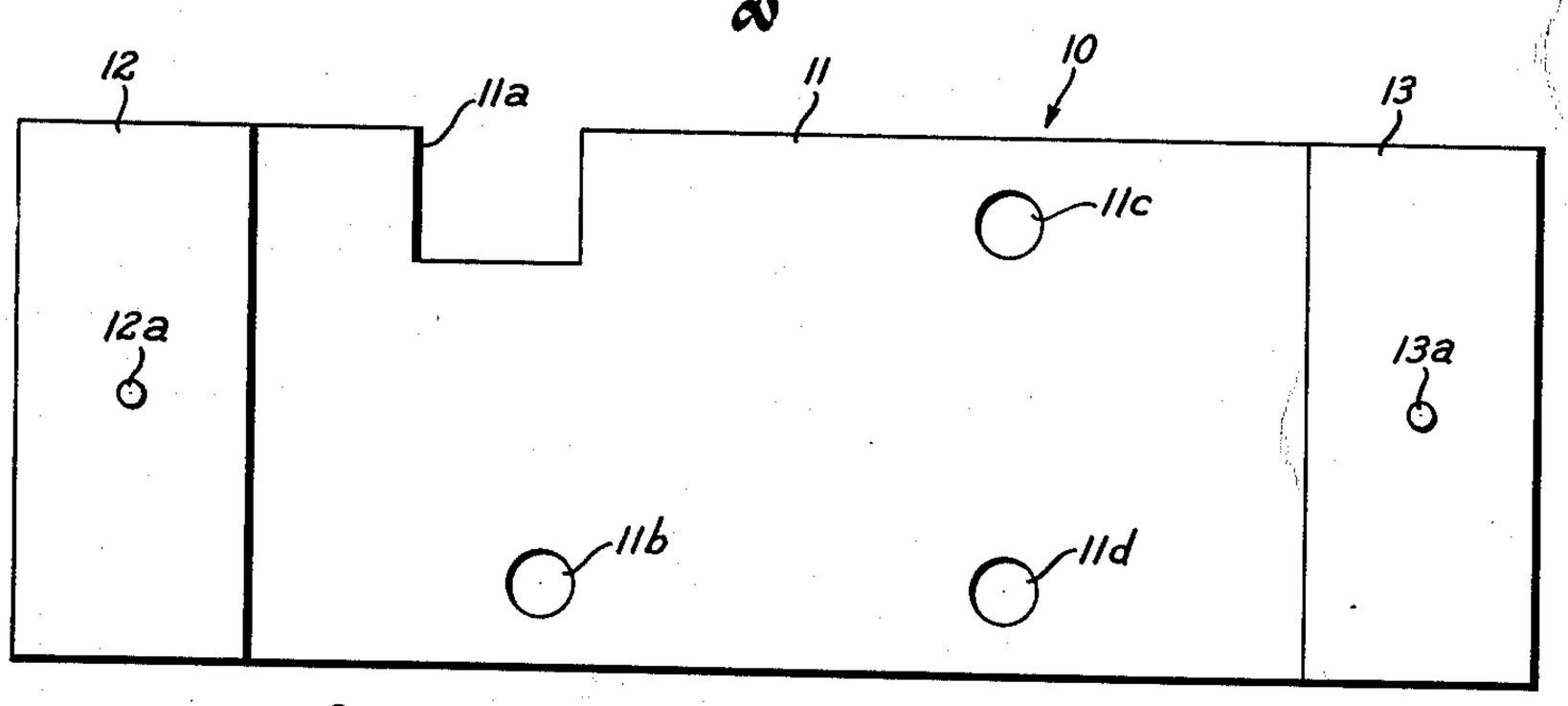


Fig. 2

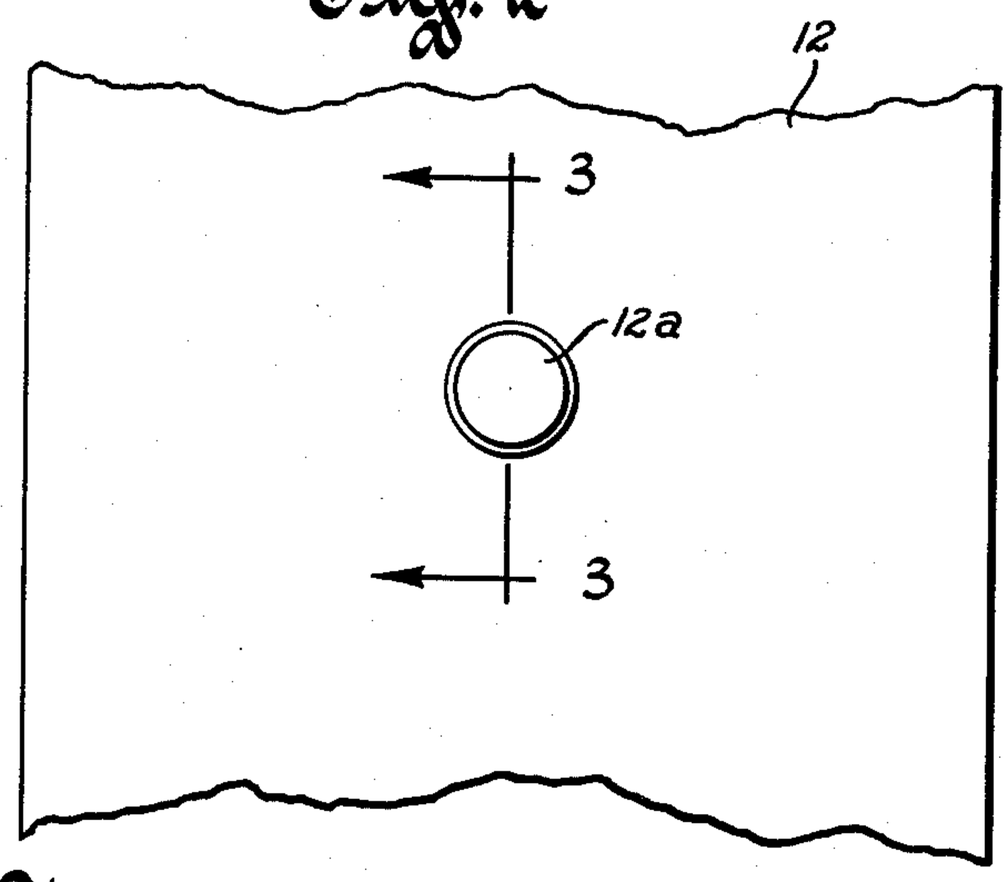


Fig. 3

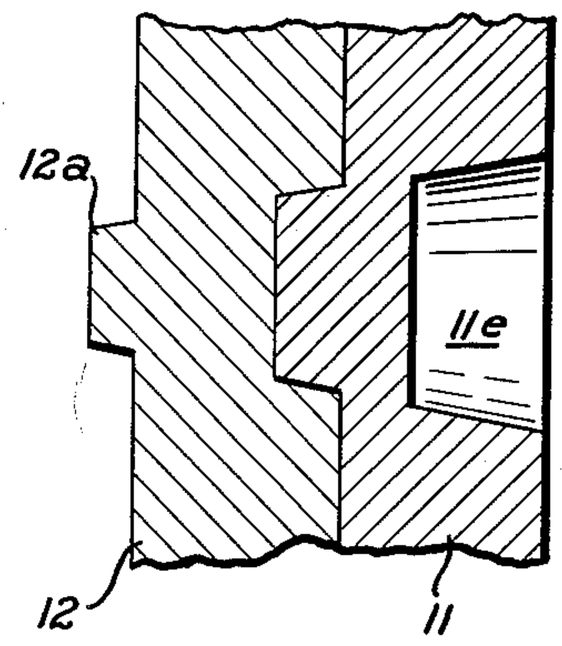


Fig. 4

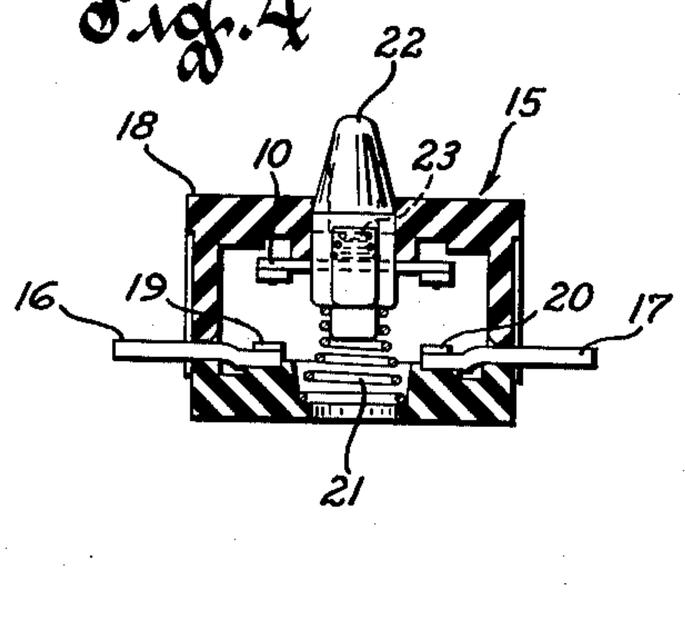
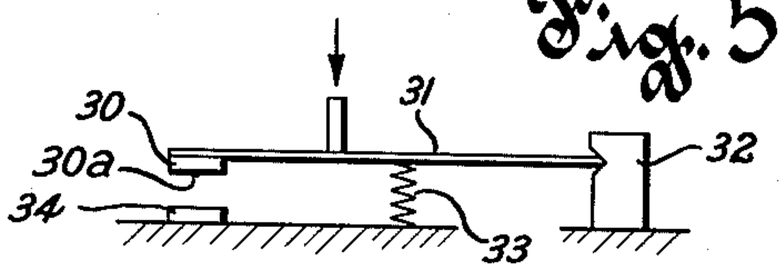


Fig. 5



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ELECTRICAL CONTACT WITH MATING SURFACE AREA HAVING AN INTEGRAL FRUSTO-CONICAL NIB THEREON

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2 Claims. (Cl. 200—166)

This invention relates to electrical contacts, and more particularly to electrical contacts affording penetration of resistance tarnish and films on mating contacts.

Electrical contacts that move into and out of engagement with sliding or wiping action afford removal of films that tend to build up thereon due to chemical action or deleterious atmospheres. However, many switches employ movable contacts which engage and disengage with mating contacts by movement in a direction normal to the surface of the latter. With such type of contact action virtually no wiping action occurs. In relatively high power applications electrical arcing occurring on contact separation serves to irradicate such films and thereby insure circuit completion on subsequent contact engagement. However, in low power applications such arcing is often not present, and resistance films build up with virtually no abatement and completion of circuit is prevented at a very early stage in service life of "butt" contacts.

It is the object of the present invention to provide an improved electrical contact for use as movable contacts which are able to penetrate films that may be built up on its mating contact and thereby insure circuit completion.

Another object is to provide a contact of the aforementioned type which is suitable for use in both low power and relatively high power applications, and

A still further object is to provide a contact of the aforementioned kind which under relatively high power application is converted by electrical arcing occurring on contact separation to a form affording greater area of contact mating.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate preferred embodiments of the invention which will now be described in detail, it being understood that the embodiments illustrated are susceptible of modifications in respect of details without departing from the scope of the appended claims.

In the drawings:

FIGURE 1 is a plan view at ten times full scale of a movable contactor which has contacts constructed in accordance with the invention;

FIG. 2 is a fragmentary view at forty times full scale showing a portion of an electrical contact shown in FIG. 1;

FIG. 3 is a fragmentary sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is a sectional view of a switch which incorporates an electrical contactor shown in FIGS. 1 to 3; and

FIG. 5 is a schematic showing of an electrical contact made in accordance with the invention as used in another form of switch.

Referring to FIGS. 1 to 3, numeral 10 designates an electrical switch contactor having a bridge member 11 and contacts 12 and 13 secured at opposite ends of member 11. Member 11 is formed of a good electrical conducting material such as copper and has a notch 11*a* and projections 11*b*, 11*c* and 11*d*. As will be understood, the notch 11*a* in cooperation with suitable shoulders or ribs

in the switch housing serve to restrain the contactor in position, and the projections 11*b*, 11*c* and 11*d* provide for lateral retention of a spring which biases the contactor in such switch.

The contacts 12 and 13 are preferably formed of a good electrical conducting, arc resistant material such as fine silver. They are welded or brazed to member 11 in partially preformed state. Then member 11 and contacts 12 and 13 are placed in a suitable forming die wherein a punch is downwardly applied on the reverse side of member 11 to penetrate the member 11, as at the recess 11*e* and through following deformation of metal in member 11 and contacts 12 and 13 effect strike up of a nib, such as the nib 12*a* shown in FIGS. 2 and 3, to stand above the faces of the contacts 12 and 13.

The contact nibs 12*a* and 13*a* are preferably of a frusto conical form in longitudinal cross section as best shown in FIG. 3. The cross sectional area of the outer ends of these nibs is extremely small in relation to the total working surface area of the contacts, being in the ratio of approximately 1 to 100. The nibs extend on the order of 10 to 15 thousandths of an inch beyond the surface of the contacts. It will be apparent that such nibs can be formed directly as a part of the molding or coining of the contacts themselves prior to attachment to a bridge or carrying member.

FIG. 4 illustrates the application of contactor 10 in a switch 15 of the momentary type which is more fully disclosed and described in the Nolden et al. Patent No. 2,930,859. Switch 15 has stationary contact terminals 16 and 17 which extend through side walls of the housing 18, and contacts 19 and 20 are suitably secured to terminals 16 and 17 respectively interiorly of housing 18. Contacts 19 and 20 are like contacts 12 and 13, but do not have the aforementioned nibs formed on their mating surfaces.

Contactor 10 is biased out of engagement from contacts 19 and 20 by a compression spring 21. An actuator 22 partially extending through the top of housing 18 when depressed inwardly moves contactor downwardly so that contacts 12 and 13 engage with contacts 19 and 20. A second compression spring 23 interposed between actuator 22 and the upper surface of member 11 affords over-travel protection.

It will be appreciated that when contactor 10 is moved downwardly the nibs 12*a* and 13*a* will contact at their outer ends against the working surfaces of contacts 19 and 20. The extremely small ends of these nibs effectively penetrate any high resistance films or tarnish formed on the surfaces of contacts 19 and 20, thus insuring that electrical circuit is completed from terminal 16 through contacts 19 and 12, bridge 11, contacts 13 and 20 to terminal 17. This is true even with relatively light contact engagement pressures on the order of two ounces per contact face.

Switches of the type schematically depicted in FIG. 5 are used in a variety of applications, some being of low power or "dry circuit" type wherein the voltages and load currents involved are of such low magnitude that no arcs are drawn on contact separation, and other applications being of relatively higher power type wherein some arcing occurs on contact separation. Switches having the preferred form of contactors 10 with the nibbed contacts 12 and 13 are well suited to both types of application. In so-called "dry circuit" application tarnish and films tend to build up increasingly on the stationary contacts, due to the lack of cleansing action afforded by electrical arcing. Thus the nibs on the contacts of the movable contactor penetrate through such films to insure circuit completion.

Where such switches are used in higher power appli-

cations the presence of the nibs on the contacts of the movable contactors insures that on initial closure that circuit will be completed. Due to long storage or subjection to deleterious atmospheres before use the high resistance films often build up to such extent that difficulty has occurred in the establishment of circuit on initial engagement of "butt" contacts. The nibbed contacts of the present invention overcome this difficulty. In higher power applications the nibs subsequently disappear due to arcs being drawn on contact separation, and the area of contact mating subsequently will cover a wider area.

FIG. 5 illustrates the use of a movable contact **30** having the small nib **30***a* mounted on one end of a flat metal spring member **31** which is pivoted at its other end on a stationary abutment **32**. Member **31** is movable against the bias of a spring **33** to move the nib **30***a* into engagement with a stationary contact **34**. In this application while the contact **30** moves into and out of engagement with contact **34** along an arcuate path, its engagement would be essentially of the "butt" type with little or no wiping action being present. Many forms of small precision limit switches have this type of contactor movement, and the nibbed contacts of the present invention are very suitable for such service.

I claim:

1. An electrical contact comprising a member formed of a good electrical conducting, arc resistant metal which has a relatively flat contact mating surface area and an integral frusto-conical nib having an end area on the

order of one one-hundreth of the total area of the contact mating surface and extending not more than fifteen thousandths of an inch beyond such surface, said nib upon movement of the contact toward another contact penetrating resistance films built up on the latter to insure circuit completion between said contacts.

2. An electrical contactor comprising a substantially rectangular member formed of a good electrical conducting metal, contacts formed of a good electrical arc resistant material secured to one face of said member at opposite ends of the latter, said member being deformed by punching recesses part way through its opposite face at two points which substantially aline with the center of the contacts and which deforms the metal of the contacts to provide small frusto-conical nibs which stand up not more than fifteen thousandths of an inch from the mating surfaces of the contacts centrally thereof.

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