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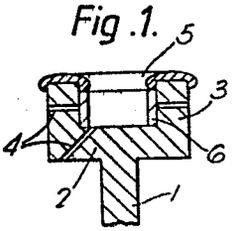
(54) **High current switch contacts.**

(57) A contact for an electrical switch, more especially a vacuum switch, comprises a generally circular conducting member having slots extending from its periphery towards its centre, and a ring of high temperature resistant material covering at least part of the exposed edges of the slots.

Fig .1.



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High Current Switch Contacts

This invention relates to contacts for electrical switch devices for use in circuits designed to carry high currents and especially to contacts for vacuum interrupters and other forms of vacuum switches.

Such contacts tend to be either disc-shaped or alternatively cup-shaped having a bottom wall and an upstanding annular wall and in each case they have oblique or spiral slots cut into them extending from the periphery towards the centre of the contact. Consequently, as the contacts are separated, the arc which is formed is magnetically deflected and caused to rotate around the periphery of the contact, so that the arc does not settle on one portion of the contact for any appreciable length of time since this causes the contact material to be vapourised by the intense heat.

Even so, some material is always vapourised and tends to get thrown off the contact and be deposited on insulating shields surrounding the switch thus impairing their performance.

Furthermore, the edges of the slots at the periphery of the contact are fairly sharp and cause local focussing points for the high voltage fields in the switch and thus impair the voltage characteristics of the switch.

A further problem that occurs with cup-shaped contacts is that the width of the oblique slots in the annular wall of the contact tends to decrease as the contact is continually compressed due to the switching load in use. A solution to this problem is suggested in U.S. Patent No. 4 390 762 where the annular wall of the contact has a groove provided in its top face and a ring of high mechanical strength is inserted into this groove to strengthen the wall. However this is clearly a step which involves considerable work and time and is therefore quite costly.

Accordingly, the invention provides a contact for electrical switch devices comprising a generally circular conducting member having slots extending from its periphery towards its centre, and a ring of high temperature resistant material covering at least part of the exposed edges of the slots.

The member may be either disc-shaped, in which case the ring is positioned around its edge or cup-shaped, in which case the ring may be positioned either around the outside or the inside of the annular wall.

If the contact is cup-shaped, a low weld-strength annular contact member is preferably provided on the top of the annular wall of the conducting member.

This contact member is preferably made of a copper/chromium material such as CLR.

The ring of high temperature resistant material preferably has a high electrical resistance and preferably also has a high mechanical strength relative to the material forming the conducting member which is conveniently copper. Accordingly, the ring may be made of the same material as the contact member and may be made in one piece with the contact member.

In some cases a ring may be provided on both the inside and outside of the annular wall and if a ring is provided on the inside, it may have a base so as to cover the bottom wall of the cup-shaped member so as to protect it from being damaged by the arc.

The invention will now be more fully described by way of example with reference to the drawings of which :-

Figures 1 to 6 show cross-sectional views of six different embodiments of a cup-shaped vacuum contact according to the invention;

Figure 7 shows a cross-sectional view of a disc-shaped contact according to the invention; and

Figure 8 shows a similar view of an alternative form of disc-shaped contact.

Turning first to Figures 1 to 6, the corresponding parts all have the same reference numeral. Thus, the cup-shaped contact has a stem 1 on which is provided a contact body, made of copper, formed in the shape of a cup having a bottom wall 2 and an upstanding annular wall 3. The contact body has slots 4 extending from the top of the annular wall 3 obliquely downwards through the annular wall 3 and also through the bottom wall 2, the slots 4 being in a chordal direction but not forming a complete chord at the top surface of the bottom wall 2. Further information regarding the disposition of the slots may be found in our co-pending Patent Application No. 2 144 916A, however it will be appreciated that any configuration of slots having the desired effect of rotating the arc may be used.

A ring 5 of material of low weld-strength is provided on the top of the annular wall 3 and this forms the actual contacting part of the contact. The ring 5 should be made of a low weld-strength material so that if it is heated up to its melting point by the arc, the contacts will not strongly weld

together. A commonly used material is a copper/chromium material such as CLR.

In accordance with the invention, contacts of the sort described above are further provided with a ring of a material having a considerably higher electrical resistance and a higher mechanical strength than that of the contact body material. Such materials could be steel, various ceramics or even plastics provided they are resistant to the high temperatures encountered. Such materials must also, of course, be compatible with being used in a vacuum.

Thus, in Figure 1, there is provided a ring 6, made of any of the materials mentioned above, on the inside of the annular wall 3. Such a ring prevents material vapourised from the bottom wall 2 of the contact body from being thrown into and through the slots 4 in the annular wall 3, and also electrically shields the sharp inner edges of the slots 4 and thus improves the voltage characteristic of the contact. The ring has the further advantage that it provides the annular wall 3 with a mechanical support.

In Figure 4, a similar ring 7 is provided on the outside of the annular wall 3 and it also prevents material being thrown through the slots 4 although it can still be thrown into the slots. However, since this material is very fragmentary, it has a high electrical resistance and thus does not impair the effect of the slots 4 to any great extent. Such an outer ring, does however electrically shield the sharp outer edges of the slots 4 and thus improves the voltage characteristics of the contact.

Figure 3 shows a contact having both inner and outer rings 6 and 7, thus combining the advantages of both rings.

In Figure 2, an inner ring 8 is provided, similar to ring 6 of Figures 1 and 3, but having a base 9 closing off the ring so as to form a cup-shaped

shield for the inside of the body portion of the contact. The base 9 thus protects the bottom wall 2 from damage should the arc move into the centre portion of the contact.

The base 9 is shown as being made in one piece with the ring 8 but it may of course be separate from the ring if desired.

In some cases, it may be desirable to form a ring 10 in one piece with a base as described above and integral with an annular contact ring as shown in Figure 5. Indeed, a ring 11 may be made, as shown in Figure 6 which combines with inner and outer rings similar to rings 6 and 7 of Figures 1 and 3, a base 9 similar to that shown in Figure 2 and a contact ring 5 similar to those shown in Figures 1 to 4, all in one piece. Such a ring 11 may well be made of CLR and would thus cover all the exposed surfaces of the annular wall 3 and the bottom wall 2 of the contact body.

The contact shown in Figure 7 is a disc-type contact comprising a disc-shaped contact body 12 mounted on a stem 13, the body 12 having spiral slots 14 extending inwards from the outer edge of the body. The invention provides a ring 15 fitted on the outer edge of the disc and extending below the lower surface of the disc-shaped body 12 so as to prevent material being thrown through the slots 14 onto the insulating shields surrounding the contact.

The contact shown in Figure 8 is a further form of disc-type contact, and comprises a disc 16 with a central projection 17 which provides a butt contact, and carried by a member 18 having swastika-shaped arms 19 mounted on a stem 20, connection between the member 18 and the disc 16 being by the supporting pedestals 21 at the ends of the arms. The inter-connection results in the development of an axial magnetic field, this opposing the natural construction

of an arc which allows interruption of higher currents than would otherwise be possible with plain butt contacts. The disc 16 is provided with a ring 22 around its periphery, which ring extends rearwards so as to surround the member 18, as shown, and operates to prevent material being thrown through the slots formed between the arms 19.

CLAIMS

1. A contact for electrical switch devices comprising a generally circular conducting member having slots extending from its periphery towards its centre, and a ring of high temperature resistant material covering at least part of the exposed edges of the slots.

2. A contact for electrical switch devices according to Claim 1 wherein the conducting member is disc-shaped with the said ring positioned around the edge.

3. A contact for electrical switch devices according to Claim 1 wherein the conducting member is cup-shaped, having a bottom wall and a surrounding annular side wall, with the said ring positioned either around the outside and/or the inside of the annular wall.

4. A contact for electrical switch devices according to Claim 3 wherein a low weld-strength annular contact member is provided on top of the annular wall of the conducting member.

5. A contact for electrical switch devices according to Claim 4 wherein the said contact member is a copper/chromium material.

6. A contact for electrical switch devices according to any preceding claim wherein the said high temperature resistant material has a high electrical resistance relative to the material forming the conducting member.

7. A contact for electrical switch devices according to any preceding claim wherein the said high temperature resistant material has a high mechanical strength relative to the material forming the conducting member.

8. A contact for electrical switch devices according to Claim 7 wherein the conducting member is copper.

9. A contact for electrical switch devices according to Claims 4 or 5 wherein the said ring is made of the same material as the contact member.

10. A contact for electrical switch devices according to Claim 9 wherein the said ring is made in one piece with the contact member.

11. A contact for electrical switch devices according to Claim 3 wherein the ring is provided on the inside of the annular wall and the said ring has a base so as to cover the bottom wall of the cup-shaped member so as to protect it from being damaged by the arc.

12. A contact for electrical switch devices substantially as herein described with reference to any one of Figures 1 to 8 of the accompanying drawing.

13. An electrical switch device incorporating a contact as claimed in any preceding claim.

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Fig.1.

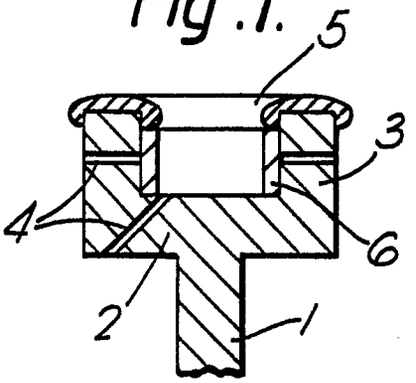

Fig.2.

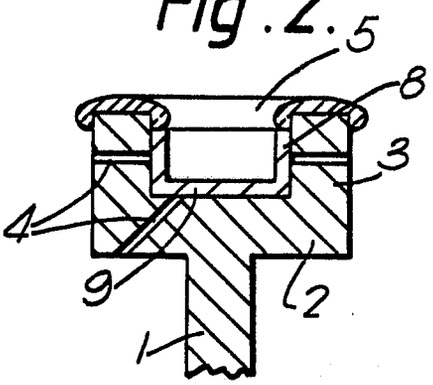

Fig.3.

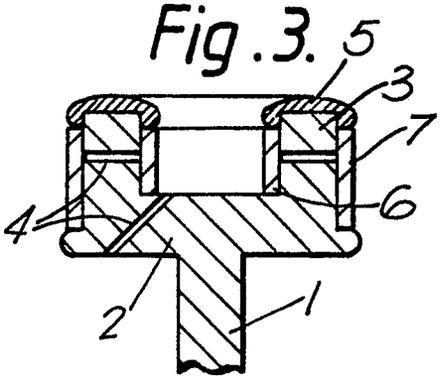

Fig.4.

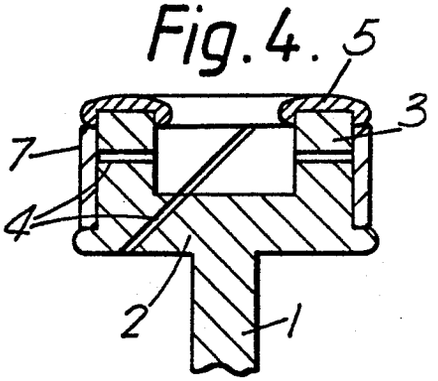

Fig.5.

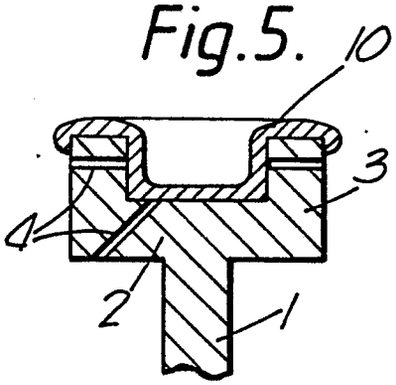

Fig.6.

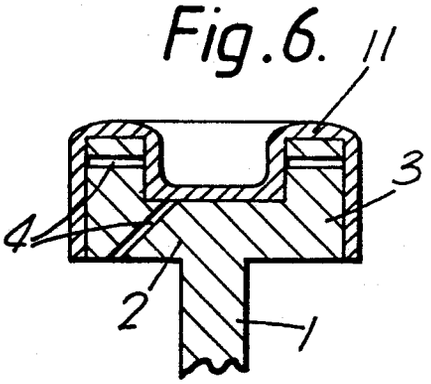

Fig.7.

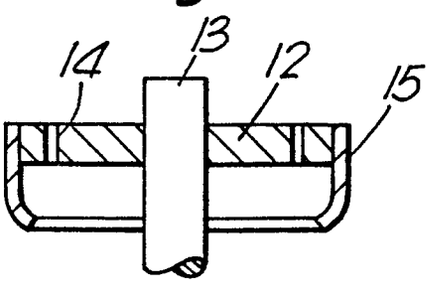

Fig.8.