United States Patent

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[31] 6525/68

[54] **CONTACT MEANS FOR ELECTRIC CIRCUIT BREAKERS**
8 Claims, 3 Drawing Figs.

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[51] Int. Cl. H01h 1/44, H01h 1/50
[50] Field of Search 200/166B1, 166B3, 166B5, 166B6, 166B8, 166C, 166D, 166E, 166H, 146, 150.5, 110

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ABSTRACT: A contact arrangement for circuit breakers includes a movable contact plug and a stationary sheath contact. In the sheath contact, a plurality of contact fingers are arranged in ring formation and are pressed against the contact plug by means of leaf springs punched out of sheet material. Each leaf spring is loosely inserted in a longitudinal groove in the associated contact finger in such a way that the spring action occurs in the plane of the spring.

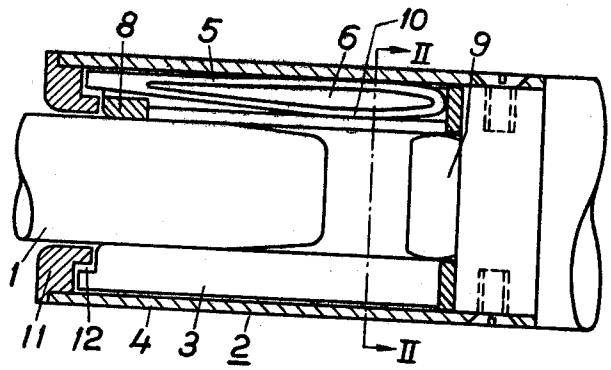


Fig. 1

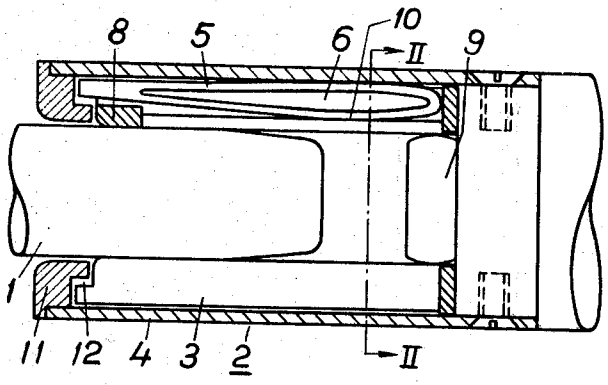


Fig. 2

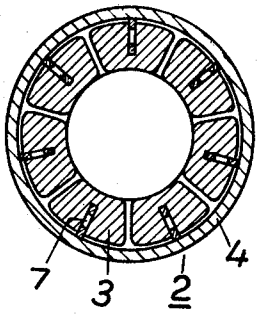
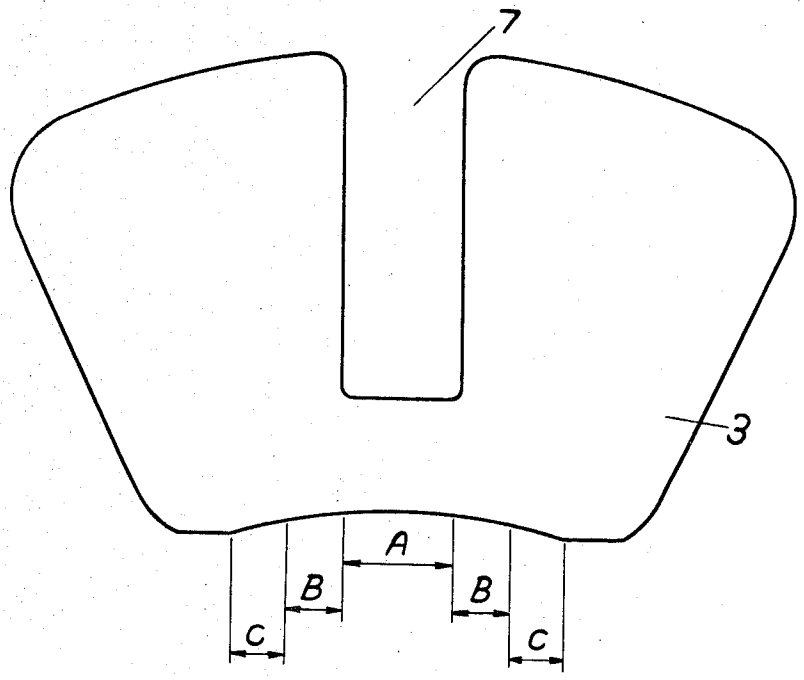


Fig. 3



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CONTACT MEANS FOR ELECTRIC CIRCUIT BREAKERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a contact means of the type comprising a contact plug and a sheath contact surrounding the contact plug, said sheath contact consisting of a plurality of contact fingers extending in the direction of said contact plug and being arranged in ring formation between the contact plug and a surrounding contact housing and arranged to be pressed radially against the contact plug by means of leaf springs arranged between the contact housing and the contact fingers.

2. The Prior Art

The main purpose of the invention is to effect a contact means of the above-mentioned type in which the parts forming the sheath contact can be manufactured and assembled in such a way that the contact means becomes less expensive than similar, previously known arrangements. It is also desirable for the contact means to be rather compact, particularly if it is to be used in oil-minimum circuit breakers for indoor use. With such circuit breakers the question of space is extremely important and it is also from the safety point of view desirable that the quantity of oil required is as small as possible. With this type of circuit breaker the contact means is often arranged so that, to a considerable extent, it determines the outer dimensions of the circuit breaker.

With a sheath contact of the type mentioned above, it is most usual to use helical springs in order to effect the contact pressure. To be able to fix such springs in the contact the contact fingers or the surrounding contact housing must be provided with recesses, guiding pegs, guide sheaths or the like. The contact fingers or the housing must therefore be pressed or cast in a special shape or be otherwise machined, which considerable increases the cost of the contact. Helical springs are also rather space-consuming.

By using leaf springs instead of helical springs it has been possible to reduce the space required by the contact means considerable. In previously known construction, leaf springs have been used which operate perpendicularly to their surface. The springs have usually been positioned by riveting or screwing them to the contact housing or contact fingers which must be provided with special holes for this purpose, possibly threaded. This considerably complicates the manufacture. Furthermore the clamping usually causes unfavorable stressing of the springs.

SUMMARY OF THE INVENTION

The contact means according to the invention is of the type of sheath contact means using leaf springs so that the space required is considerably less than with sheath contacts having helical springs. The invention is characterized in that the contact fingers and possibly also the contact housing are manufactured from rod material, which is produced, for example, by means of extrusion, having the final cross section of the fingers or the housing, respectively, longitudinal grooves being arranged in the contact fingers and/or in the surrounding contact housing, said grooves having the same cross section along the entire length of the contact fingers or housing, respectively, said leaf springs being loosely inserted in said grooves. This construction simplifies the manufacture of the contact means considerably, since the contact fingers can be produced directly by cutting them from the rod material, usually copper, and need no further machining apart from possible silver-plating or other surface treatment. Since the springs are held in position only by their positioning in the grooves in the contact fingers or contact housing, assembly of the sheath contact is considerably simplified and the strain on the springs is more uniformly distributed over the length of the spring, thus decreasing the risk of a spring breaking.

A particularly advantageous further development of the invention is characterized in that each spring is shaped and arranged in such a way that the spring action occurs in the plane of the spring. Since the springs are punched out of, for example, steel sheeting and given such a contour that they can yield edgewise, the space requirement will only be the thickness of the spring times the resilience. The space necessary for the spring is thus considerably less than for the conventional leaf spring for which the space requirement, calculated in cross-sectional area, will be the width of the spring times the resilience. The space required can be further reduced by arranging the spring for the most part so that it is set in to the contact finger.

One end of the contact fingers is suitably gripped by an arcing ring supported by the contact housing at the end situated nearest the contact isolating point and the other end of the contact fingers is pressed against a stationary, peg-shaped contact part in the sheath contact. Thus no special conducting connection for the passage of current between the contact fingers and the stationary contact member is required and the contact fingers can be arranged loosely in the contact. This considerably simplifies the construction.

The contact springs are suitably shaped so that their pressure point is placed nearest the end of the fingers which is pressed against the stationary contact part of the sheath contact. In this way greater spring action is obtained against the stationary contact part than against the contact plug, which is desirable partly because the contact fingers are pivotably arranged around the stationary contact, which must consequently be shaped have a rounded surface in axial direction and the contact surfaces are thus less than with a cylindrical contact plug, and partly because the stationary contact part is not intended to be a replaceable component and arcing must therefore be completely avoided.

So that the best possible contact is obtained between, on the one side, the contact fingers and, on the other side, the contact plug and the stationary contact part of the sheath contact, respectively, it is suitable for the surface of the contact fingers facing the contact plug to be concave, suitably cylindrical, with the same radius of curvature as the contact plug. So that the same type of contact finger may be used together with contact plugs of different diameters the contact surface of the contact fingers may have several different radii of curvature increasing in tangential direction from the symmetry axis of the surface.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be further described with reference to an embodiment shown by way of example in the accompanying drawings. FIG. 1 shows a central axial section through a sheath contact according to the invention, FIG. 2 shows a cross section through the sheath contact along the line II—II in FIG. 1 and FIG. 3, finally, shows an end view of a contact finger of the sheath contact.

The contact means shown in FIGS. 1 and 2 comprises a movable contact plug 1 which cooperates with a stationary sheath contact 2. It is of course also possible to arrange the contact plug stationary and the sheath contact movable. The end of the contact plug 1 consists of a contact shoe of copper-tungsten, not shown. The sheath contact 2 consists of a plurality of contact fingers 3 extending in the direction of the contact plug 1 and placed in ring formation between the contact plug 1 and a surrounding contact housing 4. The contact fingers 3 are pressed radially against the contact plug 1 with the help of leaf springs 5, which are punched out of steel sheeting (spring steel) about 1 mm. thick and are provided with a longitudinal hole 6 and otherwise shaped to give effective spring action in the plane of the material. The springs 5 are partly set in in narrow radial grooves in the contact fingers 3. The contact fingers 3 are made from copper rods. At the front end each finger is provided with a shoe 8 of copper-tungsten. Otherwise the section is unbroken along the entire length of the finger. At the bottom of the sheath contact is a peg-shaped stationary contact part 9. The current transfer between the base of the contact finger 3 and the stationary

contact part 9 takes place in the same manner as the transfer to the plug 1. One and the same spring 5 is utilized to maintain the contact pressure at both current-transfer points. During connection and disconnection of the contact means the contact finger 3 performs a rolling movement towards the stationary contact part 9, which is elliptically rounded in axial direction. The contact surfaces at the current-transfer point against the contact part 9 are therefore relatively small and for this reason a greater spring force is required against the stationary part 9 than against the plug 1, as mentioned above. This is effected by positioning the pressure point 10 of the spring nearer to the stationary part 9.

The front end of the contact housing 4 supports an arcing ring 11 of copper-tungsten. This ring 11 is shaped so that an annular groove 12 is formed into which the front end of the contact fingers projects. In this way both the contact fingers 3 and the springs 5 are held in position in the contact without the need for screw joints or other retaining elements.

In order to obtain high current loading capacity there should be good contact between the contact finger 3 and the contact plug 1 or contact part 9, respectively. From this point of view the inwardly facing surface of the contact finger should preferably have the same radius of curvature as the contact plug 1. However, it is usually desirable to be able to use one and the same contact finger section with contact plugs of different diameters. This can be achieved when manufacturing the contact fingers by using a copper section shaped as shown in FIG. 3. In the area A, the contact finger thus has a radius of curvature of, for example, 8 mm. in the areas B a radius of 11.5 mm. and in the areas C a radius of 12.5 mm. This contact finger can thus be used for three different plug diameters, namely 16, 23 and 25 mm.

The contact means shown as an example is particularly simple to manufacture and assemble which is due in the first place to the contact fingers being given such a shape that they can be made, for example, from extruded rods, so that the retaining of the contact springs can also be arranged in the simplest manner. Due to the special shape and placing of the springs the contact means also needs extremely little space.

However, the invention is not limited to the embodiment shown. Several modifications are feasible within the scope of the following claims. For example, instead of using leaf springs arranged to yield on edge, it is also possible to use normal leaf springs which operate perpendicularly to their surface.

I claim:

1. A contact means for electric circuit breakers comprising a contact housing, a contact plug and a sheath contact, said sheath contact surrounding said contact plug and comprising a plurality of contact fingers, said contact fingers extending in the direction of said contact plug and arranged in ring formation between said contact plug and the contact housing, leaf springs pressing said contact fingers radially against said contact plug, said springs punched out of sheet material and arranged between said contact housing and said contact fingers, said contact fingers having longitudinal grooves therein, said grooves having the same cross section along the entire length of the contact fingers, said springs loosely inserted in said grooves.

2. A contact means according to claim 1, in which each spring exerts a force in the plane of the spring.

3. A contact means according to claim 1, in which each spring is substantially housed in the associated contact finger.

4 A contact means according to claim 1, in which said contact housing is provided at one end with an arcing ring, which is arranged to engage one end of the contact fingers.

5. A contact means according to claim 1, in which a peg-shaped stationary contact part is arranged centrally at the bottom of the contact housing, the base end of said contact fingers pressed against said stationary contact part.

6. A contact means according to claim 5, in which one and the same spring effects contact pressure both against said contact plug and against said stationary contact part, the pressure point of the spring being situated nearer said stationary contact part.

7. A contact means according to claim 1, in which the surface of said contact fingers facing said contact plug has a concave surface to fit the contact plug.

8. A contact means according to claim 7, in which the surface of said contact fingers facing said contact plug has several different radii of curvature.