

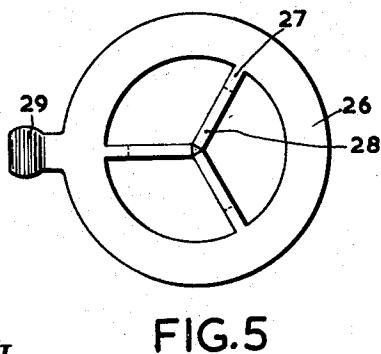
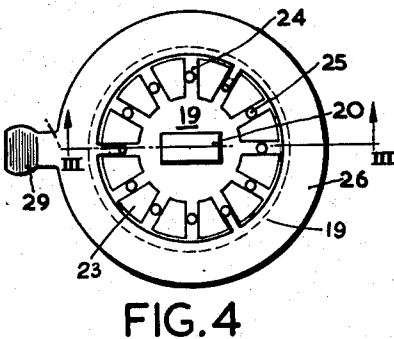
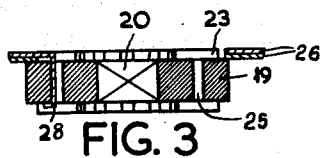
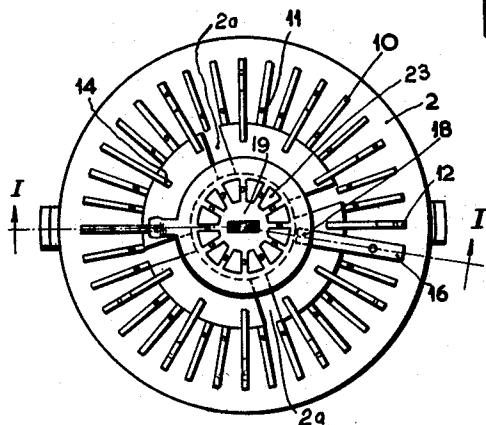
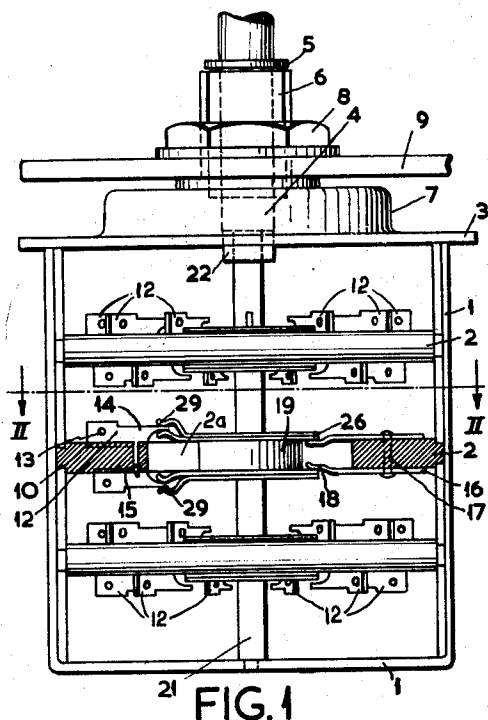
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BI-DIRECTIONAL STEP-BY-STEP RELAY

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BI-DIRECTIONAL STEP-BY-STEP RELAY

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This invention relates to switches comprising one or more fixed contact members and one or more co-operating mobile contact members, both the fixed and mobile contact members being secured in an insulated carrier body preferably of ceramic material and the mobile contact members being moved in the plane or in a plane parallel to the plane in which the body having the fixed contact members is situated. Such switches are known, but have the disadvantage that the number of contact members which may be arranged on the carrier bodies is limited on account of the required width of the material of the contact members and the spacing between these contacts which is desirable in connection with the "creep path." Furthermore, the present practice of attachment of the contacts to the carrier bodies is expensive and the risk of breakage of the carriers, particularly if they are of ceramic material, has been found considerable in practice. In accordance with the invention, said switch is characterized in that the fixed contact members are made of sheet material and arranged and secured at right angles to the carrier body, whereas the mobile contact members comprise resilient ends which, during the operation of the switch, make contact with contact areas on the fixed members, which contact areas are situated in planes parallel to the plane of the carrier body. The space occupied by the fixed contact members of this invention is much smaller than in switches of known type, so that on the one hand, the carrier bodies may be of smaller size or, with the size of known carrier bodies, a larger number of contacts may be provided. The quantity of material consumed for the contacts may also be less than in switches of known type.

In one embodiment of the invention, the contact areas of the fixed contact members are preferably constituted by surfaces at right angles to the surface defining the thickness of the sheet material. The section of the sheet material thus constitutes the contact surface, thus avoiding the necessity of forming separate contact areas as hitherto employed. In another embodiment of the invention, the fixed contact members may have the form of a hammer, the insulated carrier body being provided with radial grooves accommodating the hammer heads, which grooves have apertures in which the stems or handles of the hammers are located, the contact member being secured by deformation and more particularly bending the handle portion projecting from the body at its lower side. This embodiment of the invention affords the advantage that the fixed contact members are fixed in position in a simple manner, so that they cannot move in a direction at right angles to their respective carrier grooves while they can be secured to the carrier body without causing damage thereto.

In the switch according to the invention, the mobile contact members may perform either a translation or a

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rotation with respect to the fixed contact members. In the case of rotation, however, it is advantageous if, in another embodiment of the invention, the mobile contact members each comprise two approximately identical circular parts, each having at least one projecting resilient tongue and also a contact ring, one ring being provided tongue and also a contact ring, one ring being provided with a plurality of attachment tags evenly distributed over the circumference of the circle and radially projecting inwards, whereas the second ring has a number of corresponding locating tags. The mobile holder body, which is made of insulating material, is provided on one side, or each side, with radial grooves evenly distributed over its circumference, the width of these grooves being approximately equal to the width of the attachment tags and the locating tags and a plurality of these grooves each having an aperture, extending transversely through the holder body. The attachment tags extend through these apertures in the rotatable holder body which has a central rectangular aperture. In this embodiment also, the mobile contact members are easily and quickly fixed on the holder body without play, while furthermore the angular position of the resilient tongue with respect to the rectangular aperture, through which the shaft of the switch extends, may be chosen at will.

In order to obtain a rigid assembly, it is advantageous if, in the immediately above described embodiment of the invention, the grooves of the holder body are defined by axially projecting segments attached to or integral with the holder body which segments have a diameter smaller than that of the holder, so that the circular contact members, at their inner circumference, partly bear on the holder body.

Satisfactory centering of the mobile contact members and their holder bodies with respect to the fixed contact members and their carrier bodies is obtained if, in another embodiment of the invention, the carrier body for the fixed contact members comprises a plurality of radial projections, the thickness of which, in the axial direction of the switch, is equal to the spacing between the contact rings provided on the upper and the lower side of the holder body and/or associated collar of the rotary contact member.

It is generally necessary for the mobile contact members to have a proper connection with the exterior. According to the invention, for this purpose, the carrier body for the fixed contact members has secured to it, on one side or each side, a metallic strip having a resilient projection, which strip is located within the portion of the contact rings situated outside the holder body for the mobile contact members. A reliable contact with the mobile contact members is thus always obtained in a simple manner.

In order that the invention may be more readily carried into effect, one embodiment will now be described more fully, by way of example, with reference to the accompanying drawing, in which:

FIG. 1 is a partly sectional elevation view of a rotary switch having three rows of double fixed contacts. A section view of the second row of fixed contacts being shown which is taken along the line I—I of FIG. 2 viewed in the direction of the arrows;

FIG. 2 is a plan view of the switch of FIG. 1 taken

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along the line II—II and also viewed in the direction of the arrow;

FIG. 3 is a sectional view taken along line III—III of FIG. 4, on an enlarged scale, of the holder body for the mobile contacts;

FIG. 4 is a plan view of the carrier body for the mobile contacts with the contact rings provided, and

FIG. 5 is a plan view of a contact ring itself.

In the figures, reference numeral 1 indicates a frame in which three carrier bodies 2 for fixed contacts 12 are arranged to regular intervals. The frame 1 is secured to a front plate 3, through which extends a shaft 4 which comprises a collar 5 and is further led to the exterior. A threaded sleeve 6 is connected to a protuberance 7 of the front plate 3 and the switch may be secured to a panel 9 by means of a nut 8. A stop for the shaft 4 is provided in the protuberance 7 in a manner not shown, so that the various positions of this shaft may be fixed. The carrier body 2 for the fixed contact members has a plurality of grooves 10, regularly distributed over its circumference, each having an aperture 11 extending through the carrier body. In total twelve contact members 12 are arranged in these grooves, on each side of carrier body 2, but staggered, so that a total of 24 fixed contact members are present. These fixed contact members have a hammer like shape and have in the head portion of the hammer an aperture 13, to which connections may be secured. The upper and lower sides of the portion of the hammer like projection, which is indicated by 14, constitute the contact areas proper. The handle 15 of the contacts 12 is led through the apertures 11 and twisted outside the carrier body 2 at the portion which is remote from the hammer, so that due to its location in the groove 10 the contact member 12 cannot turn and is fixed in position within the groove as a result of the twisting. It will be evident that this twisting may alternatively be replaced by bending. Contact members 12 are also arranged on the lower side of carrier body 2 and these contact members are staggered with respect to the contact members on the upper side. The carrier body 2 also comprises four radial projections 2a which serve to centre the carrier body for the mobile contact and which will be referred to in detail hereinafter. The carrier body 2 finally comprises two strips 16 which are connected together by means of a flanged sleeve 17 and which have contact areas 18.

Reference numeral 19 indicates a holder body for mobile contacts which is made of insulating material. This holder body has a rectangular central aperture 20, through which extends a rectangular shaft 21, one end of which is supported by the frame 1 and the other end of which fits into a groove 22 of the shaft 4. Each side of the holder body 19 has axially projecting segments 23 having a diameter smaller than that of the holder or supporting body 19 and defining grooves 24 which are regularly distributed over the surfaces of the holder body. These grooves 24 also have apertures 25. Two contact rings 26 are secured to the holder body 19 at each side thereof. One of these contact rings has the shape shown in FIG. 5, but with the inwardly projecting attachment tags 28 cut off along the dotted line thus forming short locating tags 27; the other contact ring having the shape as shown. At first, a contact ring having short locating tags 27 is laid on the holder body 19, the segments 23 being located inside the inner circle of the contact ring 26 and the tags 27 being accommodated in the grooves 24. Next, a contact ring 26 having long attachment tags 28 is laid on top of the first contact ring, of which the long tags 28 bent beforehand are passed through the apertures 25 and bent over at the other side. The assembly thus comprises two contact rings 26 having contact tongues 29, which are identical. Two such rings are also arranged on the lower side of the holder 19. In the absence of fixed contacts on the lower side of carrier body 2, the contact tongue 29 for these rings may

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be dispensed with. Since all grooves 24 have apertures 25, the upper assembly comprising the lower and upper rings 26 may have a different position with respect to the lower assembly. Alternatively the contact tongues 29 of each assembly may also be shifted with respect to one another. When the rings 26 have been placed in position, both on the upper side and the lower side of the carrier body 19, a certain space approximately equal to the thickness of holder 19 thus exists between the projecting edges of the two rings. The four projections 2a of the carrier body 2 for the fixed contact members exactly fit into this space, so that these projections fully centre the carrier body 19 for the mobile contact members and keep it in position. The resilient tags 18 of the collector contacts 16 also fit into the space between the rings 26. It is possible for the rings 26 to be provided with a plurality of contact tongues 29 and it is alternatively possible to provide wide contact tongues 29, by each of which two or more fixed contacts 12 areas are connected simultaneously.

It is not necessary for the switch according to the invention to be of the rotary type. The fixed contacts may alternatively be arranged in a row and the holder body for the mobile contacts may then perform a sliding movement.

The described switch is built up from simple moulded pieces and its assembly requires only simple manipulations which may be performed by unskilled labour. In mass production, all rings 26 are punched with the same shape and the tags 28 are shortened and the contact tongues 29 are bent according to requirements. The contact surface 14 on the hammer-like fixed contact 12 is small and has sharp edges, so that very good cleaning of the contacts upon rotation of the switch is possible, since the surface of the tongues 29 is cleaned by the scraping action of the sharp edge.

Finally, it has been found that a switch according to the invention may have smaller dimensions for the same switching possibility than those of the conventional switches and may also be lighter in weight.

What is claimed is:

1. A switch having at least one fixed contact assembly and co-acting movable contact assembly, said fixed assembly comprising insulated carrier means, a plurality of radial grooves in said carrier means and a corresponding plurality of traverse apertures in said carrier means communicating with said grooves, a plurality of hammer-like shaped contacts of sheet material having a handle portion, said contacts recessed within at least some of said grooves defining a plane perpendicular to said carrier means and said handle portion projecting through the associated aperture; said movable contact assembly comprising holder means, a plurality of radial grooves in said holder means and a plurality of corresponding traverse apertures in said holder means communicating with said grooves, movable annular contact means extending beyond the outer boundary of said holder means and having at least a tongue portion at the outer periphery, a plurality of tag means at the inner periphery of said contact means, said tag means securing said annular contact means to said holder means in cooperation with said grooves and apertures in said holder means, and means to rotate said movable contact means.

2. A switch as claimed in claim 1 wherein the grooves of said holder means are defined by a plurality of circumferentially spaced axially projecting segments, said segments having a diameter smaller than the diameter of the holder whereby the contact means of the movable contact assembly at least partly bear on said holder means adjacent the outer periphery thereof.

3. A switch as claimed in claim 1 wherein said carrier means includes a plurality of radial projections, the thickness of each projection in an axial direction being substantially equal to the thickness of said holder means in an axial direction whereby said movable contact assembly

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is centered with respect to said fixed contact means and secured against axial movement in at least one direction.

4. A switch as claimed in claim 1 further comprising a metallic strip provided with a resilient contact area 5 which engages said annular contact means of the movable contact member.

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