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PRESSURE GAS OPERATED ELECTRICAL SWITCH WITH TWO STATIONARY MAIN CONTACTS AND A MOVABLE BRIDGING CONTACT BASKET

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The present invention relates to a pressure gas operated electrical switch which comprises two stationary spaced apart main contact members and a movable bridging contact basket with contact fingers arranged within a switching chamber, the contact basket being associated with a piston type driving member therefor for driving the basket in such direction as to effect disengagement between the basket and one of the stationary contact members when pressurized gas is introduced into the switching chamber, and there being a landing spring cooperative with the contact basket for returning the same into a bridging contact with both of the stationary main contact members when the pressurized gas flow into the switching chamber is cut off. A compressed gas switch has become known where a movable switch pin and a fixed tubular nozzle forming the counter-contact are connected by a movable bridging contact. The latter is connected with a drive piston and is pushed back onto the tubular nozzle by the compressed gas flowing into the switching chamber during disconnection, while at the same time the switch pin is moved by the drive in the opposite direction. With this arrangement it is disadvantageous, on the one hand, that a separate drive device is needed for the movement of the switch pin and on the other hand, since a simultaneous lifting of all individual contact fingers off the switch pin does not take place, of the always existing manufacturing tolerances, as well as due to the irregular burning occurring during operation at the individual contact fingers, there results an unfavorable load on the contact finger which last leaves the contact pin. Due to the fact that the latter carries the full disconnecting current in the end, there is formed at the point of contact with the fixed nozzle pipe, due to the electrodynamic action of the current, a very great contact-lifting force and hence, damage to the contacts by the arc not subjected to blowing at the lift point. To compensate this, very strong contact pressure springs would be necessary, which, however, would lead to an uneconomical solution.

The object of the present invention is to provide a simple solution where the mentioned disadvantages are avoided, the new arrangement being applicable to advantage for switches up to the greatest disconnecting currents. According to the invention, it is proposed that at least one of the contact fingers, but each of such fingers, be designed as a burn-off finger, at which the contact between the bridging contact and the fixed pin-shaped contact is eliminated last during a disconnection operation, the current conduction to the burn-off finger being designed as conductor loop in such manner that during engagement, the contact pressure is increased and later the arc is moved toward the center of the tubular nozzle.

Some examples of construction, with reference to which the inventive idea is explained in greater detail, are given in the accompanying drawings.

FIG. 2 shows another example of construction where the current conduction to the burn-off finger is designed as insulated conductor loop.

FIG. 3 shows, partly in section, the elevation of a switching chamber with burn-off fingers designed as multiple parts.
through the aperture 5a and thus is pressureless. In the position of the contact basket 10 shown in the drawing, the contact between the contact pin 1 and the fingers 11 is eliminated, so that the remaining burn-off finger 12 alone carries the disconnecting current, a lifting off of the burn-off finger 12 at its point of contact with the insertor 3 is avoided, and the current loop is indicated in dash-dot lines by the action of electrodynamic force, in that the repelling forces between the opposing current paths in parts 5 and 12 cause an intensification of the contact pressure. These same repelling forces bring about also a rapid downward movement of the disconnecting arc to the reference, the nozzle tube 7, thus as soon as the arc is drawn between the burn-off finger 12, 12a and the contact 1, 1a during the further upward movement of the contact basket 10. Then the disconnecting arc blown by the compressed gas burns for a short time until its extinction between the contact 1 and the nozzle tube 7, with formation of the arc roots at the bulbous part 19a of the nozzle and 8 respectively.

After extinction of the arc, the compressed gas supply is cut off by means of the switching valve not shown, as soon as the voltage insulation of the disconnected switch has been taken over in known manner by an isolating voltage switch-point which is connected in series with the gas path. The isolating voltage switch-point may be designed, for example, in a manner known in itself as a series connected knife switch. As the nozzle tube 7 carries current only for a short time during the disconnecting operation, it may be made of cheap material, e.g. iron. Another advantage of the new arrangement is that the return spring 14 need not be made of anti-magnetic material since according to the invention it does not surround the current path, so that harmful heating due to eddy currents cannot occur in the spring. In the vicinity of the upper limit position of the contact basket 10, a compression attenuation of the moving parts becomes operative as soon as the space above the contact basket 10 is closed off from the atmosphere after the aperture 5a to atmosphere has been passed and thus closed off. Connection of the switch contacts is effected in known manner by closing the mentioned series arranged knife switch, since the power switch point is again closed in the stationary disconnected position of the switch, in that the bridging contact has been brought by the return spring 14 into its lower limit position after stopping of the compressed gas supply.

In Fig. 2 another example of construction is illustrated, the parts corresponding to those of Fig. 1 being marked with the same reference symbols. Here, however, the connector part 5 is so designed that it is internally formed at the same time as a nozzle tube on which the burn-off material 8 is fixed. The current loop for the burn-off finger 12 is formed by a U-shaped yoke 19 of highly conductive material, e.g. copper, which is embedded in the connector part 5 by means of intermediate insulating layers. In tangential direction, the width of the yoke 19 is adapted to that of the respective burn-off finger 12. When several, e.g. two to three, burn-off fingers are present, each has a separate yoke 19 assigned to it, these being possibly also separated from each other by intermediate insulating layers. The return spring 14 is arranged in this construction above the connector part 5 and takes support, on the one hand, against the upper collar of the tube 17 and, on the other hand, over the ring 16 and several stay bolts 15 fastened in the contact basket 10, against the latter. The mechanism of action of the arrangement according to Fig. 2 fully corresponds to that as described under Fig. 1. By the yokes 19 embedded insulatingly in the connector part 5 an advantageous concentration of the current paths in the conductor loop is brought about and thereby the contact lifting of the one or more burn-off fingers 12 during the disconnecting operation is prevented in greater degree. Here also the return spring 14 is so arranged that encirclement of the current path is avoided.

Another example of construction is illustrated in FIGURES 3 and 4. The arrangement shown here is particularly advantageous for switches having great load current disconnecting capacity. By 1, 1a is designated the pin-shaped contact, whose attachment in the switching chamber housing 4 is effected in the same manner by means of parts 2, 3 as in FIGS. 1 and 2. The connector part 5 is of substantially cylindrical design and carries at the top the insert piece 20, into which the nozzle tube 7 is screwed. The contact basket 10 has corresponding recesses in its cylindrical surface 11, which apply at the bottom against the contact 1 and at the top against the connector part 5, the leaf springs 13a, 13b establishing the contact pressure in the connected position. As is evident from the plan cross-section of FIG. 4, there are eight contact lamination or fingers 11 in all. Opposite them are three multi-part burn-off fingers, each consisting of a hammer-like part 12, 12a and two parts 12b. The mutual engagement of the finger parts is readily visible from FIG. 5. Parts 12 and 12b have between them leaf springs 13c (FIG. 3) to produce the contact pressure which rest, for example, against the contact basket 10. The leaf springs 13c are provided with an insulating coating. Owing to the fact that the finger parts 12b rest on the connector part 5, while the finger parts 12, 12a rest on the contact pin 1, 1a, there results the current loop indicated by the dash-dot line with arrows. For the rest, the mechanism of action of the arrangement fully corresponds to that as described in FIG. 1. Due to the anti-parallel and closely opposite current paths in the finger parts 12 and 12b there results, upon disconnection of great currents, a particularly effective contact pressure increase at the transition points between the finger parts 12 and 12b on the one hand, and between the finger parts 12b and the connector part 5, on the other. As is evident from FIG. 4, several burn-off fingers 12, 12b may be provided, whereby a favorable current distribution can be achieved. In the chosen example of construction, a total of three multi-part burn-off fingers is provided. They are arranged inside the contact basket 10 in such a way that they are always on the side facing the connector flange 55.

FIG. 6 shows another example of construction where the slidable bridging contact is designed, according to the invention, to increase the dynamic strength, in such manner that a particularly advantageous pressure increase in the connected position is achieved. For this the contact lamination or fingers 11 have a crowned surface 11c, by which, under the axial force of the return spring 14, they apply against the conical inner surface of the connector part 5. By the lug part 11b they rest in a recess of the contact basket 10, so that they can execute a small rolling-sliding movement during connection and are then clamped in the manner of a wedging effect, with the result of a multiplication of the contact pressure corresponding to the inclination of the wedge surface. The inner portion of the connector part 5 may advantageously consist of an inserted bushing 5c of highly conductive material.

I claim:
1. In a pressure gas operated electrical switch, the combination comprising a pair of co-axially aligned main contact members arranged with intersecting spaced relation within a switching chamber to which a pressurized gas is introduced during electrical disconnection of said main contact members, one of said main contact members being in the form of a nozzle tubular member through which the pressurized gas flows during a contact disconnection, a movable contact member of assembled arrangement for sliding movement upon said tubular nozzle contact member to engage and be disengaged
from the other main contact member, said bridging contact assembly being comprised of a contact basket of electrically insulating material in which a circular array of contact fingers are located, said basket serving also as a piston which is slidably actuated upon introduction of pressurized gas into said switching chamber thereby to disengage said contact fingers from said other main contact member, a loading spring for said contact basket to return the same to a position wherein said contact fingers re-engage said other main contact member when the pressurized gas flow to said switching chamber is cut off, a cylinder for the sliding movement thereof, said connector member also including a laterally extending lug to which one electrical connection is made to the switch, at least one of only those contact fingers located at the same side of said cylindrical connector member as is located said connection lug being longer than the remaining contact fingers thereby to serve as the last to disengage from said other main contact member, and said cylindrical connector member also including an inverted U-shaped yoke of highly conductive material embedded therein at the side on which said connection lug is located and which surrounds said longer contact finger, said yoke serving in part to establish two closely parallel current flow paths of opposite direction between said connection lug and the adjacent side of said cylindrical connector member and said other main contact member subsequent to disengagement of said remaining contact fingers but prior to disengagement of said longer contact finger, one of said current flow paths being through said longer contact finger thereby to establish thereon an electro-dynamically derived force acting in a radially inward direction to increase the pressure of said longer contact finger on said other main contact member and thereafter move the contact disconnection arc toward the center of said nozzled tubular contact member.

2. In a pressure gas operated electrical switch, the combination comprising a pair of co-axially aligned main contact members arranged with their ends in confronting spaced relation within a switching chamber to which a pressurized gas is introduced during electrical disconnection of said main contact members, one of said main contact members being in the form of a nozzled tubular member through which the pressurized gas flows during a contact disconnection, a movable bridging contact assembly arranged for sliding movement upon said tubular nozzled contact member to engage and be disengaged from the other main contact member, said bridging contact assembly being comprised of a contact basket of electrically insulating material in which a circular array of contact fingers are located, said basket serving also as a piston which is slidably actuated upon introduction of pressurized gas into said switching chamber thereby to disengage said contact fingers from said other main contact member, a loading spring for said contact basket to return the same to a position wherein said contact fingers re-engage said other main contact member when the pressurized gas flow to said switching chamber is cut off, said loading spring surrounding said nozzled tubular contact member within an electrically conductive cylindrical sleeve provided with longitudinally extending slots, an electrically conductive cylindrical connector member surrounding said contact basket and in radial spaced relation to said cylindrical sleeve, the annular space between said cylindrical sleeve and said cylindrical connector member forming a cylinder within which said contact basket slides and with said contact fingers in contact with said cylindrical sleeve, said contact basket including radially inward portions extending through said slots in said cylindrical sleeve and which are engaged by one end of said loading spring, said connector member also including a laterally extending lug to which one electrical connection is made to the switch, at least one of only those contact fingers located at the same side of said cylindrical connector member as is located said connection lug being longer than the remaining contact fingers thereby to serve as the last to disengage from said other main contact member, and said other main contact member subsequent to disengagement of said remaining contact fingers but prior to disengagement of said longer contact finger, one of said current flow paths being through said cylindrical sleeve and thence through said longer contact finger thereby to establish thereon an electro-dynamically derived force acting in a radially inward direction to increase the pressure of said longer contact finger on said other main contact member and thereafter move the contact disconnection arc toward the center of said nozzled tubular contact member.

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