HIGH TENSION SWITCHING STATION
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ABSTRACT OF THE DISCLOSURE

A high tension switching station with a fixed component having coupling contacts positioned therein and insulated from ground, a movable power switch element also insulated from ground and having insulated couplings for making contact with the fixed station coupling contacts, and a closure mechanism in the fixed component for sealing the insulating material surrounding the coupling contacts during disengagement between the coupling contacts.

Another object of this invention is to provide a new system wherein coupling contacts protruding from the housing of the mobile power switch housing interact with stationary coupling contacts which are installed in an insulating medium in the apertures of the anterior portion of the stationary housing such that upon retraction of the power switch, a free air gap is formed between the stationary element of the station and the coupling contact of the power switch, as well as providing separation space between the coupling contacts and the grounded housing of the stationary component of the station.

Another object of this invention is to provide a high tension station which is simple in construction and yet capable of achieving operability within limited space requirements and despite its small dimensions satisfies all requirements with regard to industrial safety, desirable modification possibilities, extensive diversity of applicability, and the like.

According to one embodiment utilizing the principles of this invention there is provided the coupling contact of the stationary element of the station which is safely insulated against ground solely by the breaker distance element located in a medium of increased resistance with the power switch withdrawn. It is contemplated to use as one insulation medium for the improved high tension station liquid, as well as gaseous, substances. For example, oil, electron negative such as sulfurhexafluoride, and the like, whose electrical resistance is considerably greater than that of ambient air. Solid insulations such as casting resin may also be provided. The grounded housing filled with such an insulation medium, as well as the grounded housings for station components, such as bus-bars, voltage transformers, power transformers, cable terminals, ground fixtures and power switches, have, for the sake of safety, walls of such thickness that they can conduct short circuit currents. Further, it is advantageous to provide a seal device for each switch pole on the stationary element of the station which device will prevent the egress of gaseous or liquid insulation mediums when the power switch is withdrawn. For reasons of mechanical stability, it is advantageous to use a coupling housing leaving the fixed coupling contacts as a carrier for the remaining elements utilized in the construction of the stationary component of the station. One can thus provide each phase with two coupling housings of which one carries the bus-bar while on the other are secured the transformer cable terminals and ground fixtures. On stations with double or multiple bus-bars, the phases may be arranged in mixed order. Individual sections of the station are conveniently sealed from one another by intervening partitions.

Other objects and advantages will become apparent from a study of the following specification and drawings, in which:

FIG. 1 illustrates a side view of a high tension switching station;
FIG. 2 is a view in the direction of arrow A according to FIG. 1;
FIG. 3 is a view in the direction of arrow A according to FIG. 1 with the power switch not shown;
FIG. 4 is a cross-sectional view on line B—C of FIG. 3 without the transformers and with a switch grounded in another manner;
FIG. 5 is a cross-sectional view on line D—E of FIG. 3;
FIG. 6 is a side view exposed in part of the power switch;
FIG. 7 is a cross-sectional view on line F—G of FIG. 6; and
FIG. 8 is a detailed plan view of a portion of the driving mechanism for the switching operation.

Referring now to FIGS. 1-3, there is shown a power switch 1 supported by a grounded housing 3 and having a bushing unit 2. The connection to the bus-bars of the fixed element of the station occurs through the tube 4 by means of an upper homing contact 5 of the lug type which penetrates the capsule arrangement 12 of the fixed station element. In tube 4 is located a suitable transformer for regulating voltage (not shown) and the tube is rotatable to be fully withdrawn later, so that it may be swung to the side when the power switch is in the withdrawn position. This leaves the upper part of the switch with its removable covers 6 open for repair and modification. The lower power homing contact 7 of the power switch 1 penetrates the coupling housing 13 in the fixed station element and assumes a connection with the cable lead-off 8. The bus-bars of the individual phases are in grounded metal tubes 9, 10 and 11, which are filled with suitable insulating gases, such as electron negative gases. Coupling houses 12 and 13 are provided with fixed coupling contacts 22 of the pulp type placed behind penetration apertures 20 as best shown in FIGS. 3 and 4 and which will be described in detail below. Returning to FIG. 1, housing sections 14 and 15 enclose suitable power mechanisms for the actuation of the terminal covers for valves of the penetration apertures and tube 16 houses a suitable lead-in cable. The drive switch 18 and, along with tube 16, are all secured to the fixed station by means of suitable supports 19. As shown in FIG. 2, each phase of the fixed element of the station, as well as each pole of the extensible power switch 1, is encapsulated in itself. As shown in FIGS. 4 and 5, the coupling housing 13 has an opening 20 behind which is a seal device or shield 21 which prevents the egress of the gaseous or liquid insulation mediums when the power switch 1 is withdrawn. The device 21 may be made of a suitable shutter or screen of insulation material or metal which slides between the coupling contacts when the power switch is withdrawn. Thus, during penetration by the power switch the seal opens up and then closes upon withdrawal. The fixed coupling contact 22 is formed as a stud as shown and is adapted to be gripped by the appropriate homing contact in the mobile power switch. The contact 22 is shielded by an electrode 23 which is surrounded with an insulation material, for example, a castings resin bulb 24. A light bulb 26 serves to support the power bar 31. Further, a fixed ground switch contact 27 is provided in the housing 16 and is provided with a shielding 28. For the lead-in of cable 8 into the gas-filled station housing, a cable lead-in insulator 29 made of casting resin is utilized. The cable terminal has an oil paper insulation 30 and a pure oil insulation 32 so that in this transition area an insulation in the sequence of oil paper, oil, casting resin and insulating gas is produced. This arrangement allows for cable lead-in in a very limited space.

As previously mentioned, the bus-bars are installed in grounded tubes that are filled with an insulation medium. The tubes have disc supports which are reinforced by a bead on the tube for the purpose of avoiding the appearance of glow phenomenon in the vicinity of the bus-bars. Individual sections of the grounded housing tubes can be connected together by suitable electric wires so that the concomitant short circuit currents can be transferred easily from one section to another. Junction pieces for the bus-bars can be arranged in the shells so that an undesired increase in the intensity of the electric field is avoided. Further, the bus-bars can be provided with compensating members to compensate for expansion.

As shown in FIGS. 6 and 7, the grounded switch housing 1 is mounted on a mobile base portion 3. The housing is filled with sulfurhexafluoride or other electron negative gas. Switch positions 38 and 39 are installed in special oil filled housings 36 and 37 which are provided with fixed contact members 40 and movable switch studs 41.

Each of the studs 41 is surrounded by a quenching chamber 42. On top of the housings 36 and 37 are mounted open connection insulation tubes 43 and 44 which reach through the upper wall of the switch housing 1. The cover plates 6 above have been provided. The tubes 43 and 44 serve to separate the oil filled housings 36, 37 from the grounded housing.

This new station offers the advantage in a mutually non-restrictive manner of using a material as an extinguishing gas which is a better switch medium for the switch interval other than the medium which serves solely to insulate the current carrying elements from the grounded housing. Thus, it is possible to select from the media independent of one another that is particularly suited for arc extinction and likewise one that is particularly suited for insulating the current carrying elements from the grounded housing. One can provide, therefore, a fluid, such as oil, for arc extinction and insulation of the switch contacts after power shut-down and an insulation gas, such as an electron negative gas, sulfurhexafluoride, to insulate the current carrying elements from the grounded housing, without having these media mutually restricting one another in any manner.

The switch positions 38 and 39 are electrically switched in series since the switch studs 41 in the switching process are activated in unison so that in shutting off power a break gap in series is created.

The driving mechanism for the switching operation is located in the power compartment 47 which rests on supports 48 and which is activated by a shaft of insulating material 49 as best shown in FIG. 6. The shaft 49 with affixed metal bushings 50 and 51 is led through and seated in metal bearings 52 and 53 so that the oil or gas seal occurs between the motor 49 and the housing 47. Each of the oil filled bearing rests on the bearing 49 in FIG. 8 is turned to the left, then the angle lifter 71 draws the switch studs 41 in the switch off position. 50 Of course, any form of driving mechanism for transmitting a rotary movement into a translatory switch stud movement can be used for the purposes of this invention. The shaft 49, during the switching process, is driven by the arm 54 which is activated by spring powered drive 55. This drive consists of stacked spiral springs which are illustrated in FIG. 6 as seen from the side. These springs act on a central shaft at the bottom of which is provided a handle with wind grips (not shown). The crank moves the rod 54 which engages the shaft 49. During a full revolution of the spring powered drive 55, the switch is both switched on and off since the rod 54 is moved in one direction and subsequently during a 180° rotary movement in the opposite direction. This type of propulsion, however, should be familiar to those skilled in the art.

As shown in FIG. 6 the upper connecting homing contact 5 and the lower connecting homing contact 7 rest on guides 58, 59 which are enclosed in a solid insulation material such as casting resin. The contacts 5, 7 interact with the fixed coupling members 12 of the station element as previously mentioned (see FIGS. 4 and 5). As shown, the switch positions 38 and 39 are arranged spatially one behind the other. By this arrangement the width transverse to the line of travel becomes small. Switches with several phases therefore, with side
by side arrangement take up little room; the divided casing of each phase offers considerable advantage for requisite modification and replacement. The joint extension and retraction can be achieved through detachable connections of the switch housing as well as the joint switching of the switch poles. The connection guides 58 and 59 and connection contacts 5 and 7 of each switch pole serve to make contact with the fixed station element are perpendicular one above the other. In the engaged and power-on position the current runs from contact 5 through guide 58 past a rotatable contact fixture 60 to the switch positions 38 and 39 and the guide 59 to contact 7. In the extended position of the switch the arm 61 which contains a transformer 62 can be rotated about the rotatable contact fixture 60. In rotating arm 61 away the cover 6 can then be opened so that access may be had to the inner area of the switch. In the gas exit of the switch positions 38 and 39 which leads through an exhaust chamber 63, as best shown in FIG. 7, there are provided gas-filled bellows 64 and 65 which allow for expansion in the switching gases before they exit from the switch. The volume of each gas-filled bellows should be such that its eventual destruction can be detected by a drop in a suitable extinguishing and insulation medium gauge. Further, the switching gases should be discharged from the switch positions 38, 39 in such a manner that they do not come into contact with the insulation material tube leading from the walls of the switch to the walls of the grounded housing. The current carrying elements of the switch can be borne by insulation material supports whose metallic end fittings are placed in the walls of the switch housing and the grounded housing. The end fittings of the supports should be so formed that no destructive diminutive insulation gaps are formed in the support positions. It should be remembered that the power switch can be built extra to very small space dimensions. It is very practical to use as a power switch that has been provided with arc extinction using an extinguishing and insulation medium of increased resistance. This switch is situated in the insulated medium of the grounded housing of the retractable element of the station, wherein the extinction and insulation medium, for example, arc extinguishers are fixed to the switch chamber connected to the open air for the purpose of discharge of switching gases and, further, wherein the partitions of the switch chamber completely divide the extinction and insulation medium of the switch interval from the insulation medium which serves solely to insulate the current carrying elements from the wall of the grounded housing. Thus, the switching gases are not blown into the grounded housing. The insulation property of the insulation medium of the grounded housing remains practically limitless maintained and the insulation intervals can be kept so small that an optimum of small space dimensions can be achieved. Although several embodiments of the invention have been depicted and described, it will be apparent that these embodiments are illustrative in nature and that a number of modifications in the apparatus and variations in its end use may be effected without departing from the spirit or scope of the invention as defined in the appended claims. What is claimed is:

1. In a high tension switching station having grounded housing means the combination comprising; a fixed station element having fixed coupling contacts positioned therein, aperture means on said fixed element adjacent said fixed coupling contacts, a movable power switch element, a resistance medium having a higher breakdown resistance than air for insulating said fixed station element and said movable power switch element from said grounded housing means, said resistance medium surrounding said fixed coupling contacts, said power switch element having coupling contacts extending through said aperture means for making contact with said fixed coupling contacts in said fixed station element, and closure means preventing egress of said resistance medium to the ambient air and positioned between said aperture means and said fixed coupling contacts in said fixed station element for closing before withdrawal of said coupling contacts of said movable power switch element from said aperture means, whereby a breaker gap is formed in said fixed station element between said fixed coupling contacts and said grounded housing means.

2. In a high tension station according to claim 1, wherein said fixed element comprises a single encapsulated phase means and said power switch element comprises a single encapsulated pole means.

3. In a high tension station according to claim 1, wherein a plurality of fixed station elements is provided in side-by-side relationship for cooperating with a corresponding plurality of power switch elements, and said power switch elements being selectively withdrawn from coupling contact with said fixed station elements.

4. In a high tension station having a grounded housing including a fixed station element having fixed coupling contacts, the combination comprising; a grounded mobile housing having current conductive means and insulated couplings for making contact with said fixed contacts, a power switch means, chamber means for enclosing said power switch means in said housing, said chamber means connecting with the atmosphere, an arc-extinguishing liquid medium in said chamber means, and an insulation medium for said current conductive means located between said chamber means and said grounded housing whereby said insulation medium is separate from said arc-extinguishing medium.

5. In a high tension station according to claim 4, wherein said chamber means is an electron negative gas.

6. In a high tension station according to claim 4, wherein said switch means comprise two series connected switches positioned in line with the path of travel of said mobile housing.

7. In a high tension station according to claim 4, wherein said chamber means is provided with a compressible bellows means for enabling the expansion of switch gases associated with said arc-extinguishing liquid medium in said chamber means.

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