Jan. 31, 1939. B. V. GIEGERICH 2,145,720

SWITCHING APPARATUS

Filed June 25, 1937

Fig. 2.

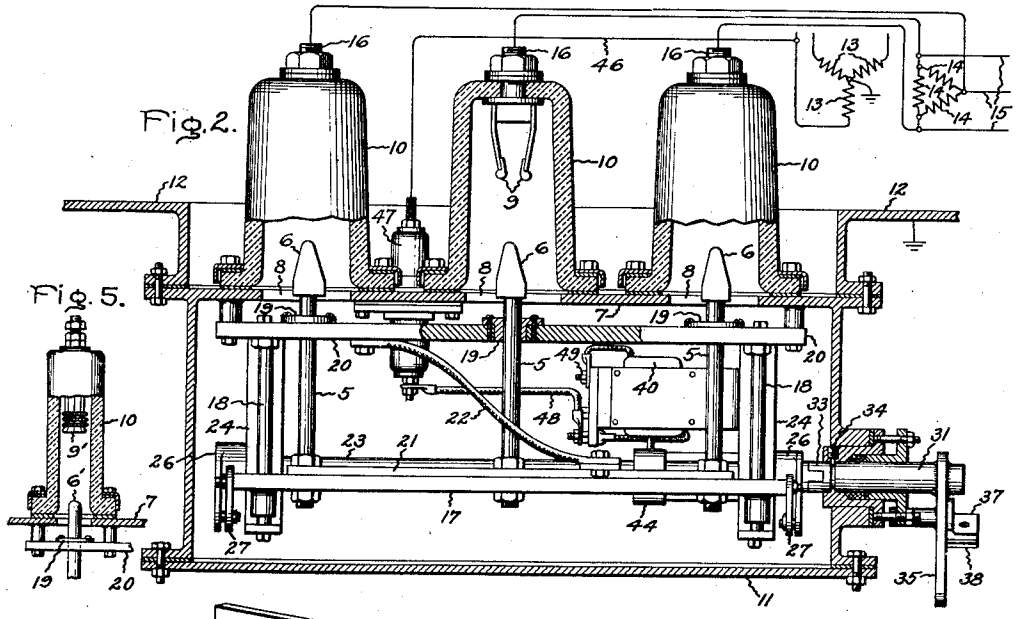


Fig. 5.

Fig. 1.

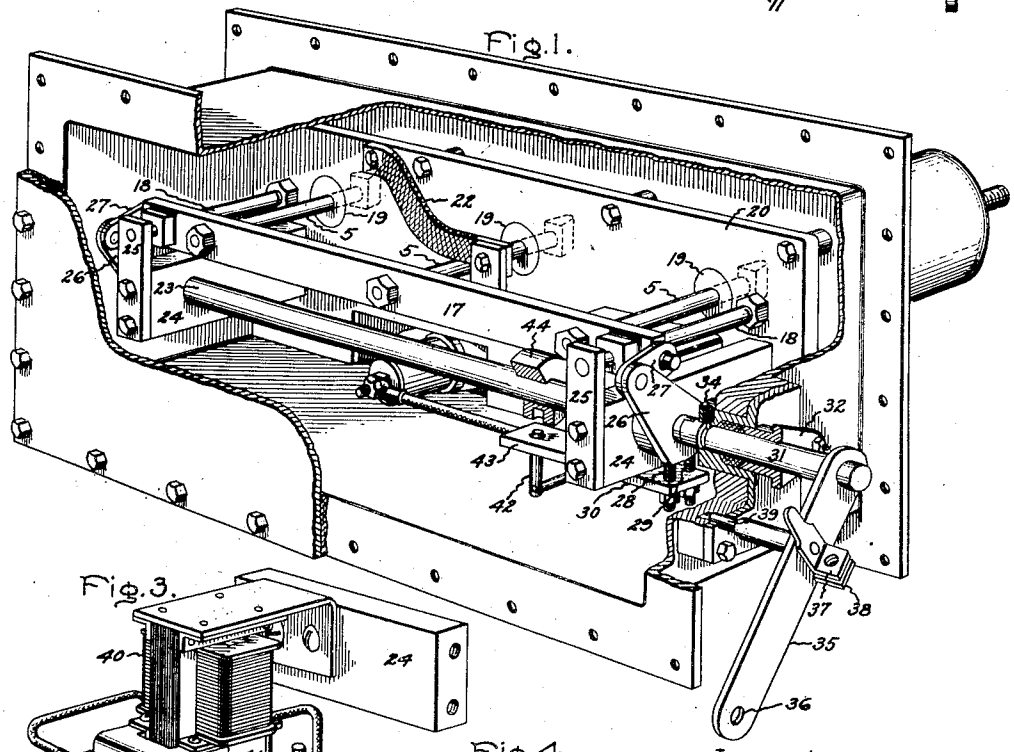
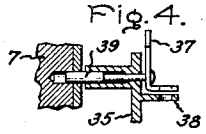


Fig. 3.

Fig. 4.



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Patented Jan. 31, 1939

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UNITED STATES PATENT OFFICE

2,145,720

SWITCHING APPARATUS

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Application June 25, 1937, Serial No. 150,390

5 Claims. (Cl. 200—16)

My invention relates to improvements in switching apparatus for electric systems and more particularly low voltage network distribution systems. In such systems which are used principally in metropolitan areas, it is customary to place the transformers in vaults. Because of property values and building costs, such vaults are much restricted as to size. Also because of the fire hazard, it has become necessary to use a non-inflammable insulating liquid in the transformers and appurtenances thereto. Such liquids are relatively costly so the question of compactness is further accentuated. Moreover, for safety in inspection and maintenance, it is desirable to ground the high voltage side of the transformer and the line conductors connected thereto. It must not, however, be possible to do this while the transformer is energized since it is not economically feasible to build the grounding switches with any large circuit rupturing capacity. In the usual arrangement of grounding switches, two sets of insulators have been used, one set on which the contacts are mounted in the switching chamber and another set giving entrance to the transformer tank from the switching chamber. Such arrangements are bulky and incompatible with the space limitations for installation not only because of the limited vault size but also the necessity for entrance to and exit from the vault through a comparatively small opening. In accordance with my invention, I provide an improved switching apparatus which uses only one set of insulators whereby to attain compactness, economy and reduction in weight because of less equipment, ease of manufacture and necessity for less of the relatively costly non-inflammable insulating liquid. Further, in accordance with my invention, I provide a switching apparatus which is removable from its enclosing structure on the transformer tank without the necessity for removing any insulating liquid from the transformer whereby the inspection and maintenance of structure is greatly simplified. Also, in accordance with my invention, I provide an improved switching apparatus which is not operable to ground the transformer while the latter is energized. These, and other objects of my invention, will appear in more detail hereinafter.

My invention will be better understood from the following description when considered in connection with the accompanying sheet of drawings, and its scope will be pointed out in the appended claims.

In the accompanying drawing, Fig. 1 illustrates in perspective an embodiment of my invention with parts broken away to show the structural features; Fig. 2 is a horizontal sectional view, with parts broken away, of the embodiment of my invention shown in Fig. 1 as applied to a transformer casing; Fig. 3 is a perspective view of a detail of the embodiment of my invention shown in Fig. 1; Fig. 4 is a detail in section of a locking arrangement for use with switches embodying my invention; and Fig. 5 is a detail of another type of contact construction suitable for use in my invention.

In the illustrated embodiment of my invention, one or more movable contacts 5 provided with contact tips 6, are positioned on one side of a support 7 for movement through openings 8 therein to engage co-operating stationary contacts 9, which are secured within hollow insulators 10 mounted over the openings 8 on the other side of the support. Instead of the wedge and jaw type of contacts, other suitable forms may be used as, for example, the bayonet and socket co-operating contacts 6' and 9' shown in Fig. 5. The support 7 may take the form of a hollow box-like or enclosing structure provided with a cover 11. This structure is suitably adapted, as shown, to be secured over an opening in the side or top of a transformer casing 12 with the insulators 10 projecting into the casing. Inasmuch as the transformer construction per se forms no part of my invention, I have in Fig. 1 merely illustrated schematically, for clarity in understanding the use of my invention, low voltage windings 13 which supply a network, not shown, and high voltage windings 14 which are energized from a feeder comprising phase conductors 15. The high voltage windings 14 are connected to terminals 16 forming a part of the stationary contacts 9 and closing the ends of the insulators 10.

For actuating the movable contacts simultaneously, they are suitably secured to a crosshead 17 which may be of metal such as steel and which is slidably mounted on guide rods 18. The free ends of the contacts 5 are suitably guided as by bushings 19 set in a guide plate 20 which is suitably secured to the support 7. In order to insure a good current bonding and grounding action when the contacts 6 and 9 are closed, the crosshead 17 may be backed up on the contact side by a copper bar 21 from which a suitable grounding lead 22 extends to the plate 20 which is grounded through the transformer casing.

For actuating the crosshead 17 to effect engagement and separation of the contacts 5 and

9, I provide suitable means such as an operating shaft 23 which is suitably journaled in blocks 24, secured to the plate 20. Plates 25, secured to the blocks 24, may be used to support one end of the guide rods 18. The shaft 23 is provided with one or more cranks 26 which are pivotally connected to the crosshead 17 through links 27 whereby to reciprocate the crosshead when the shaft is turned. In order to control the angular movement of the shaft 23 for the necessary contact engagement and separation, the shaft end of one of the cranks 26, the right hand crank as shown in Fig. 1, may be suitably shaped to engage, in one position or the other, one of the adjustably positioned stops 28 and 29 which are mounted on a plate 30 suitably secured to the right hand block 24.

For actuating the operating shaft 23, I provide an extension shaft 31 which projects through a fluid tight bushing 32 into the supporting structure 7 and has a slotted end 33 for engaging a tongue on the end of the operating shaft. To retain the extension shaft 31 in engagement with the operating shaft, a threaded locking pin 34 may be screwed into the supporting structure to engage a recess in the extension shaft. Near the outer end of the extension shaft, there is secured thereto an operating lever 35, the end of which may be provided with an opening 36 to which a flexible cord such as a rope may be secured so that the switch can be remotely operated from the outside of the usual vault which houses the transformer to ground the transformer without the necessity of entering the vault and possible danger attendant thereon in the event of unusual or unknown conditions prevailing at the time it is desired to operate the switch. The switch may be locked in the open position, as shown, by inserting a padlock through openings in co-operating members 37 and 38 mounted on the lever 35. As shown more clearly in Fig. 4, the locking member 37 is slidably positioned on the lever 35 and is provided with a projecting end 39 which is adapted to engage a recess in the support 7. When thus engaged, a padlock through the registering openings in the members 37 and 38 effectively prevents any actuation of the shaft 23.

In order to prevent operation of the switch to the grounding position while the transformer is energized, means are provided for locking the shaft 23 against turning while the switch is open and the transformer is energized. As shown, this means comprises an electromagnet 40 which may be bracketed on one of the blocks 24 and whose armature 41 is arranged to actuate a locking member such as a pin 42. This pin is guided by a plate 43 so as to enter an opening in a collar 44 on the shaft 23 when the switch is open. The movement of the armature to the unattracted position may be by gravity or by spring action and is limited by a plate 45, shown in Fig. 3. Also, as illustrated, the electromagnet 40 has its winding connected to be energized by the voltage to ground of one leg or winding 13 of the low voltage side of the transformer, a lead 46 being brought through an insulator 47 mounted on the support 7 to a lead 48 connected to one terminal of the electromagnet winding. The other terminal of the winding may be grounded on the frame mechanism at 49, as shown. With this arranagement, it will be obvious that while the transformer is energized, either from the high voltage side or the low voltage side, the pin 42, actuated by the electromagnet 40, will engage the recess in the collar 44 whereby to prevent any operation of the switch. When the electromagnet 40 is de-energized, the switch may be closed to ground the transformer by first moving the member 37 so as to disengage the portion 39 thereof from the support 7 whereupon an upward pull, as viewed in Fig. 1, on the lever 35 moves the contact tips 6 to engage the contacts 8.

With apparatus embodying my invention, it will be apparent that the switching mechanism may be readily removed without the necessity of drawing off insulating fluid from the transformer. To remove the mechanism, the insulating fluid, if any, may be drained from the supporting structure 7. The cover plate 11 is removed, and the lead 48 disconnected. The retaining pin 34 is then backed off sufficiently to permit the extension shaft 31 to be withdrawn from engagement with the tongue on the operating shaft 23. Then merely by unscrewing the bolts which secure the base plate 20 to the supporting structure 7, the switch-operating mechanism, including the movable contacts 6, may be withdrawn. When this is done, the condition of the contacts 9 may also be examined. The accessibility and compactness of the arrangement is, therefore, obvious. When the switch enclosing structure 7 is mounted on the side of the transformer casing, this structure may be filled with insulating fluid. When the switch is mounted on the cover of the transformer casing, the insulators 10 extend into the transformer insulating liquid above the level of the contacts, but the enclosing structure 7 itself does not necessarily have to be filled with insulating liquid.

While I have shown and described my invention in considerable detail, I do not desire to be limited to the exact arranagements shown but seek to cover in the appended claims all those modifications that fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In an electric switch adapted for use with a transformer having a casing provided with an opening, a support provided with an opening and adapted to be secured across the opening in the transformer casing, a movable contact, actuating means for moving said contact through the opening in said support, said movable contact and said actuating means being mounted on the support on the side thereof away from the transformer casing, a hollow insulator mounted over the opening in said support on the side thereof toward the transformer casing and extending into the opening in the transformer casing, and a contact mounted within said hollow insulator in a position to be engaged by said movable contact upon movement thereof in one direction.

2. In combination with a transformer casing provided with an opening, a fluid tight structure having one side secured across the opening in said casing and provided with a plurality of openings, a plurality of hollow insulators respectively mounted on the outside of said structure over the openings on the side thereof secured to said casing, a terminal closing the end of each insulator and extending into the transformer casing, a contact within each insulator conductively connected to the insulator terminal, a co-operating movable contact for each of said fixed contacts mounted within said structure for movement to engage the fixed contact in the corresponding insulator and means within said structure for actuating said movable contacts.

3. In combination with a transformer casing provided with an opening, a support secured across the opening in said casing and provided with a plurality of openings, a plurality of hollow insulators respectively mounted over the openings in the support on the side thereof toward the transformer casing and extending into the casing through the opening therein, a fixed contact mounted within each insulator at the end thereof extending into the transformer casing, a co-operating movable contact for each of said fixed contacts mounted on the side of said support away from the transformer casing for rectilinear movement relatively to the corresponding fixed contact, and means for actuating said movable contacts mounted on said support.

4. In combination with an electrical apparatus casing provided with an opening, a switch enclosing structure having one side secured across the opening in said casing and provided with an opening, said casing and structure being at ground potential, a hollow insulator mounted on the outside of said structure over the opening on the side of the structure secured to said casing so as to project into the casing, a terminal closing the end of said insulator and extending into said casing, a contact within said insulator conductively connected to the insulator terminal, a cooperating movable contact for said fixed contact mounted within said structure for movement to engage the fixed contact in the insulator, means within said structure for actuating said movable contact, and means including a removable cover on said structure for providing access to said contacts and said actuating means without removing the structure from the casing.

5. In an electric switch adapted for use with an electrical apparatus having a casing provided with an opening, a switch enclosing structure having one side adapted to be secured across the opening in said casing and provided with a plurality of openings, said structure being at substantially the same potential as the casing when secured thereto, a plurality of hollow insulators respectively mounted on the outside of said structure over the openings on the side thereof secured to said casing so as to project into the casing when said structure is secured thereto, a terminal closing the end of each insulator and extending into said casing, a contact within each insulator conductively connected to the terminal, a cooperating movable contact for each of said fixed contacts mounted within said structure for movement to engage the fixed contact of the corresponding insulator, means within said structure for actuating said movable contacts, and means for obtaining access to said contacts and actuating mechanism while said structure is in position on said casing without entry into the casing.

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