Jan. 5, 1965 E. B. GORMAN ETAL 3,164,694

DOUBLE BREAK HIGH VOLTAGE DISCONNECT SWITCH

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FIG. 1

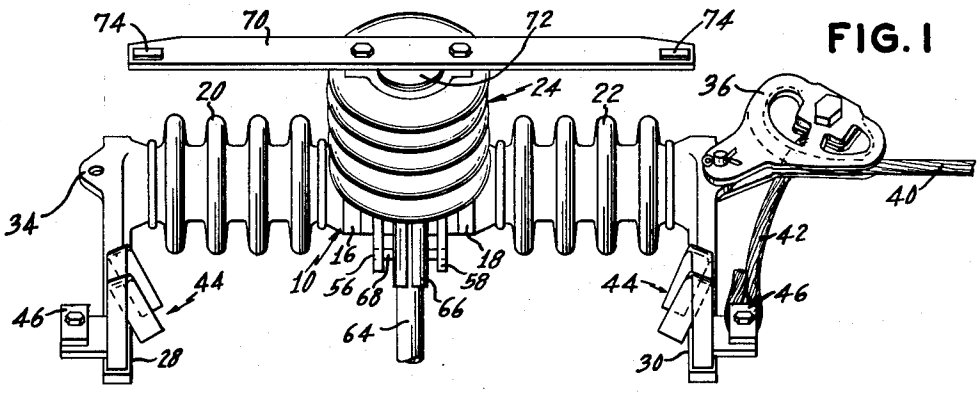
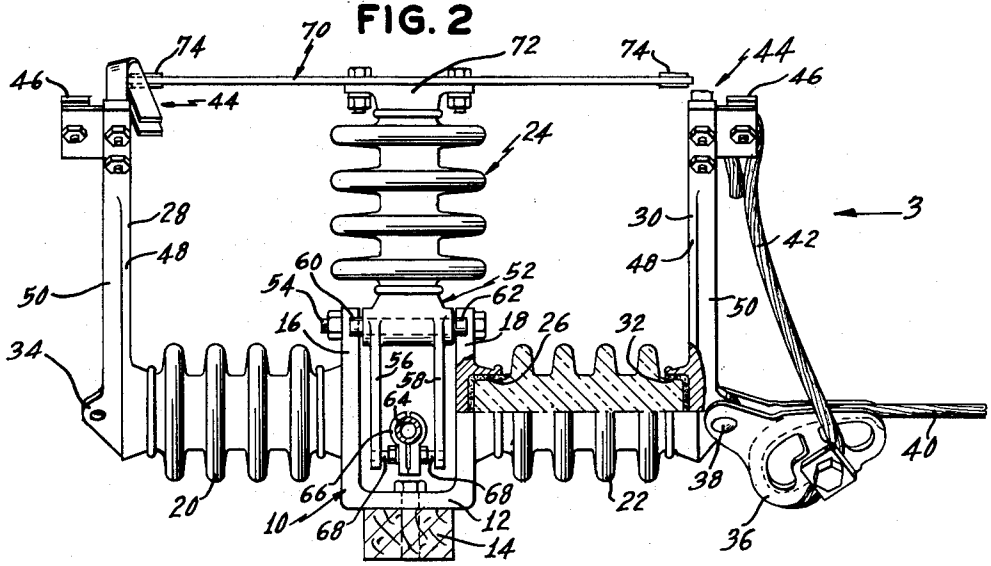


FIG. 2



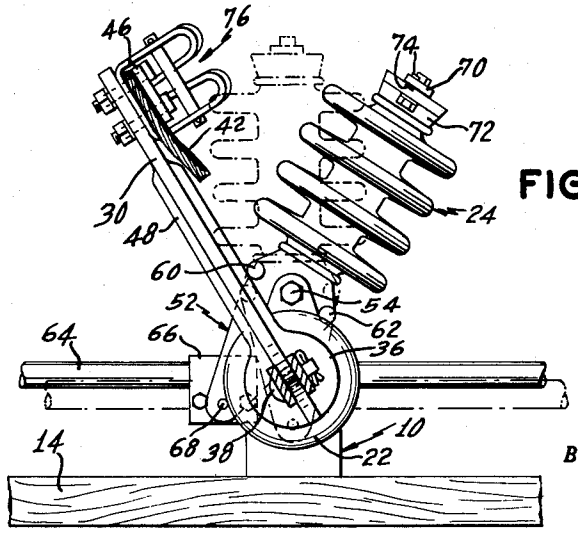


FIG. 3

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FIG. 4

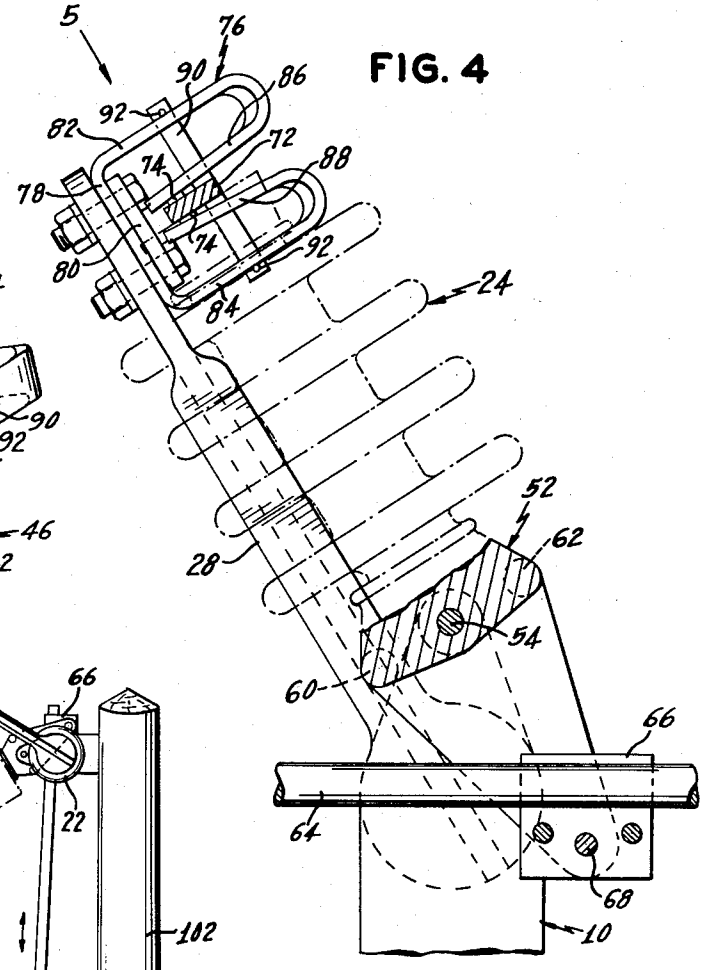


FIG. 5

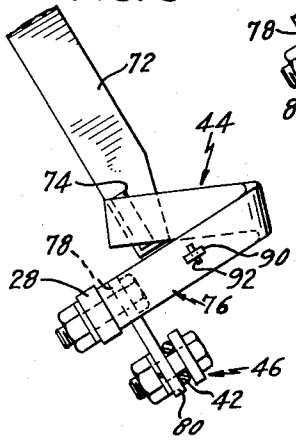
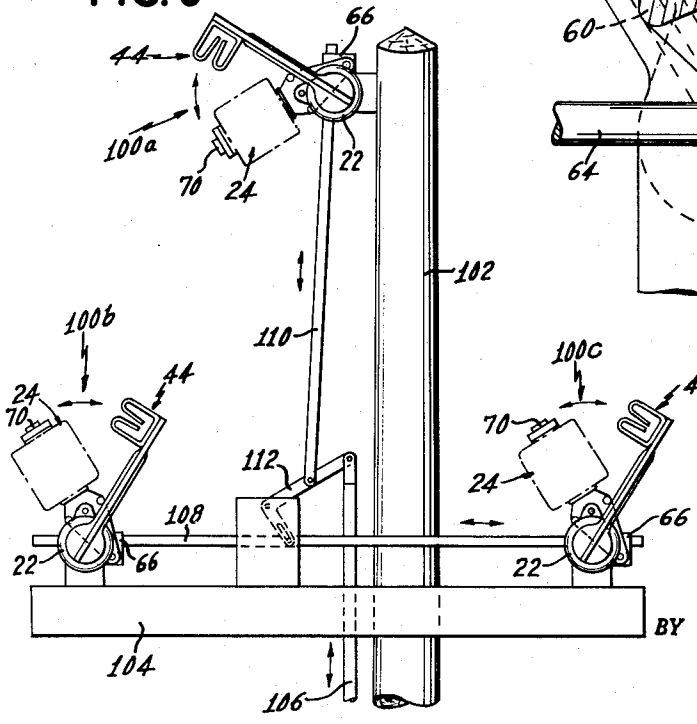


FIG. 6



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DOUBLE BREAK HIGH VOLTAGE DISCONNECT SWITCH

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8 Claims. (Cl. 200—48)

This invention relates to disconnect switches and more particularly to disconnect switches of the high voltage type for transmission lines.

Disconnect switches are widely used to de-energize transmission lines under no load conditions. Additionally they are used to sectionalize high-voltage electrical equipment for various purposes such as maintenance and repair. The illustrative embodiment of the invention described below is intended for the type of services in which tilting-insulator single-break switches are currently used, but has certain advantages over such switches.

It is an object of this invention to provide a novel compact and economical double-break high voltage disconnect switch.

It is another object of this invention to provide a high voltage disconnect switch having a simplified mounting arrangement and which is adopted to varied installation or mounting requirements. A related object is to provide a disconnect switch well adapted to withstand mechanical tension imposed by transmission lines anchored thereto.

It is a further object of this invention to provide an improved contact structure for use in disconnect switches.

The above and other objects and advantages are achieved in an illustrative embodiment of the invention described in detail below and shown in the accompanying drawings. This embodiment includes a switch base having a general U-shape with a bight portion for attachment to the support structure and with a pair of upstanding legs. Aligned insulators extend in opposite directions from the legs of the U-shaped base, and these insulators carry transmission-line anchors. A movable insulator assembly carrying a bridging contact member is pivotally supported between legs of the switch base for rocking movement. Fixed contact arms are mounted on the insulators, in position to be engaged by the bridging contact member. Means are provided for moving the rocking insulator assembly between the "open" and "closed" position of the contact member.

For a better understanding of the invention, reference is made to the following description of an illustrative embodiment that is shown in the accompanying drawings, in which:

FIG. 1 is a plan view of the illustrative embodiment of the invention, shown in the contact-open position;

FIG. 2 is a front view of the switch of FIG. 1 with the movable contact-supporting insulator in the vertical, intermediate, position;

FIG. 3 is an end view taken in the direction of the arrow 3 in FIG. 2;

FIG. 4 is a vertical view, partially in cross-section, showing the switch in closed position and on a larger scale than FIGS. 1–3, with some parts omitted and other parts broken away;

FIG. 5 is a fragmentary view taken in the direction of the arrow 5 in FIG. 4; and

FIG. 6 is a view of a typical installation of the illustrative embodiment for sectionalizing a three phase transmission line.

Referring to the drawings, the illustrative embodiment includes a strong and rigid substantially U-shaped metal member 10 which may be considered as the switch base. The base 10 is secured by its bight portion 12 to the cross

arm 14 of a supporting structure in a typical installation of the switch. Upstanding legs 16 and 18 act as supports for respective insulator assemblies 20 and 22, and legs 16 and 18 also pivotally support the rocking insulator assembly 24. The insulator assemblies 20 and 22 are secured to complemental formations integral with the legs 16, 18 of the base 10 by ceramic cement 26 (see FIG. 2). The longitudinal axes of the insulators are coaxial and are perpendicular to the support legs 16, 18.

Fixed contact arms 28 and 30 are connected by ceramic cement 32 to the ends of the respective insulator assemblies 20, 22. The contact arms are provided with a cable clamp mounting portion 34 which is so arranged that direction of pull of the transmission line 40 will be substantially in line with the longitudinal axis of the insulators. Cable clamps 36 are secured to the contact arms at the mounting portion 34 by a fastener 38. Transmission line 40 is anchored by the clamp 36, transferring the pull to the insulators. Connecting wire 42 extends between the clamp 36 and the stationary contact structure 44 where it is held by a clamp 46. The structure of the fixed contacts 44 will be discussed in greater detail below. The fixed contact arms 28 and 30 are provided with strengthening rib portions 48 and 50.

The rocking insulator assembly 24 is secured to a bifurcated metal yoke 52 by ceramic cement. Yoke 52 is mounted on the switch base 10 by pivot 54. The depending legs 56 and 58 of yoke 52 are parallel to and spaced inwardly from the legs 16 and 18 of the switch base 10. Stop members 60 and 62 are secured to the yoke 52 and cooperate with the base 10 to limit the travel of the rocking insulator assembly 24 (see FIG. 3) in the circuit-open and circuit-closed positions. Operating rod 64 passes between the legs 56 and 58 of the yoke 52 and carries a clamp 66. The clamp is connected, in turn, to the yoke 52 by universal joints 68, represented schematically in FIG. 2. When the rod 64 is moved, by means not shown, the rocking insulator assembly 24 is caused to move about the pivot 54.

Bridging contact member 70 or blade, of a highly conductive metal such as copper, is supported by the rocking insulator assembly 24 for movement between closed-circuit and open-circuit positions. In the closed position, a circuit is established between the opposed stationary contacts 44 through the bridging contact member 70. The longitudinal axis of the bridging member is parallel to the longitudinal axes of the fixed insulator assemblies 20 and 22 and when moved to the open position produces a pair of series breaks of the same length measured between the ends of the bridging member 70 and the associated, respective fixed contacts 44. In the illustrative embodiment member 70 is fixed to a carrier 72 which is bonded by ceramic cement to the rocking insulator assembly 24. The bridging contact member is provided with inserts 74 of silver for lowered contact resistance.

FIGS. 4 and 5 illustrate in some detail the presently preferred form of construction of the stationary contact structures 44 which are companion to the bridging contact member 70. Each of the contact structures includes a contact member 76 which is formed out of a strip of copper or similar material of proper stiffness, resilience and conductivity. Each contact member 76 includes a central base or mounting portion 78 which is secured by the base 80 of wire clamp 46 to the support arm 28 (30). Upstanding legs 82 and 84 extend from the ends of portion 78, being formed by right-angle bends. From the free ends of these legs 82, 84 there are further reverse-bent contact portions 86 and 88 that confront each other. Contact elements 74 of the bridging contact member 70 are resiliently gripped between these contact portions 86 and 88. A tie-bar 90 extends through legs 82 and 84, and pins 92 in the extremities of this tie-bar bear against

the outer surfaces of legs 82 and 84 so as to restrict those legs against mutual separation. The confronting portions of elements 86 and 88 are closer together than the thickness of the blade 70 with its contact surfaces 74 when the switch is open; and when blade 70 drives into the position illustrated in FIG. 4 it is resiliently gripped by contact portions 86 and 88. This is a firm degree of resilience, which is provided by virtue of the tie-bar arrangement described. Portions 86 and 88 extend from bends at the ends of legs 82 and 84 that are formed at a slant angle to those legs, so that portions 86 and 88 slant in relation to those legs and bypass tie-bar 90. Consequently there is no problem of interference between bridging blade 70 and tie-bar 90.

A multi-circuit triangular configuration switching installation is shown in FIG. 6 employing the described illustrative embodiment of the invention. Switch 100*a* is mounted on the pole 102 and switches 100*b* and 100*c* are mounted on the cross arm 104 that is suitably secured to the pole. The switches are operatively connected together and to a main operator bar 106 by linkage including horizontal rod 108, vertical rod 110 and a pivoted bell crank 112 on the cross arm. (In FIGS. 1–4 rod 64 represents rods 108 and 110 in FIG. 6). Reciprocation of the main operator 106 pivots the bell crank 112, driving the horizontal and vertical rods to cause the movement of the respective rocking insulator assemblies 24 between circuit "open" and "closed" positions. The rod 106 may be reciprocated manually or automatically from a position beneath the switch structure, or, by use of suitable mechanisms, from a remote position.

The operation of the switch may be best described by referring to FIGS. 1, 2 and 3. The rocking insulator 24 is inclined at an angle of approximately 30° with respect to the vertical in the circuit-open position. At this time the operator rod 64 is in the position shown by the solid line in FIGURE 3. Movement of the rod 64 is translated to pivotal movement of the insulator 24 through the operation of the universal joints 68 which couple the yoke 52 to the clamp 66 on the rod. Movement of rod 64 operates the switch to its closed position by tilting insulator 24 about pin 54 through the aforementioned angle to the vertical position shown in phantom in FIG. 3 and then through an additional angle of approximately 30° to the closed-circuit position. The switch blade 70 engages the fixed contact structures 44 toward the end of the closing stroke of the rod 64. The contact ends 74 of the blade 70 are driven between the reverse-bend confronting contact portions 86 and 88 of the contact element 76. Tie-bar 90 restrains the upstanding legs 82, 84 of the contact element 76 from separating. This results in increased contact pressure over that which would be produced by the legs without the tie bar because they would otherwise be deflected without restraint. The depending contact engaging portions 86, 88 extend from the contact element 76 at a slant angle and the blade 70 is free to enter therebetween without interference with the tie bar 90. The slant angles are arranged so that the contact portions 86, 88 are inclined inwardly toward the path of moving arm 70. The penetration of the contacts 74 between the contact portions 86, 88 is limited by the engagement of the yoke carried stops 60 with the legs 16, 18 of the switch base 10. Therefore, the only forces on the free end of insulator assembly 24 are those incident to the driving of the blade 70 between the contact portions 86 and 88. The open position of the blade 70 is determined by the engagement of the stops 62 and the legs 16 and 18 as the switch is driven open by the rod 64.

The pull or tension of the transmission lines is transmitted to the mounting structure by the relatively heavy base 10. When the switch is installed in a transmission line circuit the transmission lines are substantially coaxial with insulators in contrast to switches employing vertical terminating insulators. The described illustrative embodiment mounting the three switch elements i.e. fixed insulators 20, 22 and tilting insulator 24 in a confined area is particularly advantageous since it obviates the necessity for an elaborate mounting structure capable of absorbing the transmission line stresses.

The compactness of the aforedescribed switch element is particularly apparent in the triangular, multi-circuit, configuration shown in FIG. 6 as can be seen it is possible to mount the switch 100*a* directly on the pole top without requiring additional transmission line terminating insulators.

While one embodiment of the invention has been shown and described it will be apparent to one skilled in the art that various modifications and changes may be made without departing from the spirit and scope of the invention.

What we claim is:

1. A high voltage disconnect switch including an elongated insulating and supporting structure having laterally spaced insulators whose longitudinal axes extend in generally opposite directions, means at the outer end of each of said insulators for anchoring transmission lines extending in said generally opposite directions, fixed contact arms upstanding from the outer ends of said insulators, a movable upstanding insulator pivotally carried by said elongated supporting structure midway between said contact arms and extending in the direction which bisects the angle formed by the longitudinal axes of said insulators, and a bridging contact member carried by said insulator and cooperable with said contact arms.

2. A disconnect switch including a U-shaped mounting base having upstanding legs, oppositely extending transmission-line anchoring insulators fixed to said base legs, respectively, and aligned along a common axis, a movable insulator assembly pivotally mounted at one end between said base legs for movement between open circuit and closed circuit positions, a bridging contact member fixed to the free end of said movable insulator and having its longitudinal axis parallel to but offset from the common axis of said fixed insulators, fixed contact structures mounted on the free ends of said fixed insulators for cooperation with said contact member in the closed circuit position of said movable insulator, and means for pivoting the movable insulator between said open circuit and closed circuit positions.

3. A disconnect switch including a U-shaped mounting base having upstanding legs, a pair of oppositely extending transmission-line anchoring insulators fixed to said base legs and aligned along a common axis, a bifurcated yoke member pivotally mounted at one end between said base legs and having depending portions, a third insulator fixed at one end to said yoke for movement between open circuit and closed circuit positions, stops on said yoke for cooperation with said base for delimiting the movement of said yoke in either of said positions, a contact member fixed to the free end of said third insulator and having its longitudinal axis parallel to but offset from the common axis of said fixed insulators, fixed contact structures mounted on the free ends of said fixed insulators for cooperation with said contact member in the closed circuit position of said movable insulator, and driving means engaging the depending portion of the yoke for moving said third insulator between said open circuit and closed circuit positions.

4. A disconnect switch including a U-shaped mounting base having upstanding legs, oppositely extending transmission-line anchoring insulators fixed at one end to said base legs with their longitudinal axes aligned, a movable insulator assembly pivotally mounted at one end between said base legs for movement between open circuit and closed circuit positions, a bridging contact member fixed to the free end of said movable insulator, fixed contact structures mounted on the free ends of said fixed insulators and having respective contact structures for cooperation with the ends of said bridging contact member in the

closed circuit position of said movable insulator, each said contact structure including a metal strip having a central mounting portion, upstanding legs extending integrally from said mounting portion, and reverse-bend confronting contact portions extending from said upstanding portions respectively, a tie-bar extending directly from one of said upstanding portions to the other so as to fix said portions against mutual separation, and said reverse-bend contact portions extending laterally past said tie-bar and receiving an end portion of said bridging contact member arm.

5. A switch including a movable switch blade and a companion contact engageable by the switch blade, said companion contact including a metal strip having a central mounting portion, upstanding legs extending integrally from said mounting portion, and reverse-bend confronting contact portions extending from said upstanding portions respectively, a tie-bar extending directly from one of said upstanding portions to the other so as to fix said portions against mutual separation, and said reverse-bend contact portions extending laterally past said tie-bar and receiving therebetween contact portions of said blade in the closed condition of the switch.

6. A switch including a movable switch blade and a companion contact engageable by the switch blade, said companion contact including a metal strip having a central mounting portion, upstanding legs extending integrally from said mounting portion, and slant-angled reverse-bend confronting contact portions extending from said upstanding portions respectively, a tie-bar extending directly from one of said upstanding portions to the other so as to fix said portions against mutual separation, and said slant angled reverse-bend contact portions extending laterally past said tie-bar and inclined toward said switch blade for receiving therebetween contact portions of said blade in the closed condition of the switch.

7. A disconnect switch including a U-shaped mounting base having upstanding legs, oppositely extending transmission line anchoring insulators fixed to said base legs with their longitudinal axes aligned, a movable insulator assembly pivotally mounted at one end between said base

legs for movement between open circuit and closed circuit positions, a bridging contact member fixed to the free end of said movable insulator, fixed contact structures mounted on the free ends of said fixed insulators for cooperation with said contact member in the closed circuit position of said movable insulator, said contact structures each including a companion contact engageable by one end of said contact member, said companion contact including a metal strip having a central mounting portion, upstanding legs extending integrally from said mounting portion, and slant-angled reverse-bend confronting contact portions extending from said upstanding portions respectively, a tie-bar extending directly from one of said upstanding portions to the other so as to fix said portions against mutual separation, and said slant angled reverse-bend contact portions extending laterally past said tie-bar and inclined toward said contact arm for receiving therebetween contact portions of said arm in the closed condition of the switch, and means for pivoting the movable insulator between said open circuit and closed circuit positions.

8. A disconnect switch including a mounting base, oppositely extending transmission line anchoring insulators fixed to the opposite sides of said base, a movable insulator assembly pivotally mounted at one end on said base in a plane which generally bisects the angle formed by the longitudinal axes of said insulators, a bridging contact member fixed to the free end of said movable insulator and having each of its opposite ends extending in a direction generally parallel to but offset from the axis of one of said insulators, fixed contact structure mounted on the free ends of said fixed insulators for cooperation with said bridging contact member when said movable insulator is in a closed position, and means for pivoting said movable insulator between said closed position and an open circuit position.

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