

June 10, 1958

A. C. SCHWAGER
CIRCUIT INTERRUPTING AND ISOLATING MEANS
FOR HIGH VOLTAGE CIRCUITS

2,838,637

Filed Oct. 15, 1956

3 Sheets-Sheet 1

Fig. 1.

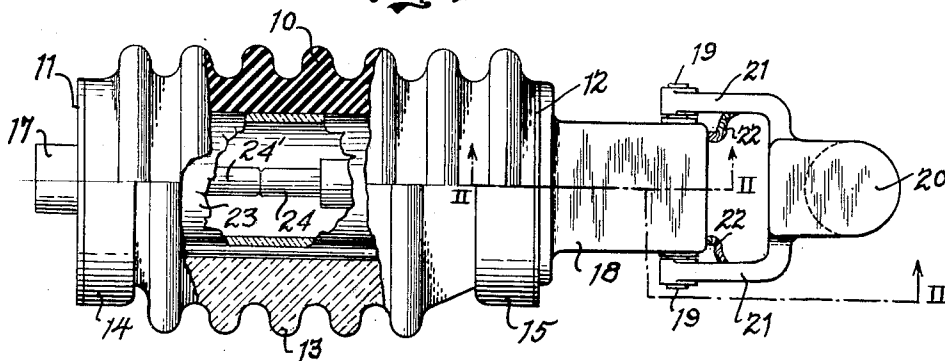
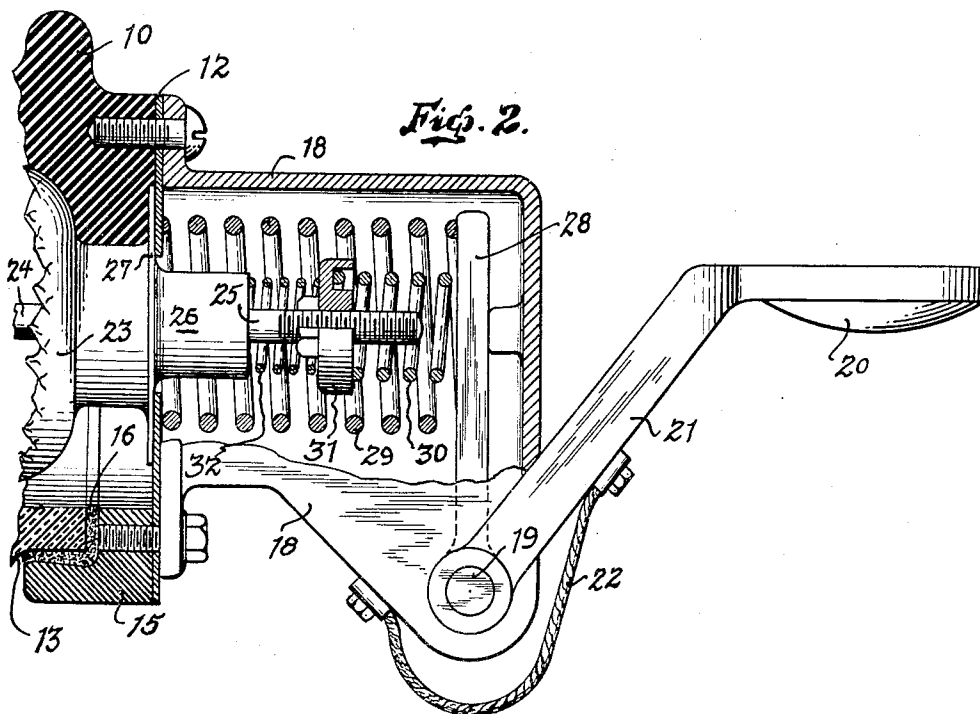


Fig. 2.



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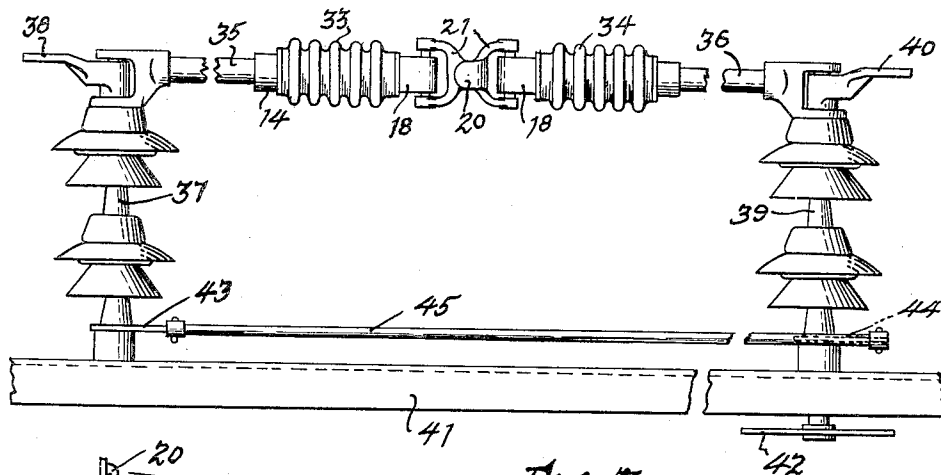


Fig. 3.

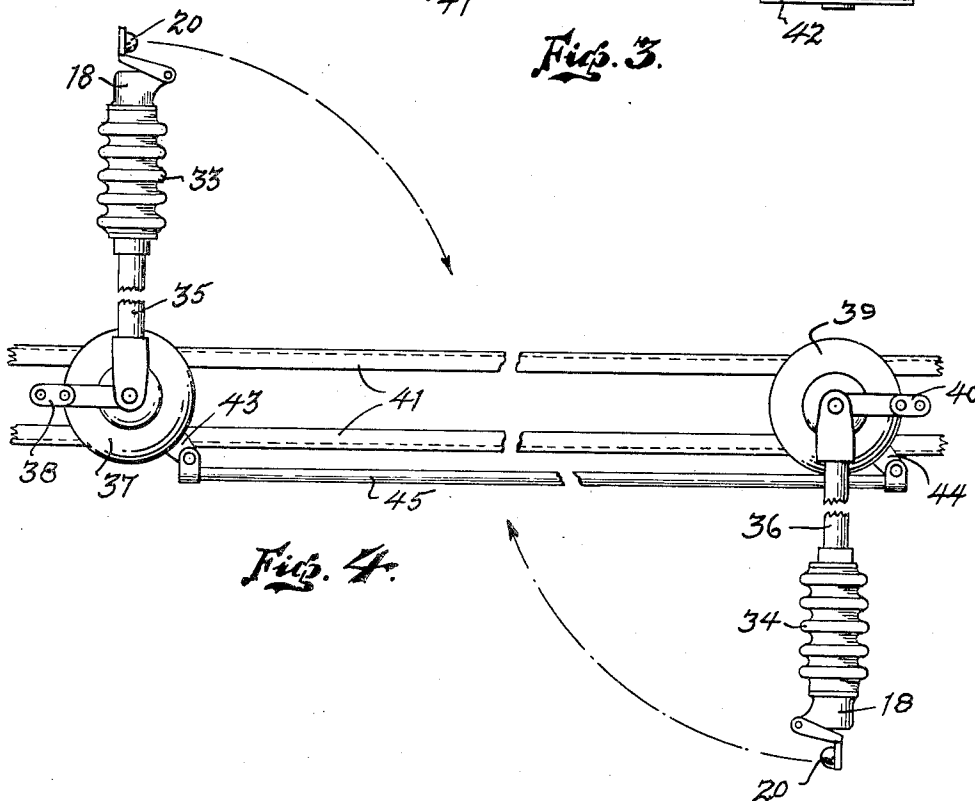


Fig. 4.

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3 Sheets-Sheet 3

Fig. 5.

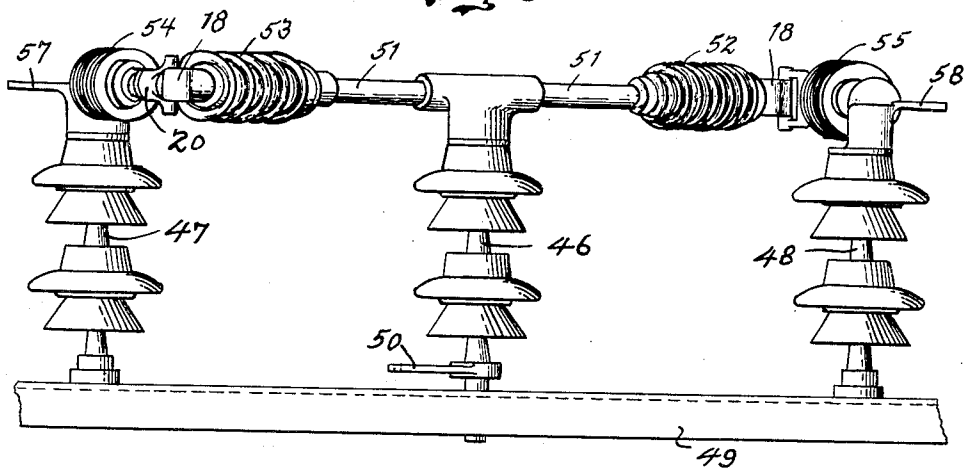
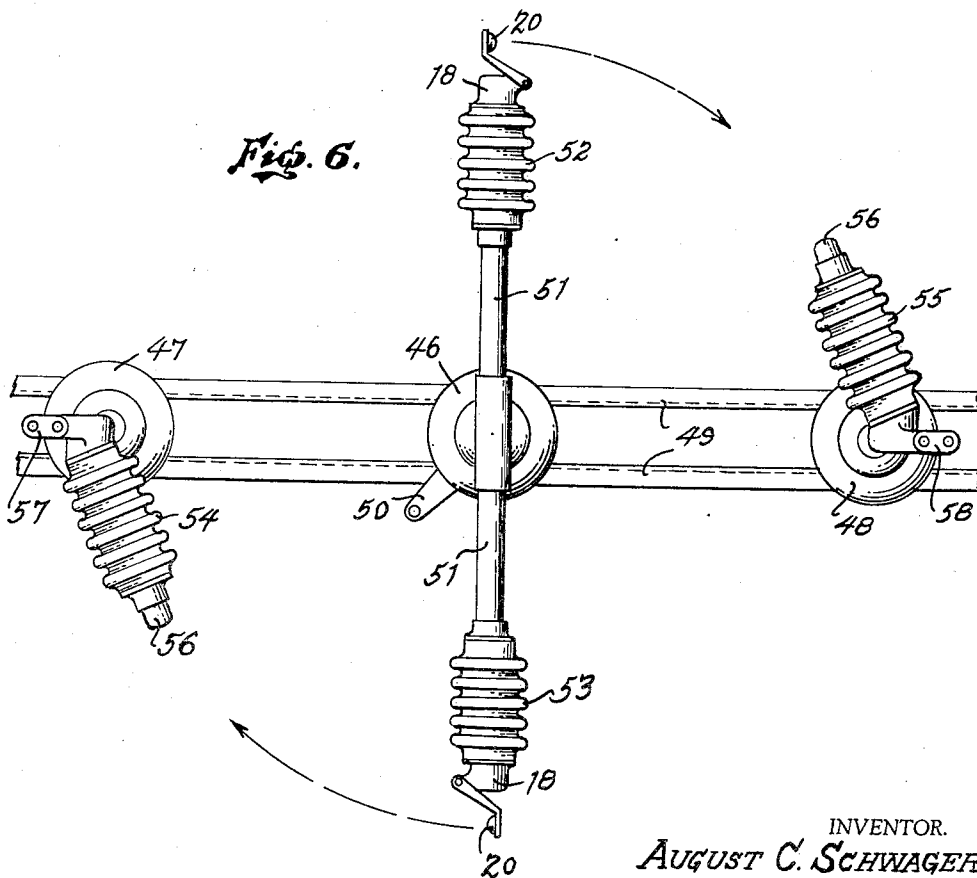


Fig. 6.



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2,838,637

CIRCUIT INTERRUPTING AND ISOLATING MEANS FOR HIGH VOLTAGE CIRCUITS

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Application October 15, 1956, Serial No. 615,837

8 Claims. (Cl. 200—145)

The present invention relates to a high voltage circuit interrupting and isolating switching means and more particularly to a novel arrangement in which a high voltage vacuum insulated circuit breaker is mounted upon and operated in series circuit with a circuit isolating air break switch blade.

The main object of my invention is to provide a new and novel arrangement in which a high voltage vacuum insulated arc quenching circuit breaker is mounted upon and/or operated in series circuit with a circuit isolating switch blade of conventional design in a practical, efficient and effective manner.

Another object of the invention is to provide a high voltage circuit interrupting switch having circuit interrupting contacts enclosed in a vacuum maintaining envelope which can be mounted upon a circuit isolating air break switch blade and operated in series circuit with said switch blade to produce an arc free interruption in the circuit to be isolated by the air break switch blade.

Another object of the invention is to provide a high voltage circuit interrupting circuit breaker having relatively movable contacts enclosed within an evacuated envelope with terminal connections extending through the walls of said envelope and which can be mounted in series circuit with an air break circuit isolating switch blade and controlled by the operating movements of said switch blade.

Another object of the invention is to provide an operating means for the circuit controlling contacts of a vacuum insulated circuit breaker of the type having its contacts enclosed in a fragile glass envelope with an encapsulation completely surrounding said envelope as is illustrated for example in a co-pending application filed by Henry H. Schwager, Serial Number 606,265, filed August 27, 1956, entitled, "Encapsulated Vacuum Insulated Circuit Breaker," and assigned to the assignee of this application.

A further object of the invention is to provide an operating arrangement for vacuum insulated circuit breaker carried by and operating in series circuit with a conventional switch blade or the like in which a high air break contact pressure is established between a cooperating contact and the circuit isolating switch blade and a relatively lower contact pressure is established between the contacts of the vacuum insulated circuit breaker.

Another object of the invention is to provide an arrangement similar to that set forth in my co-pending application Serial Number 610,933 filed September 20, 1956 and entitled, "High Voltage Circuit Interrupting and Isolating Apparatus," but wherein the vacuum insulated circuit breaker operating force exerted by the supporting switch blade is applied laterally rather than axially to the axis of the vacuum insulated circuit breaker by the circuit isolating switch blade.

Other objects and advantages will be in part evident to those skilled in the art and in part pointed out hereinafter in connection with the accompanying drawing, wherein

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there is shown by way of illustration and not of limitation preferred embodiments of the invention.

In the accompanying drawing wherein like figures refer to like parts throughout the several views:

5 Figure 1 is a view in side elevation showing a vacuum insulated circuit breaker unit and operating means as contemplated by this invention,

Figure 2 is an enlarged fragmentary sectional view taken along section lines II—II—II of Figure 1, looking 10 in direction of arrows,

Figures 3 and 4 are respectively a side elevation and a plan view showing an arrangement employing two vacuum insulated switches in conjunction with two oppositely swinging air break switch blades,

15 Figures 5 and 6 are respectively side and plan views showing further modifications of the invention.

The switching on high voltage transmission systems of the nature contemplated by the present invention up to the present time have for safety generally required the use of relatively larger circuit breakers in which the circuit interrupting contacts are immersed in an arc extinguishing medium such as oil or in which resort is had to the use of a blast of air, gas or a fluid with an arc confining chamber with baffles as a means for interrupting or quenching the arc which results from a separation of 25 the circuit breaker contacts. Circuit breakers of this type are not only extremely expensive, but they are bulky and require considerable space at the point of installation and when used upon high voltage power transmission lines, it is the practice to also provide a relatively long circuit isolating blade in series circuit therewith to insure against a restrike or the re-establishment of an arc between the separating oil immersed contacts, due to charging currents and/or other conditions.

35 As distinguished from the above prior practice, my present invention contemplates the employment of a vacuum insulated circuit breaker in conjunction with an air break circuit isolating switch blade which can be relied upon to interrupt and isolate high voltage power transmission line circuits with operating results comparable to the results now obtained under the same load conditions with a conventional oil circuit breaker operating in series circuit with a separately mounted air break circuit isolating switch blade.

45 For a detailed description of the invention reference is now made to the accompanying drawings wherein I have illustrated a vacuum insulated circuit breaker of the type described in United States Patent No. 2,740,869 and manufactured by Jennings Radio Manufacturing Corporation of San Jose, California. Circuit breakers of this type have been found to have an interrupting capacity with a contact separation of $\frac{5}{16}$ of an inch of approximately 30,000 volts and a current rating in the neighborhood of 2500 amperes. It has been found by actual tests 55 on a loaded high voltage power transmission line that by employing four of these vacuum insulated units arranged in series circuit and with the contacts operating substantially simultaneously that it is possible to interrupt a 120,000 volt circuit carrying 2500 amps. Recent tests have also shown that these vacuum insulated circuit breakers are capable of interrupting a current flow of several thousand amperes. It is, therefore, conceivable that the arrangements here shown are not limited to sub-station switching operations, but will be found practical as a circuit controlling means on the main lines of the system.

65 Vacuum insulated circuit breakers of the type hereinabove referred to constructed with a vacuum retaining envelope of glass are of an extremely fragile character and because of this their use has been limited mainly to indoor installations. However, as pointed out in my above identified co-pending application, I have shown a 70

construction by which these fragile vacuum insulated circuit breakers may be employed in a practical and effective manner on outdoor installations. In this arrangement the air break circuit controlling contacts of co-operating switch blades and/or a cooperating contact are brought into overlapping relation in a novel manner so that the axial contact establishing force required for the vacuum insulated circuit breaker contacts is applied in a novel manner as a part of a substantially greater force laterally exerted to provide the necessary contact pressure between overlapping switch blade contacts as they come into full circuit completing relation with each other.

Reference is now made to Figure 1 of the drawings wherein there is shown a vacuum insulated circuit breaker unit having an encapsulation and an operating means of the character here involved. In this instance the contacts of the circuit breaker are employed for the purpose of interrupting the flow of current in the line and the switch blade mounting serves to isolate the power line circuit in accordance with the practice generally employed in switching on high voltage power line transmission systems. In this figure the vacuum insulated circuit breaker is shown as having two types of encapsulation. The encapsulation in the upper half of this view, designated by the numeral 10, may be of any suitable moulded or cast insulating material; as for example, a hard setting plastic or a cast epoxy resin. The encapsulation 10 is extended between and completely fills the space between two axially separated terminal plates 11 and 12 that are respectively connected electrically to a stationary contact and a relatively movable contact disposed in axial alignment within the vacuum retaining envelope of the circuit breaker. At the lower half of this view, the numeral 13 designates an encapsulation in the form of a fired porcelain insulator unit having a cylindrical opening into which the vacuum retaining envelope of the circuit breaker may be positioned out of contact therewith. The encapsulation 13, unlike the encapsulation 10, is here shown as positioned between and secured to the terminal contact plates 11 and 12 of the circuit breaker by means of flanged collars 14 and 15.

For a detailed showing of the manner in which the encapsulations 10 and 13 are secured between the terminal contact plates 11 and 12 of the circuit breaker, reference may be had to Figure 2 of the drawings. In this view, it will be noted that the porcelain encapsulation 13 is sealed within the flanged collars 14 and 15 by means of a mastic 16. It should be here stated that except for the difference in construction between the ends of the circuit breaker unit the assemblies at the ends of the encapsulations 10 and 13 are identical to that here shown. The terminal contact plate 11 is here shown as having a cylindrical extension 17 of conducting material which may be inserted into the end of a tubular air break circuit isolating switch blade as a mounting therefor and to also provide an electrical connection between the switch blade and the stationary contact of the encapsulated circuit breaker. At the other end of the encapsulations 10 and 13, there is an outwardly disposed housing 18 of current conducting material that forms an enclosure and support for the mechanism by which the operations of the encapsulated circuit breaker contacts are controlled. At its outer end the housing 18 has a shaft 19 which is off-center with respect to the axis of the circuit breaker unit and extends at opposite sides thereof. In this particular arrangement, the shaft 19 carries a contact 20 which is disposed with its circuit making contact surface in a plane substantially in alignment with the axis of the circuit controlling contacts of the encapsulated circuit breaker. The contact 20 is formed upon a yoke having spaced arms 21 that are keyed to the extending ends of the shaft 19. To provide for a low resistance current carrying connection between the terminal contact plate 12 of the circuit breaker and the air break contact

20, there is a pair of flexible jumpers 22 that are connected between the housing 18 and the arms 21 of the yoke which carries the air break contact 20.

Reference is now made to Figure 2 of the drawing for a more detailed description of the circuit breaker operating mechanism which in this view is shown in full size. It will be understood, however, that at the unshown end of the vacuum retaining envelope, here designated by the numeral 23 and as shown by sectioned portion of Figure 1, there is a stationary contact 24' which is carried by the terminal contact 24' plate 11. Mounted for axial movement within the evacuated envelope 23, there is a moving contact 24 that engages said stationary contact. This contact 24 is moved between its circuit open and closed positions with respect to said stationary contact 24' by an operating rod 25 that extends through a metallic collar 25 having a flange 27 that is connected to the terminal plate 12 and operated as a terminal at this end of the vacuum insulated circuit breaker. With this type of vacuum insulated circuit breaker, it will be seen that the forces required to move the movable contact 24 into its circuit closed position will necessarily be applied axially upon the operating rod 25. Therefore, as pointed out in my above identified co-pending application, since different contact pressures are required between the vacuum insulated contacts and the air break contacts a special spring arrangement to be hereinafter described is required to meet these conditions. While I have in my aforesaid co-pending application disclosed and claimed an arrangement wherein the operating force for the movable contact 24 is controlled in this manner by the application of a contact pressure exerting force applied through its supporting switch blade and in axial alignment with the movable contact 24 of the circuit breaker there are many situations where the conjoint action of the vacuum insulated circuit breaker contacts and its supporting circuit isolating switch blade will not permit such a mode of operation. Therefore, to meet those other situations wherein the air break contact pressure exerting force is applied in a direction transverse to and/or substantially at a right angle to the direction of force application required by the vacuum insulated circuit breaker contacts, I have shown the yoke 21 which carries the air break contact 20, as operating through the shaft 19 as a bell crank and a lever arm 28. The lever arm 28 is engaged by a relatively strong compression spring 29 that serves by its reaction to establish a relatively high contact pressure upon the contact 20 as movement is imparted to operating rod 25 of the vacuum insulated circuit breaker. Associated with the lever arm 28 there is an inner concentrically disposed compression spring 30 that engages an adjustable collar 31 that is carried by the operating rod 25 of the circuit breaker. This inner spring 30 is of a relatively weaker nature than is the spring 29 and is so arranged and proportioned that the contact operating force exerted upon the movable contact 24 of the circuit breaker will be sufficient to establish a necessarily lower contact pressure required to complete the circuit at this point. In practice, it has been found that a pressure of about 5 pounds is sufficient between the stationary and movable contact of the vacuum insulated circuit breaker, whereas a contact pressure varying from 35 to 50 pounds may be required between the air break contact 20 and a cooperating similar contact or other circuit completing terminal. As a means for returning the movable contact 24 of the circuit breaker to its open circuit position when the air break contact 20 is out of engagement with a co-operating contact, there is a third compression spring 32 that is disposed between the stationary collar 26 of the vacuum insulated circuit breaker and the adjustable collar 31 carried by the circuit breaker operating rod 25. With the above described arrangement, it will be seen that the vacuum insulated circuit breaker as here disclosed may be mounted upon the end of a circuit isolat-

ing switch blade for operation in series circuit therewith in such a manner that the air break circuit isolating contact 20 may be brought into circuit completing relation with a corresponding contact or circuit completing terminal and establish an air break contact pressure producing movement in a direction transverse or at substantially a right angle to the direction in which the contact establishing force is applied to the contacts of the vacuum insulated circuit breaker by a circuit closing movement of the switch blade upon which it is mounted.

In Figures 3 and 4 of the drawings, there is shown an arrangement wherein two vacuum insulated circuit breaker units, designated by the numerals 33 and 34, are mounted respectively upon two oppositely disposed circuit isolating switch blades 35 and 36. The switch blade 35 is carried by an insulator stand 37 which also supports a line terminal 38 and the switch blade 36 is carried by a second insulator stand 39 which supports a second line terminal 40. These insulator stands 37 and 39 are rotatably mounted upon a support 41. The rotatable insulator stand 38 has an operating lever 42 by which rotation may be imparted thereto. Connected between lever arms 43 and 44 carried by the insulator stands 37 and 39 there is a connecting rod 45. In this showing, the connecting rod 45 is so disposed that when the insulator stand 39 is rotated counter-clockwise, as viewed in Figure 4, the insulator stand 37 will turn clockwise. When the circuit isolating switch blades 35 and 36 have been operated in this manner and brought into circuit completing alignment, the air break contacts 20 carried by the vacuum insulated circuit breaker units 33 and 34 will have come into full high contact pressure engagement. At the same time, the bell crank connection through the yoke arm 21 of the movable contact 20 and the lever arm 28 within the housing 18, will have operated the movable contact 24 of the vacuum insulated circuit breaker into circuit completing engagement with its cooperating stationary contact. Under these conditions, the required high contact pressure established between the engaging air break contacts 20 will be determined by the force applied through the operating lever 42 while, at the same time a lower contact pressure will be applied to the movable contact 24 of the circuit breaker. With the circuit isolating switch blades 35 and 36 supported and moved in the manner here indicated, it will also be seen that a maximum circuit isolating gap will be established between the air break contacts 20 at the ends of the switch blades 35 and 36.

In Figures 5 and 6 of the drawings, there is shown four vacuum insulated circuit breakers operating in series circuit with a double ended circuit isolating switch blade. In this arrangement, a single rotatable insulator stand, designated by the numeral 46, is positioned midway between two stationary insulator stands 47 and 48 that are mounted upon a suitable support 49. The rotatable insulator stand 46 has an operating lever 50 by which it may be turned about its axis. Extending transversely at the top of the insulator stand 46 there is a double ended switch blade 51 upon the outer ends of which there is mounted an outwardly extending circuit breaker unit of the type hereinabove described. These circuit breaker units, designated by the numerals 52 and 53, with their air break circuit isolating contacts 20 are mounted upon the switch blade 51 in right and left hand relation with each other. While it is conceivable that additional vacuum insulated circuit breakers such as the units 52 and 53 might be used in conjunction therewith, as here proposed, I have in this instance shown vacuum insulated circuit breaker units, designated by the numerals 54 and 55 of the type described and claimed in my co-pending application, as mounted respectively upon the insulator stands 47 and 48 in such a manner that the axially movable air break circuit completing and circuit breaker operating contacts 56 carried thereby will be directly

engaged by the pivotally mounted air break contacts 20 of the circuit breaker units 52 and 53. The insulator stand 47 also carried a line terminal 57 and the stationary insulator stand 48 carried a second terminal contact 58 by which the switching arrangement here shown may be connected in series circuit in a power line conductor. While the current carrying capacity of the individual vacuum insulated circuit breaker units 52, 53, 54 and 55 will not be increased by this arrangement, it will be seen with each circuit breaker having a voltage interrupting capacity of 30,000 volts that a total line voltage of 120,000 volts may be safely interrupted.

In these latter figures of the drawings, as in the case of Figures 3 and 5, the upper views show the circuit isolating switch blades in their circuit closed positions and the lower views Figures 4 and 6, show the switch blades with the circuit interrupting circuit breakers in an open circuit position.

While I have, for the sake of clearness and in order to disclose my invention so that the same can be readily understood, described and illustrated a specific form and arrangement, I desire to have it understood that this invention is not limited to the specific form disclosed, but may be embodied in other ways that will suggest themselves to persons skilled in the art. It is believed that this invention is new and all such changes as come within the scope of the appended claims are to be considered as part of this invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a high voltage circuit interrupting and isolating switch, the combination of a vacuum retaining envelope, an enclosed fixed contact sealed in a wall of said envelope with an exterior circuit completing terminal for mounting said envelope and said fixed contact upon a movable current conducting support, a movable contact also enclosed within said envelope, an external air break contact supporting means electrically connected to the movable contact within said envelope, an exposed stationary line terminal contact, an air break circuit completing contact mounted upon said supporting means for pivotal movement upon engagement with said exposed stationary line terminal contact and means responsive to pivotal movement of said air break contact relative to said supporting means for operating the movable contact within said evacuated envelope into a circuit closed position with respect to said fixed contact.

2. In a high voltage arc interrupting and circuit isolating switch, the combination of an elongated vacuum retaining envelope, an enclosed stationary contact sealed in a wall of said envelope, a cooperating circuit completing movable contact sealed in said evacuated envelope, an operating means for said movable contact extending externally from said envelope, a pivot forming support carried by said envelope, an air break circuit completing contact pivotally mounted upon said pivot forming support and electrically connected to said movable contact, a pivotally mounted circuit isolating switch blade, means by which said vacuum retaining envelope with said enclosed stationary and movable contact is supported in co-extending relation and electrically connected to the outer end of said pivotally mounted switch blade, and means responsive to pivotal movement of said air break contact when brought into engagement with a circuit completing terminal as said circuit isolating blade is operated into its circuit closed position.

3. In a high voltage arc interrupting and circuit isolating switch, the combination of a circuit isolating switch blade pivotally mounted upon a line terminal support, a vacuum retaining envelope mounted in co-extending relation upon the end of said switch blade, an enclosed stationary contact sealed in a wall of said vacuum retaining envelope and electrically connected to the outer end of said circuit isolating switch blade, a movable contact also enclosed within said envelope in cooperating relation with

said stationary contact, means sealed in an opposite wall of said vacuum retaining envelope and extending externally thereof for controlling the movements of said movable contact, an exposed contact supporting means at the outer end of said envelope, a line terminal engaging air break circuit completing contact pivotally mounted upon said exposed contact supporting means, a cooperating line terminal contact disposed in spaced relation with the line terminal support upon which said switch blade is pivotally mounted and in line with the arc described by the air break circuit completing contact, and means responsive to pivotal movement of said air break contact for moving the movable contact within said vacuum retaining envelope into a circuit closed position as said air break circuit completing contact is brought into circuit establishing relation with said cooperating line terminal contact.

4. In a high voltage arc interrupting and circuit isolating switch, the combination of a circuit isolating switch blade pivotally mounted at one end to swing in an arc about a fixed axis, a vacuum insulated circuit interrupting means having a stationary contact enclosed within an evacuated envelope, means carried by said envelope for mounting and connecting said stationary contact in series circuit upon the free end of said switch blade, a movable contact sealed within said envelope in cooperating relation with said stationary contact, an operating rod connected to said movable contact and extending through a wall of said envelope and forming a support for an air break contact, a reinforcing protective encapsulation of insulating material extending over said vacuum retaining envelope, means normally biasing said movable contact and operating rod into a circuit open position with respect to said enclosed stationary contact, a bell crank supported by said encapsulation for pivotal movement about an axis extending parallel with the axis about which said switch blade pivots, a circuit completing contact carried by said bell crank having a terminal contact engaging surface extending in a plane substantially transverse to the plane in which said switch blade swings about its fixed axis, a stationary line terminal contact, and means forming an operating connection between said movable contact operating rod and said bell crank, whereby the movable contact of said vacuum insulated circuit interrupting means will be moved into circuit completing contact with said enclosed stationary contact as the circuit completing contact carried by said bell crank is brought into circuit establishing contact with said stationary line terminal contact by pivotal movement of said circuit isolating switch blade.

5. In a high voltage arc free circuit interrupting and isolating switch, the combination of a support, a pair of rotatable insulator stands extending in spaced parallel relation from said support, a circuit isolating switch blade mounted upon the upper end of each of said insulator stands for swinging movement toward and away from each other in a plane transverse to the axis about which said insulator stands rotate, line terminals for said switch blades at the upper ends of each of said insulator stands, a vacuum insulated circuit breaker unit having relatively movable contacts enclosed within a vacuum retaining encapsulation mounted in co-extending circuit completing relation upon the ends of said switch blades, the relatively movable contacts of said circuit breaker being normally biased into an open circuit position with respect to each other, an exposed switch blade contact pivotally mounted upon the outer ends of said encapsulated circuit breaker units adapted and arranged to be brought into circuit completing engagement with each other as said switch blades are brought into alignment by rotation of said insulator stands, and means responsive to pivotal movement of said switch blade contacts relative to said encapsulation for moving the contacts of said vacuum insulated circuit breaker in a circuit closed position and complete

a circuit through said switch blades to said line terminals as the switch blades are brought in alignment by rotation of said insulator stands.

6. In a high voltage arc free current interrupting and circuit isolating switch, the combination of a pair of rotatable insulator stands mounted in spaced relation upon said support, a circuit isolating switch blade mounted upon one of said insulator stands for swinging movement in one direction in a plane transverse to the axis of its supporting insulator stand, a second circuit isolating switch blade mounted upon the other of said insulator stands for swinging movement in an opposite direction in a plane transverse with the axis of rotation of its supporting insulator stand, line terminals for said switch blades at the upper ends of each of said insulator stands, a vacuum insulated circuit breaker unit having a stationary and a movable contact enclosed within a vacuum retaining envelope and mounted upon the free end of each of said switch blades, the stationary contacts of said vacuum insulated circuit breaker units being connected to the ends of their respective supporting switch blades, a reinforcing encapsulation of insulating material extending over said vacuum retaining envelopes and secured in co-extending relation upon each of said switch blades, a movable contact supported by said encapsulation and enclosed within each of said vacuum retaining envelopes, said movable contacts being normally biased into an open circuit position with respect to the stationary contacts of said circuit breaker units, an exposed air break circuit completing contact pivotally mounted at the outer ends of said encapsulations adapted and arranged to be brought into overlapping engagement with each other as said switch blades are swung into alignment between said supporting insulator stands, and an operating connection between said exposed circuit completing contacts and the enclosed movable contacts of said circuit breaker units operating to close the circuit through the enclosed stationary and movable contacts of the circuit breaker units and complete a circuit through said switch blades as said exposed circuit completing air break contacts are brought into engagement with each other by rotation of said switch blade supporting insulator stands.

7. In an arc free current interrupting and high voltage circuit isolating switching means, the combination of a pair of power line supporting insulator stands each having a line terminal for connection into a circuit to be controlled, a rotatable insulator stand positioned midway between and in line with said pair of insulator stands, a double ended current conducting switch blade mounted upon said rotatable insulator stand with blade portions projecting oppositely from said rotatable insulator stand, a vacuum insulated circuit breaker unit mounted upon each of the projecting portions of said switch blade and connected for operation in series circuit with the projecting portions of said switch blade, a reinforcing encapsulation for said circuit breaker units carried by and extending coaxially with said blade portions, a terminal contact support mounted upon the outer ends of said encapsulations, movable circuit completing contacts for said circuit breaker units also enclosed within said evacuated envelopes, an operating means for said movable circuit completing contacts extending in sealed relation through a wall of said evacuated envelopes and supported by said terminal contact supports, an exposed circuit completing air break contact pivotally mounted upon the terminal contact supports at the outer ends of said encapsulations, and an operating connection between said movable contact operating means and said exposed circuit completing contact adapted and arranged when brought into circuit completing relation with the line terminals carried by said pair of insulator stands to complete a series circuit through said switch blade and each of said vacuum insulated circuit breaker units.

8. In an arc free current interrupting and high voltage

circuit isolating switching means, the combination of a pair of power line supporting insulator stands each having a line terminal for connection into a circuit to be controlled, a rotatable insulator stand positioned midway between and in line with said pair of insulator stands, a double ended current conducting switch blade mounted upon said rotatable insulator stand with blade portions projecting oppositely from said rotatable insulator stand, a vacuum insulated circuit breaker unit mounted upon the projecting blade portions of said switch blade, a stationary contact for said circuit breaker enclosed within an evacuated envelope and connected to said switch blade, a reinforcing encapsulation for said circuit breaker units secured upon the ends of said blade portions as a support for an air break contact, a cooperating movable contact also enclosed within each of said evacuated envelopes, an operating means for said cooperating movable contacts extending in sealed relation through a wall of said evacuated envelope and connected to said terminal contact supports, an exposed circuit completing air break contact pivotally mounted upon said terminal contact supports, an operating connection between said movable contact operating means and said exposed circuit completing air break contact adapted and arranged to complete a circuit through said switch blade and the cooperating contacts of said vacuum insulated circuit breaker units when said switch blade is moved into a circuit closing position by rotation of said supporting insulator stand, and a vacuum insulated circuit breaker unit having an encapsulated

vacuum retaining envelope with an enclosed stationary contact connected to each of said line terminals and an enclosed movable contact operatively connected with an exposed movable air break contact with which the pivotally mounted air break contacts of said first circuit breaker units engage, whereby a circuit will be established through said switch blade and each of said circuit breaker units in series when the exposed air break contacts of the circuit breaker units at the ends of said switch blade are brought into circuit completing engagement with corresponding exposed and movable contacts of the circuit breaker units mounted upon and carried by the line terminals supported by said pair of power line supporting insulator stands.

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