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T. FJELLSTEDT ET AL
SWITCH CONSTRUCTION

2,527,924

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2 Sheets-Sheet 1

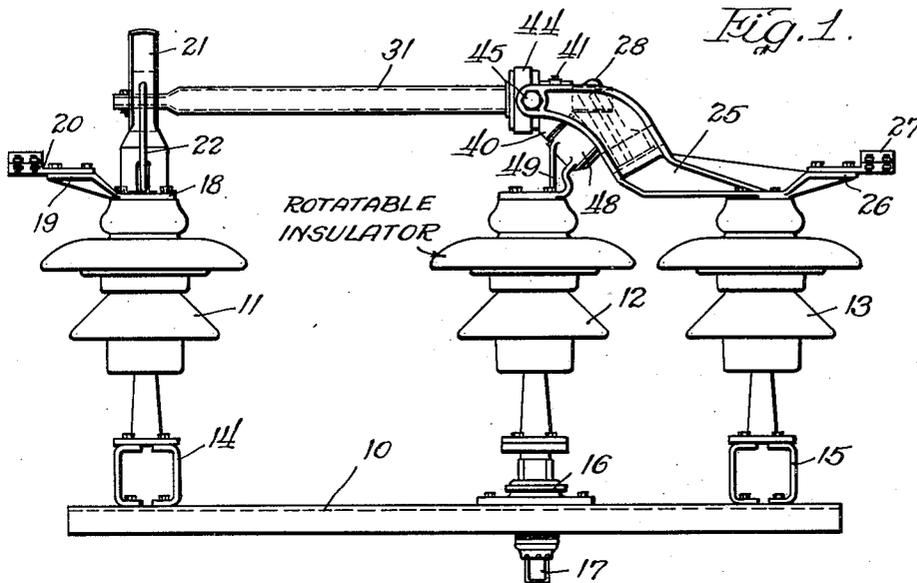


Fig. 1.

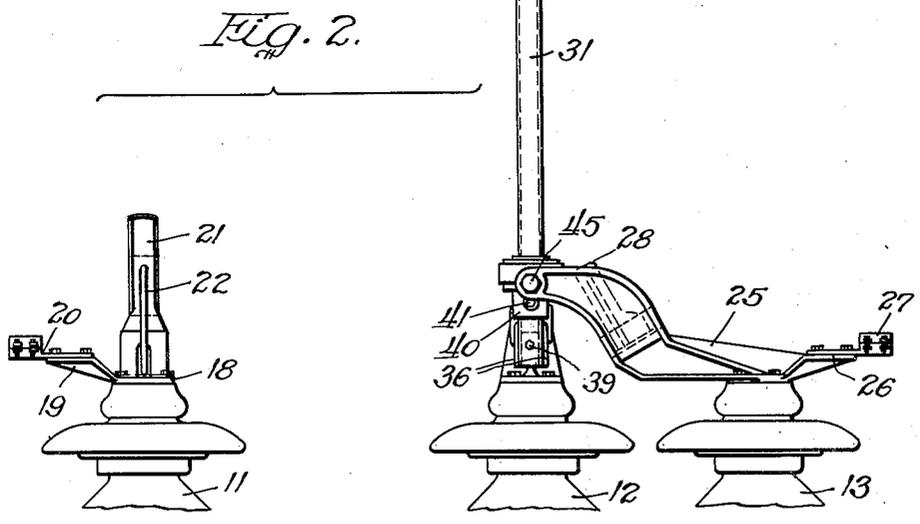


Fig. 2.

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2 Sheets-Sheet 2

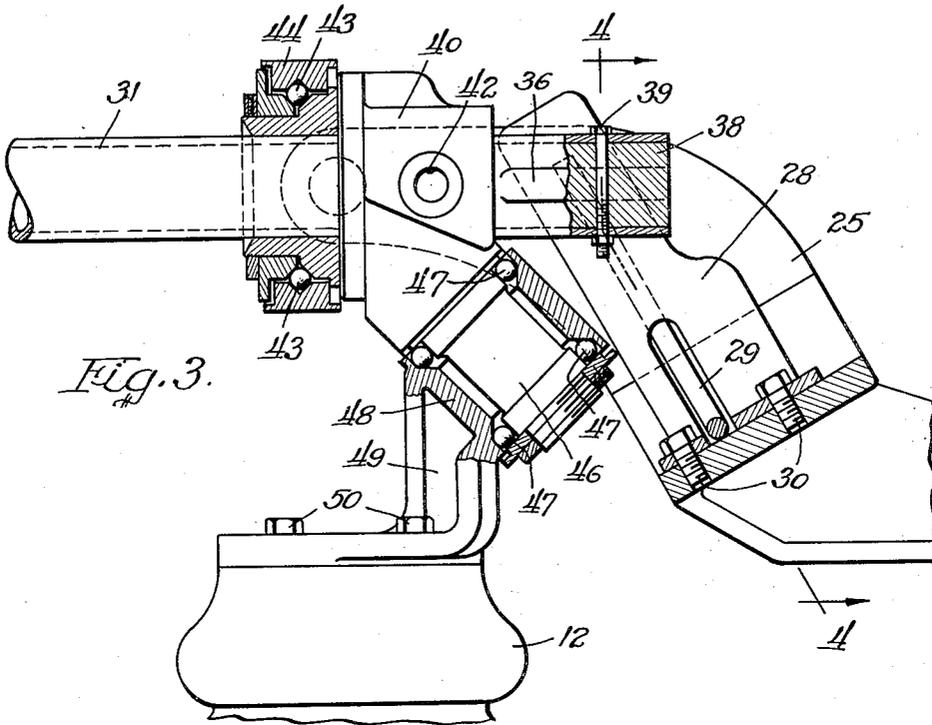


Fig. 3.

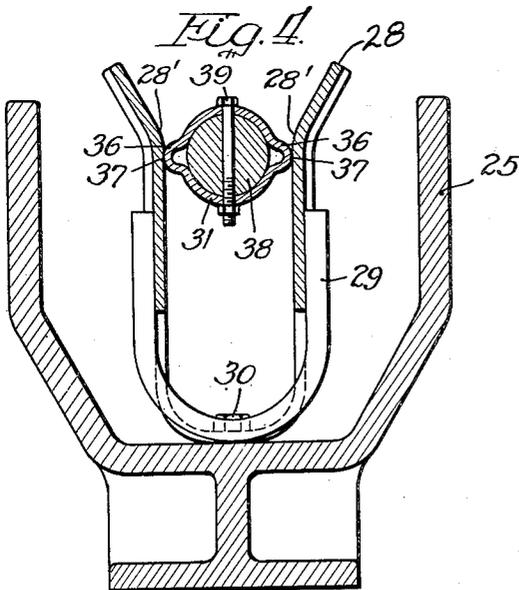


Fig. 4.

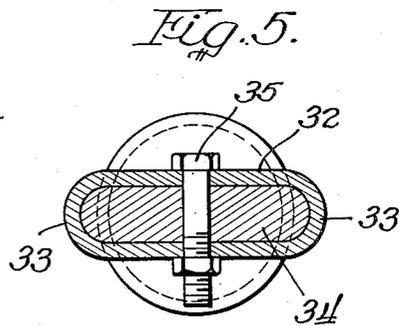


Fig. 5.

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UNITED STATES PATENT OFFICE

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SWITCH CONSTRUCTION

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6 Claims. (Cl. 200—48)

1

This invention relates, generally, to switch constructions, and it has particular relation to disconnecting switch constructions that are employed for sectionalizing high voltage electric power transmission lines and opening the circuit to circuit breakers and other apparatus.

The present invention more particularly relates to improvements in the switch construction shown in Patent No. 2,231,992, issued February 18, 1941, to one of the inventors herein and which is assigned to the assignee of this application. The disconnecting switch construction disclosed in this patent comprises two stationary insulators carrying line terminals with a rotatable insulator therebetween. When the rotatable insulator is rotated the switch blade is first turned primarily about its longitudinal axis in the switch closed position to disengage the high pressure small area contacts carried by one of the stationary insulators and is also rotated about an axis that is transverse to the longitudinal axis for providing an air gap in the circuit. The switch blade is mounted in part on a frame member that is carried by the other stationary insulator. The frame member also includes a circular bearing which cooperates with the upper end of the rotatable insulator.

The rotatable insulator carries a crank member which has a pin that extends at an angle of 45° to the vertical and cooperates with a correspondingly positioned bearing carried by a blade carriage in which the switch blade is mounted. The blade carriage has a contact surface provided thereon which is engaged by contact fingers to complete the circuit through the switch. In the commercial form of switch this contact surface is shaped so as to provide small area high pressure contact engagement with the contact fingers. It is difficult to machine and hence increases the cost of construction of the switch.

Among the objects of this invention are: To modify the switch construction shown in the patent referred to above to the end that the cost thereof will be reduced and its operating characteristics improved; to mount the crank means on the rotatable insulator independently of the frame support so as to avoid the necessity for the circular bearing mentioned above; to employ a stationary contact member on the frame support for engagement by the switch blade in the switch closed position and thus avoid the necessity for providing contact surface on the blade carriage or blade hinge; and to provide a bearing pin or arm on the blade hinge and mount

2

it in a bearing carried by a crank pin that is mounted on and rotates with the rotatable insulator.

Other objects of this invention will, in part, be obvious and in part appear hereinafter.

Accordingly, this invention is disclosed in the embodiment thereof shown in the accompanying drawings, and it comprises the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of this invention, reference can be had to the following detailed description taken together with the accompanying drawings, in which:

Figure 1 is a view, in side elevation, of a switch embodying the present invention and shown in the closed position;

Figure 2 is a view of the upper portions of the insulators with the switch being illustrated in the open position;

Figure 3 is a view, partly in side elevation and partly in section, showing the details of construction of the hinge and of the switch blade and parts carrying the same;

Figure 4 is a detail sectional view taken along the line 4—4 of Figure 3; and

Figure 5 is a detail sectional view showing the construction of the switch blade at its outer end.

Referring now particularly to Figure 1 of the drawings, it will be observed that the reference character 10 designates a channel iron base that is mounted horizontally. It will be understood that the base 10 can be mounted vertically and that it can be mounted in an inverted position. For illustrative purposes, however, it is shown in a horizontal position, but it can be mounted otherwise as stated. Accordingly, the words "horizontal" and "vertical" as used in the specification and claims with respect to axes of certain elements of the switch are to be considered to express certain relative positions of the axes with respect to each other since, while the words accurately identify the axes which are illustrated in the drawing, the "vertical" and "horizontal" positions might change if the switch of this invention were mounted in other than a horizontal position.

The base 10 carries insulators 11, 12 and 13 which are of conventional construction and, as shown, may be of the pin type. The insulators 11 and 13 at the ends of the base 10 are stationary

and are mounted on suitable spacers 14 and 15 to position them at the desired elevation. As indicated, the intermediate insulator 12 is rotatable. For this purpose a bearing 16 is mounted on the base 10 and, as will appear hereinafter, constitutes the sole bearing support for the insulator 12. An octagonal shank 17 projects below the base 10 and is arranged to receive suitable crank means for rotating the insulator 12.

The insulator 11 at the upper end carries a terminal bracket 18 that may be a bronze casting and it has a terminal pad 19 formed integrally therewith to which a terminal connector 20 may be secured as shown. Mounted on the terminal bracket 18 is a U-shaped contact member 21 of hard drawn copper or the like, the blade portions of which are curved so as to provide small area high pressure contact engaging surfaces. A generally U-shaped reinforcing spring 22 serves to urge the arms of the contact member 21 toward each other to provide the required contact pressure. If desired straight contact bars secured along the sides of a terminal casting and backed up by leaf springs can be employed as a substitute for the U-shaped contact member 21 and spring 22 as will be understood readily.

At its upper end the insulator 13 carries a frame support 25 that may be a bronze casting. It has a terminal pad 26 for receiving a terminal connector 27. It will be understood that the conductors of the circuit in which the switch is connected are connected to the terminal connectors 20 and 27.

In accordance with this invention, the frame support 25 carries a U-shaped contact member 28 which is similar in construction to the contact member 21 described above. As illustrated more clearly in Figure 4, the arms of the contact member 28 are formed so as to provide longitudinally extending raised portions 28' which provide the desired small area contact engaging surfaces which are urged toward each other by a U-shaped reinforcing spring 29. The contact member 28 is secured to the frame support 25 by bolts 30 as shown in Figure 3. The contact construction employing the straight contact bars and leaf reinforcing springs described above can be employed in lieu of the U-shaped contact member 28 and spring 29.

The U-shaped contact members 21 and 28 with reinforcing springs 22 and 29 or the equivalent construction using straight contact bars and reinforcing leaf springs are considered as U-shaped contact members herein.

The U-shaped contact members 21 and 28 are interconnected in the switch closed position by a tubular switch blade 31 that may be formed of hard drawn copper. Its outer end is deformed, as shown in Figure 5, at 32 to provide small area surfaces 33 which cooperate with the corresponding contact surfaces of the arms of the contact member 21. A plug 34, held in place by bolt 35, serves to maintain the shape of the deformed end 32 and prevents the same from collapsing when it is subjected to the pressure incident to the switch blade 31 being placed in and remaining in the switch closed position. If the wall thickness of the tubular switch blade 31 is sufficient, the plug may be omitted.

At its other end, as shown in Figure 4, the switch blade 31 is deformed as indicated at 36 to provide small area contact engaging surfaces 37 for engaging the corresponding surfaces 28' of the contact member 28. A plug 38 is positioned within the end of the switch blade 31

adjacent the deformed part 36 and is held in place by a bolt 39. The purpose of the plug 38, like the plug 34 previously mentioned, is to prevent the walls of the switch blade 31 from collapsing when it is subjected to the pressure exerted by the spring 29 in applying the relatively high contact pressure in the switch closed position. As before, if the wall thickness of the tubular switch blade 31 is sufficient, the plug 38 can be omitted.

The switch blade 31 is carried by a blade hinge 40 which may be a bronze casting that is suitably machined to the shape illustrated. The blade hinge 40 may be secured to the switch blade 31 by a bolt 41 which, as shown in Figure 3, may be located in a tapped hole 42 to one side of the blade hinge 40 rather than on top as illustrated in Figure 1. If desired, the bolt 39 can be omitted and the plug 38, if used, can be held in position by the bolt 41.

The blade hinge 40 is rotatably mounted by ball bearings 43 in a blade guide 44 which, as shown in Figures 1 and 2, is mounted by bolts 45 on the frame support 25 to rotate about a horizontal axis through the longitudinal axis of the bolts 45.

In order to rotate the blade 31 about its longitudinal axis as permitted by the ball bearings 43 in the blade guide 44 and also to swing the switch blade 31 to the open position as shown in Figure 2, the blade hinge 40 is provided with an arm 46 that extends at an angle of 45° away from the longitudinal axis of the switch blade 31.

As illustrated more clearly in Figure 3 of the drawings, the arm 46 which extends at an angle of 45° from the blade hinge 40 is carried by ball bearings 47 in a bearing portion 48 of a crank pin 49 that is secured by bolts 50 to the rotatable insulator 12 and rotates therewith when the same is turned.

When the insulator 12 is rotated in either direction from the position shown in Figures 1 and 3, the switch blade 31 will be rotated about its longitudinal axis to relieve the pressure between the high pressure contact surfaces 33 and 37 and their respective stationary contact members 21 and 28, and to move the small area high pressure contact surfaces 33 and 37 out of engagement with the corresponding surfaces of the contact members 21 and 28. Simultaneously, the rotation of the insulator 12 and of the crank pin 49 causes the switch blade 31 to rotate about the horizontal axis through the bolts 45. Reference in the claims to rotation of the switch blade about its longitudinal axis "to relieve pressure between it and a stationary, small area, high pressure contact member" (or members) is intended to cover both of the following sequences of action: (1) where the pressure is relieved and a slight separation of the contacts results from rotation of the switch blade about its longitudinal axis, even before the contact on the blade is moved arcuately out of the neighborhood of the stationary contact by rotation of the blade about an axis transverse to its longitudinal axis, and (2) where most of the pressure is relieved between the contacts but separation results only following arcuate movement of the blade about said transverse axis out of the neighborhood of the stationary contacts. It will be appreciated that our invention embraces both types of separation of the contacts and either one may be had by appropriate proportioning of the respective dimensions of the contacts. Correspondingly, reference in the claims to swinging said switch blade "out of engagement with

said stationary, high pressure, small area contact member" (or members) is intended to embrace both of the following actions (related to actions 1 and 2 set forth above): (1) where the contact on the switch blade has already separated from the stationary contact by rotation of the switch blade about its own longitudinal axis, with the swinging movement thereafter carrying the contact of the switch blade out of the neighborhood of the stationary contact to provide a substantial air gap, and (2) where the blade contact has been rotated to relieve most of the pressure between it and the stationary contact but the two do not separate until the swinging movement has carried the contact on the switch blade out of the neighborhood of the stationary contacts. When the movement of the insulator 12 has been completed the switch blade 31 is moved to the full open position as shown in Figure 2 and it has rotated about its longitudinal axis.

The blade guide 44 permits the switch blade 31 to rotate about its longitudinal axis and this movement is facilitated by the ball bearings 43. The blade guide 44 itself is rockably mounted on the frame support 25 about a horizontal axis through the longitudinal axis of the bolts 45 on opposite sides. This movement of the blade guide 44 guides the switch blade 31 in its movement through 90° from the switch closed position shown in Figure 1 to the switch open position shown in Figure 2 and vice versa. Since the blade hinge 40 is fastened to the switch blade 31 and its arm, which extends at 45°, is rotatably mounted by ball bearings 47 in the bearing portion 48 of the crank pin 49, rotation of the insulator 12 about its vertical axis causes the crank pin 49, which is secured thereto, to rotate about this vertical axis and, initially, the switch blade 31 to rotate principally about its longitudinal axis and thereafter principally about the horizontal axis through the bolts 45.

When the insulator 12 is rotated in the reverse direction, the switch blade 31 is swung through 90° to the switch closed position. At the same time the switch blade 31 is rotated about its longitudinal axis, its final rotation about this axis taking place as it approaches the horizontal position so that the final movement thereof into high pressure contact engagement with the contact members 21 and 28 takes place while there is a small amount of arcuate movement thereof about its horizontal axis. This permits the necessary torque to be transmitted through the switch blade 31 for rotating it into the switch closed position with the contact surfaces under relatively high pressure.

It will be observed that when the switch construction disclosed herein is employed, it is unnecessary to provide a bearing extension from the frame support 25 for guiding the upper end of the rotatable insulator 12. This materially simplifies the construction of the frame support 25 and effects a corresponding reduction in cost.

When the contact member 28 is provided on the frame support 25, it is unnecessary to provide a contact surface on the blade hinge 40 and to machine it as an eccentric in order to provide small area high pressure contact engagement therewith. The blade hinge 40 can be shaped by suitable simple machine operations which further go toward reducing the cost of the switch construction. At the same time by placing the contact member 28 on the frame support 25 and causing it to engage directly the switch blade

31, a lower resistance current carrying path is provided.

The construction of the crank pin or arm 49 is simplified by arranging to have it carry the ball bearings 47 and by providing the arm 46 integral with the blade hinge 40 for journalling the same. It will be observed that the axis of rotation of the blade guide 44 about bolts 45, the longitudinal axis of the switch blade 31, the axis of rotation of the crank pin 49, and the axis of the arm 46 all intersect at a common point.

Since certain changes can be made in the foregoing switch construction and different embodiments of the invention can be made without departing from the spirit and scope thereof, it is intended that all matter shown in the accompanying drawings and described hereinabove shall be interpreted as illustrative and not in a limiting sense.

What is claimed as new is:

1. In a disconnecting switch, in combination, a pair of stationary U-shaped high pressure small area contact members in insulated spaced relation, a tubular switch blade with the ends providing small area contact engaging surfaces for engaging said stationary U-shaped contact members, a frame support, a blade guide mounted for rotation about a horizontal axis on said frame support, a blade hinge secured to said blade intermediate said contact engaging surfaces at its ends and rotatably mounted on said blade guide about the longitudinal axis of said switch blade and having an arm extending at an angle of forty-five degrees thereto, and a crank pin rotatable about a vertical axis intersecting said horizontal and longitudinal axes and having a bearing portion rotatably mounting said arm whereby on rotation of said crank pin about said vertical axis said switch blade is rotated about its longitudinal axis to relieve the pressure between it and said contact members and about said horizontal axis to swing said switch blade out of engagement with one of said contact members to provide an air gap between it and said switch blade.

2. In a disconnecting switch, in combination, a stationary frame support, a pair of high pressure small area contact members one mounted on said frame support and the other in insulated spaced relation thereto, guide means rotatably mounted on said frame support, a switch blade having small area contact engaging surfaces near its ends for engaging said contact members mounted for rotation intermediate its ends about its longitudinal axis on said guide means, and crank means independent of said frame support for rotating said switch blade about its longitudinal axis to relieve the pressure between it and said contact members and about the axis of rotation of said guide means to swing said switch blade out of engagement with said contact members to provide an air gap between said other contact member and said switch blade.

3. In a disconnecting switch, in combination, a stationary frame support, a pair of U-shaped high pressure small area contact members one mounted on said frame support and the other in insulated spaced relation thereto, a blade guide mounted for rotation about a horizontal axis on said frame support, a tubular switch blade with the ends providing small area contact engaging surfaces for engaging said stationary contact members, a blade hinge secured to said blade intermediate said contact engaging surfaces at its ends and rotatably mounted on said blade

7

guide about the longitudinal axis of said switch blade and having an arm extending at an angle of forty-five degrees thereto, a crank pin rotatable about a vertical axis intersecting said horizontal and longitudinal axes and having a bearing portion rotatably mounting said arm whereby on rotation of said crank pin about said vertical axis said switch blade is rotated about its longitudinal axis to relieve the pressure between it and said contact members and about said horizontal axis to swing said switch blade out of engagement with said other contact member to provide an air gap between it and said switch blade, and bearing means mounting said crank pin for rotation independently of said frame support.

4. The invention, as set forth in claim 3, wherein the tubular switch blade extends through the blade guide and blade hinge to engage the contact member mounted on the frame support.

5. In a disconnecting switch, in combination, a pair of stationary contact members in insulated spaced relation, at least one of said pair comprising a high pressure, small area contact member; a switch blade having contact engaging surfaces near its ends for engaging said stationary contact members, at least one of said contact surfaces of the switch blade having a small area for engagement with said stationary, high pressure, small area contact member; a frame support; a blade guide mounted for rotation about a horizontal axis on said frame support, a blade hinge element secured to said switch blade intermediate said contact engaging surfaces at its ends and rotatably mounted on said blade guide about the longitudinal axis of said switch blade, and a crank pin element rotatable about a vertical axis intersecting said horizontal and longitudinal axes, an arm extending from one of said elements at an angle of 45° with respect to the longitudinal axis of the switch blade, and a bearing for rotatably mounting said arm, said arm and bearing interconnecting the blade hinge element and crank pin element, said crank pin element, when rotated about said vertical axis, causing said switch blade to be rotated simultaneously about its longitudinal axis to relieve the pressure between it and said stationary, high pressure, small area contact member and about said horizontal axis to swing said switch blade out of

8

engagement with said high pressure, small area contact member to provide an air gap between the latter and said switch blade.

6. In a disconnecting switch, in combination, a frame support; a pair of stationary U-shaped high pressure, small area contact members in insulated spaced relation, one of said contact members being mounted on the frame support; a tubular switch blade with the ends providing small area contact engaging surfaces for engaging said stationary U-shaped contact members; a blade guide mounted for rotation about a horizontal axis on said frame support; a blade hinge secured to said switch blade intermediate said contact engaging surfaces at its ends and rotatably mounted on said blade guide about the longitudinal axis of said switch blade and having an arm extending at an angle of 45° with respect to said blade, said tubular switch blade extending through the blade guide and blade hinge to engage the U-shaped contact member which is mounted on said frame member; and a crank pin rotatable about a vertical axis intersecting said horizontal and longitudinal axes and having a bearing portion rotatably mounting said arm whereby, upon rotation of said crank pin about said vertical axis, said switch blade is rotated about its longitudinal axis to relieve the pressure between it and said contact members and about said horizontal axis to swing said switch blade out of engagement with one of said contact members to provide an air gap between it and said switch blade; the axis of rotation of the blade guide, the longitudinal axis of the switch blade, the axis of rotation of the crank pin, and the axis of said arm all intersecting at a common point.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
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1,793,797	Hampton et al.	Feb. 24, 1931
2,231,992	Fjellstedt	Feb. 18, 1941
2,420,074	Froland	May 6, 1947