Oct. 9, 1956 W. A. GUSSOW 2,766,340

SWITCH CONSTRUCTION

Filed Jan. 27, 1954

2 Sheets-Sheet 1

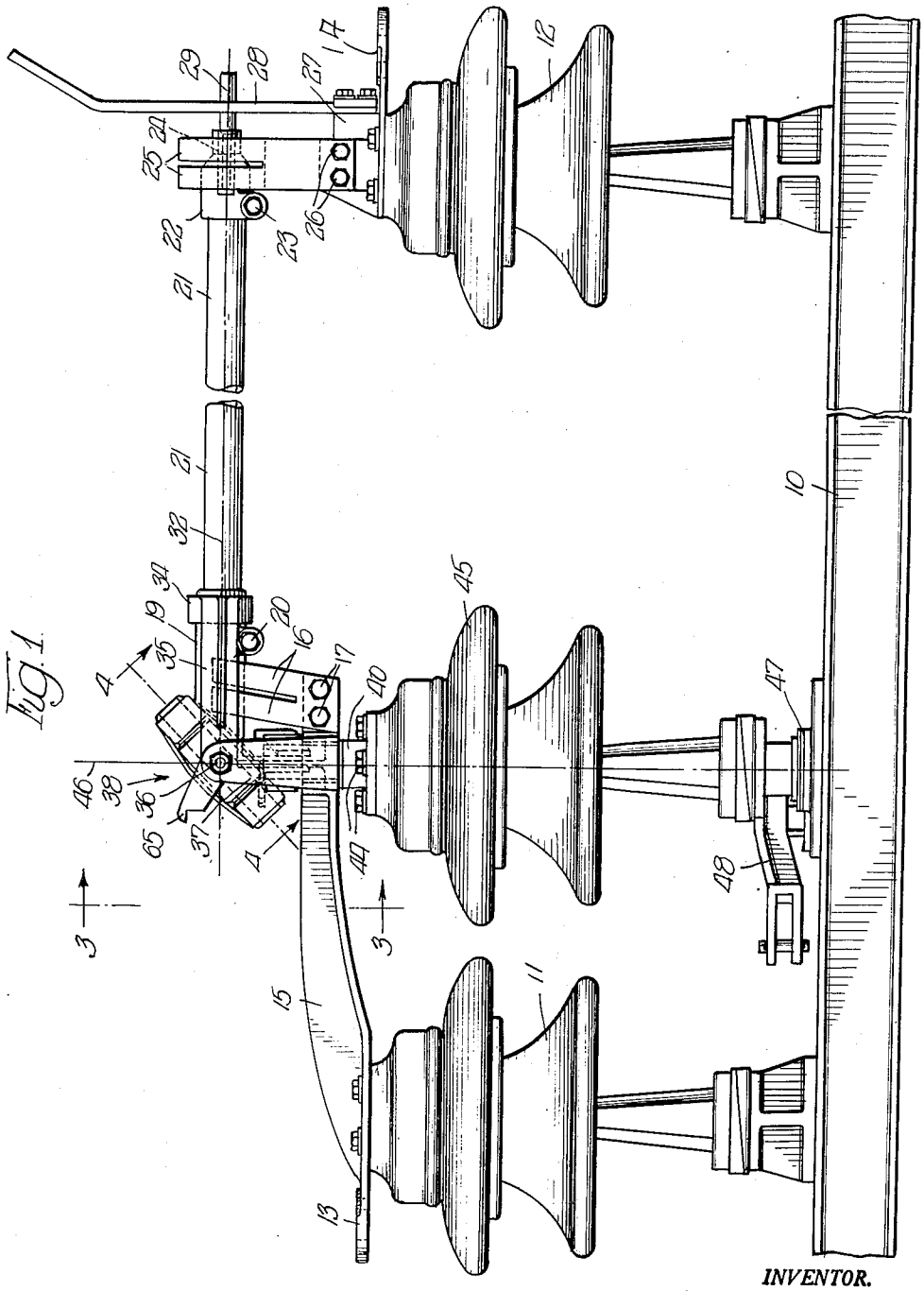


Fig. 1

INVENTOR.

William A. Gussow,

BY

Robert R. Lockwood

atty.

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2 Sheets-Sheet 2

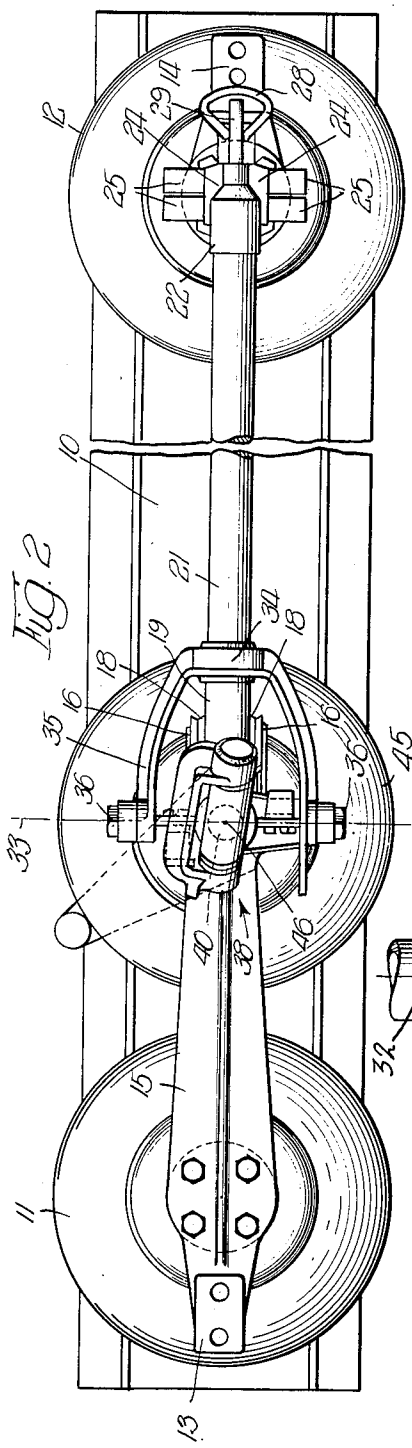


Fig. 2

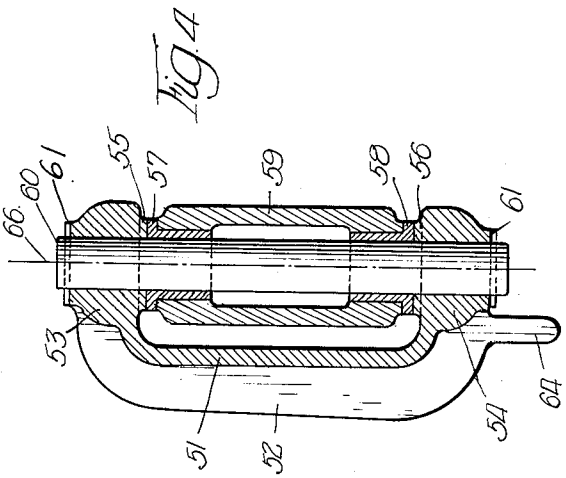


Fig. 4

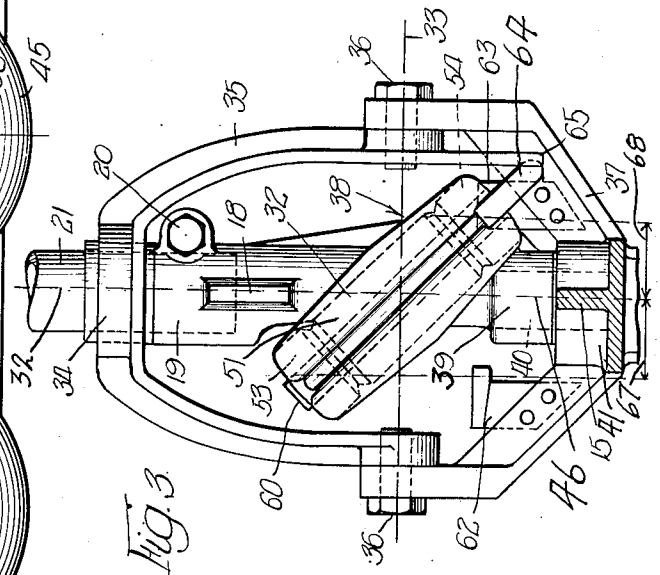


Fig. 3

INVENTOR.
William A. Gussow,
BY
Robert R. Lockwood
Atty

United States Patent Office

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SWITCH CONSTRUCTION

William A. Gussow, Chicago, Ill., assignor to S & C Electric Company, Chicago, Ill., a corporation of Delaware

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6 Claims. (Cl. 200—48)

This invention relates, generally, to high voltage disconnecting switches, and it has particular relation to operating mechanisms therefor.

Among the objects of this invention are: To construct the switch blade operating mechanism in such manner that it is simple and economical to manufacture and can be readily and economically installed and maintained in operation; to reduce the bearing load on the shaft or pin on which the switch blade is mounted for movement about four axes intersecting each other, resulting in a reduction in bearing friction and in effect to move the blade; to mount the switch blade in a switch blade carrier that is pivoted about a first axis and carries the blade through an arcuate motion and in addition allows the blade to rotate about its own longitudinal or a second axis; to employ a clevis and a pin rotatably mounted thereon to provide a couple about a third axis intersecting the first and second axes to balance out the forces about this third axis and about this pin; to subject this pin substantially only to shear stresses; to absorb substantially all cantilever and bending forces and resulting stresses about this third axis by the clevis which has the pin rotatably mounted thereon; and to swing the switch blade and the switch blade carrier about the first axis, rotate the switch blade about the second axis while simultaneously rotating it about the third axis on rotation of the clevis itself about a fourth axis which is the axis of rotation of a rotating insulator to which the couple about the third axis is transferred when the switch mechanism is operated, thereby balancing out forces about each of the four axes by the application of a couple about each of these four axes through the agency of the clevis.

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

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 high voltage disconnecting switch in which the present invention is embodied;

Figure 2 is a top plan view of the switch shown in Figure 1;

Figure 3 is a sectional view, at an enlarged scale, taken generally along the line 3—3 of Figure 1; and showing the switch blade in the vertical switch open position; and

Figure 4 is a sectional view, at an enlarged scale, taken generally along the line 4—4 of Figure 1.

Referring now particularly to Figures 1 and 2 of the

drawings, it will be observed that the reference character 10 designates a base which may be in the form of a channel on which stationary insulators 11 and 12 are mounted. It will be understood that the number of sections for the stationary insulators 11 and 12 will be determined by the voltage of the system to which the switch is connected. For illustrative purposes only a single section is shown for each of the insulators 11 and 12. Additional sections would be used for higher voltage operation.

At their upper ends the stationary insulators 11 and 12 carry terminal pads 13 and 14 to which the line conductors can be connected in accordance with conventional practice. Extending from the terminal pad 13 and formed integrally therewith is a contact support 15 which carries contact fingers 16 at the end opposite the terminal pad 13. The contact fingers 16 are secured by bolts 17 to the contact support 15 and they are arranged to engage ridges 18 which extend outwardly from a contact fitting 19 which also forms a switch blade support member and is so referred to hereinafter. The contact fitting or switch blade support member 19 is of split construction and is arranged to be clamped by a bolt 20 to one end of a tubular switch blade 21. While the member 19 and switch blade 21 can be formed integrally, it is preferable, from a manufacturing standpoint, to form them in two parts as shown and described herein. The opposite end of the tubular switch blade 21 has a contact fitting 22 secured thereto by a transverse bolt 23. Ridges 24 extend from opposite sides of the contact fitting 22 for engagement with contact fingers 25 which form part of a stationary switch contact. The contact fingers 25 are secured by bolts 26 to a contact support 27 which is carried by the upper end of the stationary insulator 12 and is integral with the terminal pad 14. An arcing horn 28 extends upwardly from the contact support 27 and is arranged to be engaged by an arcing tip 29 which extends from the contact fitting 22. It will be understood that any arc which is drawn when the switch blade 21 is swung to the switch open position is drawn between the arcing horn 28 and the arcing tip 29 and not between the contact fitting 22 or the ridges 24 thereof and the contact fingers 25 of the stationary switch contact.

Provision is made for rotating the tubular switch blade 21 about its longitudinal axis 32, Figures 1 and 3, or the second axis previously referred to. The reason for this is to bring the ridges 18 and 24 into contact engagement with the respective contact fingers 16 and 25 when the switch blade 21 has been swung to the switch closed position and also to move them out of engagement therewith prior to swinging the switch blade 21 to the switch open position. It will be observed that the switch blade 21 is swung to the switch open position about a transverse axis 33, the first axis referred to above, in a manner to be described presently.

The tubular switch blade 21 and the blade support member 19 are rotatably mounted in a bearing 34 at the central portion of a generally U-shaped blade carrier 35 which is pivoted at 36 about the transverse or first axis 33. It will be understood that the transverse or first axis 33 extends through the pivots 36 and, for the switch construction disclosed, is a horizontal axis. The pivots 36 are carried by a U-shaped support bracket 37 which is preferably formed integrally with the contact support at its forward end 15. It will now be apparent that the tubular switch blade 21 and the blade support member 19 are arranged to be rotated about the longitudinal or second axis 32 in the bearing 34 and that it is also arranged to be swung about the transverse or first axis 33 as a result of a corresponding swinging movement of the blade carrier 35.

It remains to describe the operating mechanism which

causes this movement of the switch blade **21** about the first and second axes which, it will be observed, are at right angles to each other. For this purpose there is provided a switch blade operator that is indicated, generally, at **38**. The switch blade operator **38** includes a hub **39**, Figure 3, which is fast on the upper end of a shaft **40** that is journaled in a bearing **41** at the base of the U-shaped support bracket **37**. As shown in Figure 1, the lower end of the shaft **40** is secured by bolts **44** to the upper end of an insulator **45** which is rotatable about a vertical axis **46**, the fourth axis previously mentioned, that coincides with the longitudinal axis **32** of the switch blade **21** when it is in the switch open position as shown in Figure 3. At its lower end, the insulator **45** is rotatably mounted by a bearing **47** which is carried by the channel base **10**. An operating arm **48** extends from the pin that supports the insulator **45** and is arranged to receive a suitable operating rod for rotating the insulator **45** about the fourth axis **46** through about 90 degrees, there being sufficient overtravel at each extreme to effect the necessary operation.

Provision is made for translating the rotary movement of the insulator **45** to effect the rotation of the switch blade **21** about the right angularly related axes **32** and **33**. Formed integrally with the hub **39** and being a part of the switch blade operator **38** is a clevis **51**, Figures 3 and 4, which is provided with a reinforcing rib **52**. The arms **53** and **54** of the clevis **51** extend generally at right angles to a plane containing the axes **32** and **46** when the switch blade **21** is in the switch closed position shown in Figure 1, and the clevis **51** is inclined at an angle of 45 degrees thereto. Facing inwardly from the arms **53** and **54** of the clevis **51** are thrust bearings **55** and **56** which are arranged to be engaged by thrust bearings **57** and **58** that are mounted on a sleeve **59** preferably formed integrally with the contact fitting or switch blade support member **19**. In order to center the sleeve **59** with respect to the thrust bearings **55—57** and **56—58**, a pin **60** extends through the sleeve **59** and into and through the arms **53** and **54** of the clevis **51**. Snap washers **61** at the ends of the pin **60** hold the same in position.

With a view to limiting the extent of rotation of the insulator **45**, stops **62** and **63**, Figure 3, are carried by the support bracket **37** and are arranged to be engaged by the arm **54** of the clevis **51** in either of the extreme positions of the switch blade **21**.

In order to initiate the swinging movement of the carrier **35** from the position shown in Figure 3 to move the switch blade **21** to the switch closed position, a detent **64** extends from the lower portion of the rib **52** of the clevis **51** and is arranged to engage an arm **65** which constitutes an extension of one arm of the carrier **35**.

The longitudinal axis of the pin **60** is indicated at **66** in Figure 4 and is the third axis referred to hereinbefore. In the embodiment of the invention disclosed, this third axis **66** is generally inclined at an angle of 45 degrees away from the horizontal transverse or first axis **33** and from the vertical or fourth axis **46**. When the insulator **45** and the switch blade operator **38** are rotated with the switch blade **21** in the switch open position shown in Figure 3, the functioning is such that, after the detent **64** has engaged the arm **65** and initiated the swinging movement of the carrier **35** toward the switch closed position, the carrier **35** continues to swing toward the switch closed position carrying with it the switch blade **21**. The necessary force for effecting this operation is transmitted through the clevis **51** and is applied by the arms **53** and **54** thereof to the ends of the pin **60**. As illustrated in Figure 3, these arms **53** and **54** cooperate with the ends of the pin **60** at locations on opposite sides of the vertical axis **46** of the insulator **45**. Preferably the distances **67** and **68** from the axis **46** to the arms **53** and **54** are equal, thereby providing a couple about the vertical axis **46** which balances out cantilever and bending forces otherwise applied to the pin **60** with the result that it is subjected substantially only to shear stresses for transmitting the force necessary to operate the switch blade about its longitudinal axis **32** and its transverse axis **33**. This construction employing the clevis **51**, makes it unnecessary to use a massive cantilever pin construction for effecting the rotation of the switch blade **21** about the two axes **32** and **33** as described.

The construction and arrangement of the clevis **51**, as disclosed herein, makes it possible to balance out forces that otherwise would be applied around the four axes and, as a result, it is possible to reduce the friction in the several bearings. Because of these reductions in friction, it is possible to achieve economies in construction by reducing the size and weight of the various parts of the operating mechanism. Moreover, it is possible to effect the operation of the switch with the application of a relatively smaller force to the operating arm **48**. More specifically it is pointed out that there is a couple about the first axis **33** by virtue of the use of the clevis **51** which eliminates forces tending to cause the blade carrier **35** to move about the second axis **32** and hence reduces friction at the pivots **36**. There is a couple about the second axis **32** which eliminates forces tending to cause the switch blade **21** to move transversely, resulting in a reduction in friction in the bearing **34**. There is a couple about the third axis **66** which eliminates forces acting on the pin **60** and thus reduces friction in the bearings **55—57** and **56—58** in which the pin **60** is mounted. Finally, there is a couple about the fourth axis **46** which eliminates forces tending to cause the insulator **45** to move back and forth, thereby reducing friction in the bearing **47**.

As the switch blade **21** approaches the stationary switch contact or the contact fingers **25**, the motion applied thereto is such that it is rotated about its longitudinal axis **32** to bring the ridges **18** and **24** into contact engagement with the respective contact fingers **16** and **25**.

It will be understood that the reverse operation takes place when the insulator **45** is rotated in the opposite direction, its motion in this direction being limited by the stop **63** as described.

The clevis **51** and the third axis **66** are inclined at an angle of 45 degrees to the first axis **33** and to the fourth axis **46** as disclosed when it is desired to swing the switch blade **21** in a plane at right angles to the transverse or first axis **33**. If it is desired to swing the switch blade **21** in a plane at a lesser angle to the first axis **33**, then the angle of inclination of the clevis **51** and of the third axis **66** would be changed in accordance with the desired plane of movement of the switch blade **21**.

Since certain changes can be made in the foregoing 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 hereinbefore shall be interpreted as illustrative and not in a limiting sense.

What is claimed as new is:

1. A switch comprising, in combination, a stationary contact, a switch blade rotatable about its longitudinal axis for engaging said switch contact at one end, a carrier swingable about an axis transverse to said longitudinal axis for swingably mounting said switch blade, a switch blade operator rotatable about an axis which is perpendicular to said longitudinal and transverse axes when said switch blade is in engagement with said switch contact, a clevis carried by and rotatable with said operator, the arms of said clevis extending to opposite sides of said axis of said switch blade operator and generally at right angles to a plane in switch closed position and containing said axis of said switch blade operator, and a switch blade support member secured to said switch blade and journaled on said arms of said clevis to rotate about an axis intersecting said longitudinal and transverse axes and said axis of said switch blade operator and transmitting torque applied thereto by said switch blade operator through a couple about each of the four mentioned axes thereby balancing out forces

about said axes whereby, on rotation of said operator with said switch blade in engagement with said switch contact, said switch blade is rotated about its longitudinal axis to disengage said switch contact and then is swung about said transverse axis away from said switch contact.

2. A switch comprising, in combination, a stationary switch contact, a switch blade rotatable about its longitudinal axis for engaging said switch contact at one end, a carrier swingable about an axis transverse to said longitudinal axis for swingably mounting said switch blade, a switch blade operator rotatable about an axis which is perpendicular to said longitudinal and transverse axes when said switch blade is in engagement with said switch contact, a clevis carried by and rotatable with said operator, the arms of said clevis extending to opposite sides of said axis of said switch blade operator and substantially equidistant therefrom and generally at right angles to a plane containing said longitudinal axis of said switch blade in switch closed position and containing said axis of said switch blade operator, and a switch blade support member secured to said switch blade and journaled on said arms of said clevis to rotate about an axis intersecting said longitudinal and transverse axes and said axis of said switch blade operator and transmitting torque applied thereto by said switch blade operator through a couple about each of the four mentioned axes thereby balancing out forces about said axes whereby, on rotation of said operator with said switch blade in engagement with said switch contact, said switch blade is rotated about its longitudinal axis to disengage said switch contact and then is swung about said transverse axis away from said switch contact.

3. A switch comprising, in combination, a stationary switch contact, a switch blade rotatable about its longitudinal axis for engaging said switch contact at one end, a carrier swingable about an axis transverse to said longitudinal axis for swingably mounting said switch blade, a switch blade operator rotatable about an axis which is perpendicular to said longitudinal and transverse axes when said switch blade is in engagement with said switch contact, a clevis carried by and rotatable with said operator, the arms of said clevis extending to opposite sides of said switch blade operator and substantially equidistant therefrom and generally at right angles to a plane containing said longitudinal axis of said switch blade in switch closed position and containing said axis of said switch blade operator, a switch blade support member secured to said switch blade, and bearing pin means carried by said support member and journaled on said arms of said clevis to mount said support member for rotation about an axis intersecting said longitudinal and transverse axes and said axis of said switch blade operator and transmitting torque applied to said clevis by said switch blade operator through a couple about each of the four mentioned axes thereby balancing out forces about said axes whereby, on rotation of said operator with said switch blade in engagement with said switch contact, said switch blade is rotated about its longitudinal axis to disengage said switch contact and then is swung about said transverse axis away from said switch contact, the force required for rotating and swinging said switch blade being transmitted to said bearing pin means principally through shear stress applied thereto.

4. A switch comprising, in combination, a stationary switch contact, a switch blade rotatable about its longitudinal axis for engaging said switch contact at one end, a carrier swingable about an axis transverse to said longitudinal axis for swingably mounting said switch blade, a switch blade operator rotatable about an axis which is perpendicular to said longitudinal and transverse axes when said switch blade is in engagement with said switch contact, a clevis carried by and rotatable with said

operator, the arms of said clevis extending to opposite sides of said switch blade operator and substantially equidistant therefrom and generally at right angles to a plane containing said longitudinal axis of said switch blade in switch closed position and containing said axis of said switch blade operator, a switch blade support member secured to said switch blade, and a bearing pin extending through said support member and into said arms of said clevis to mount said support member for rotation about an axis intersecting said longitudinal and transverse axes and said axis of said switch blade operator and transmitting torque applied to said clevis by said switch blade operator through a couple about each of the four mentioned axes thereby balancing out forces about said axes whereby, on rotation of said operator with said switch blade in engagement with said switch contact, said switch blade is rotated about its longitudinal axis to disengage said switch contact and then is swung about said transverse axis away from said switch contact, the force required for rotating and swinging said switch blade being transmitted to said bearing pin means principally through shear stress applied thereto.

5. A switch comprising, in combination, a switch blade carrier rotatable about a first axis, a switch blade rotatably mounted on said carrier about a second axis extending lengthwise of said switch blade and transverse to said first axis, a stationary contact for engagement by said switch blade at one end, aligned bearing means carried by the other end of said switch blade on opposite sides of said second axis and lying along a third axis inclined to and intersecting said first and second axes, a switch blade operator rotatable about a fourth axis perpendicular to said first axis and intersecting said second and third axes, and force transmitting means integral and rotatable with said switch blade operator and extending wholly around said second axis and interfitting with said aligned bearing means whereby, on rotation of said operator about said fourth axis with said switch blade in engagement with said switch contact torque is applied to said bearing means, a couple is applied about each of said four axes thereby balancing out forces about said axis, said switch blade is rotated about said second axis to disengage said switch contact and then is swung about said first axis away from said switch contact.

6. A switch comprising, in combination, a switch blade carrier rotatable about a first axis, a switch blade rotatably mounted on said carrier about a second axis extending lengthwise of said switch blade and transverse to said first axis, a stationary contact for engagement by said switch blade at one end, aligned bearing means carried by the other end of said switch blade on opposite sides of said second axis and lying along a third axis inclined to and intersecting said first and second axes, a switch blade operator rotatable about a fourth axis perpendicular to said first axis and intersecting said second and third axes, and a clevis integral and rotatable with said switch blade operator with the central portion spaced from said second axis and the arms interfitting with said aligned bearing means whereby, on rotation of said operator about said fourth axis with said switch blade in engagement with said switch contact torque is applied to said bearing means, a couple is applied about each of said four axes thereby balancing out forces about said axis, said switch blade is rotated about said second axis to disengage said switch contact and then is swung about said first axis away from said switch contact.

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