Sept. 5, 1950 F. G. SCHMIDT 2,521,484

ELECTRIC SWITCH WHOSE BLADE SWINGS AND TWISTS

Filed Feb. 6, 1947 7 Sheets-Sheet 1

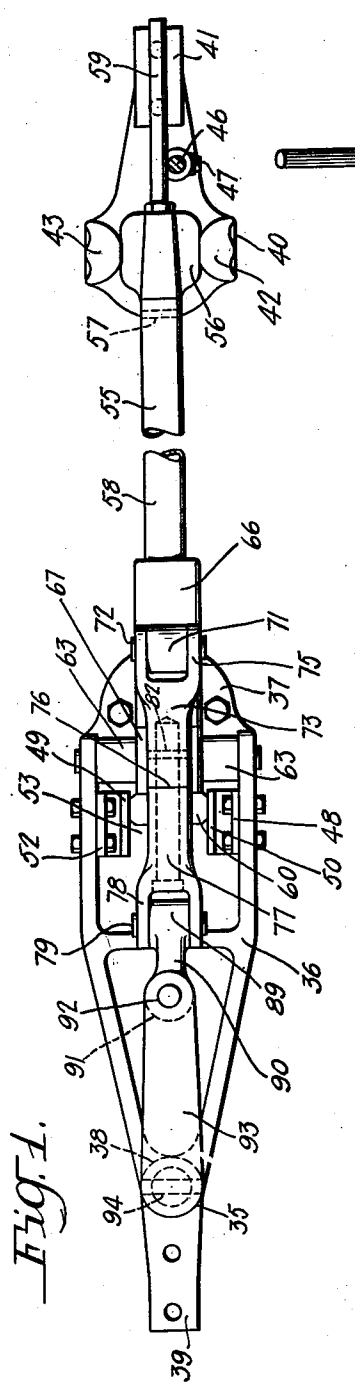


Fig. 1.

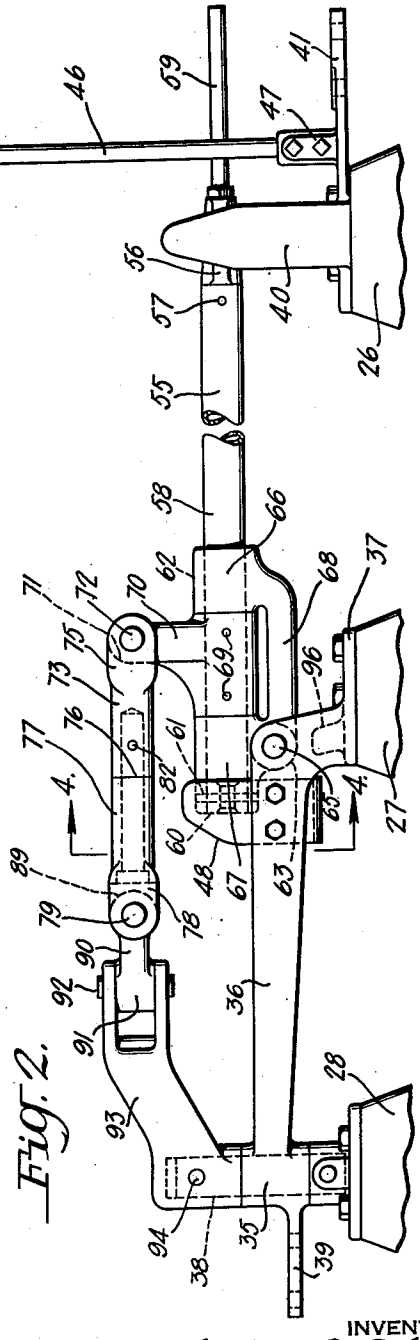


Fig. 2.

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Sept. 5, 1950 F. G. SCHMIDT 2,521,484

ELECTRIC SWITCH WHOSE BLADE SWINGS AND TWISTS

Filed Feb. 6, 1947 7 Sheets-Sheet 2

Fig. 7.

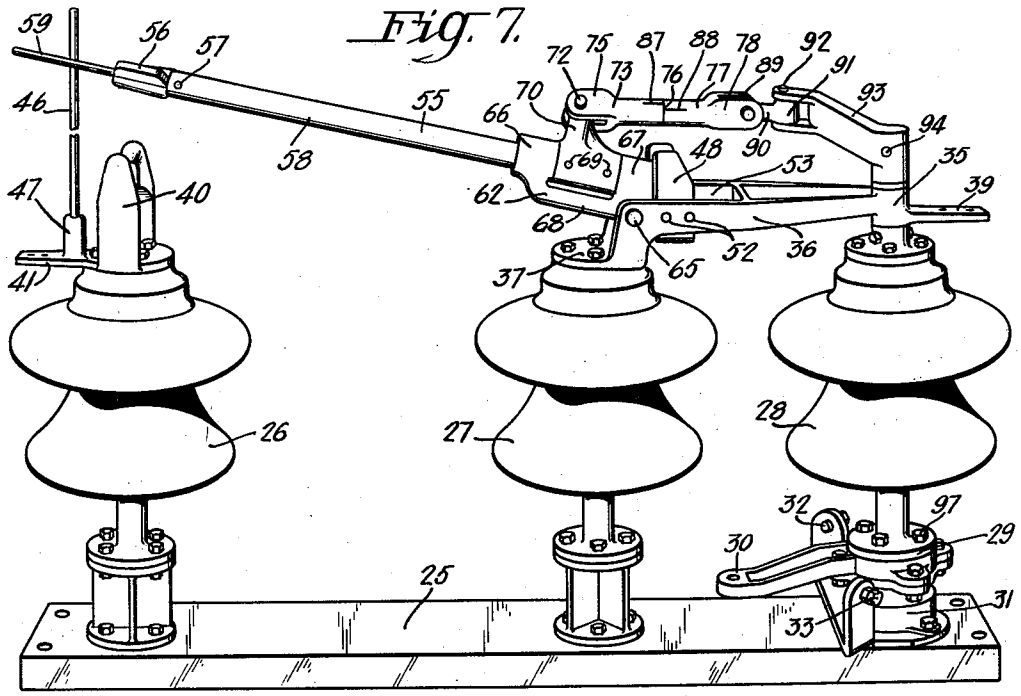


Fig. 3.

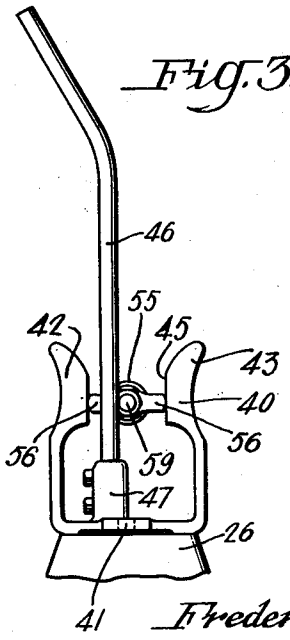
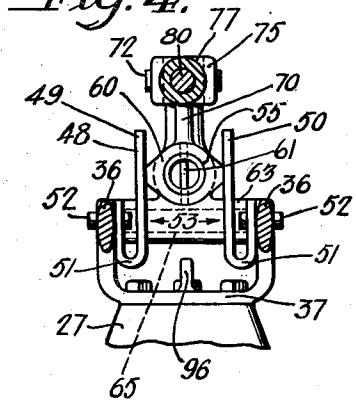


Fig. 4.



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Sept. 5, 1950 F. G. SCHMIDT 2,521,484

ELECTRIC SWITCH WHOSE BLADE SWINGS AND TWISTS

Filed Feb. 6, 1947 7 Sheets-Sheet 3

Fig. 5.

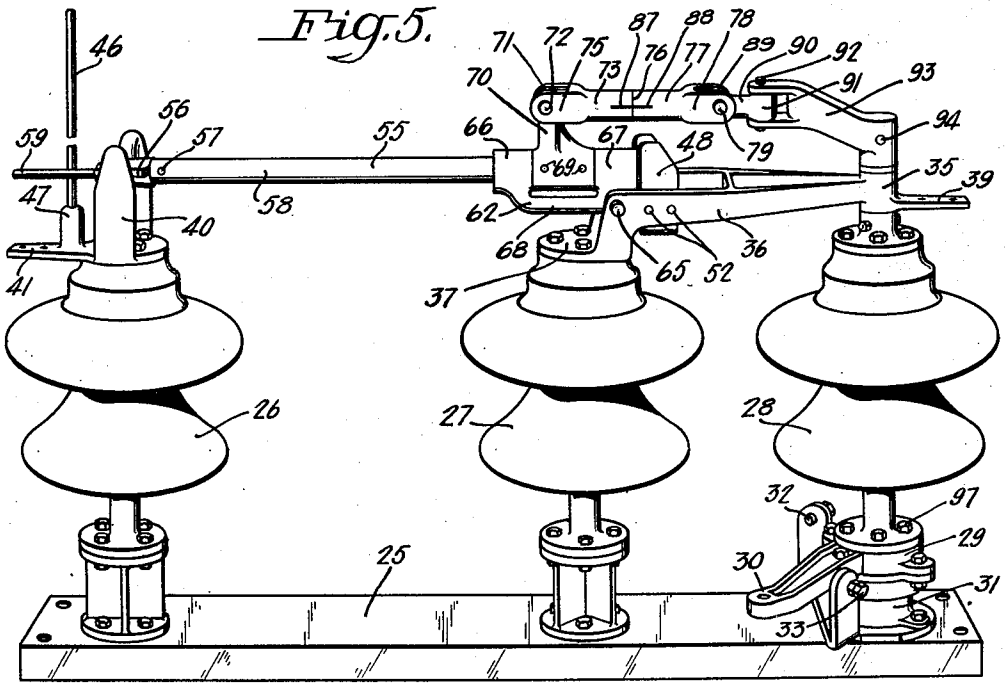
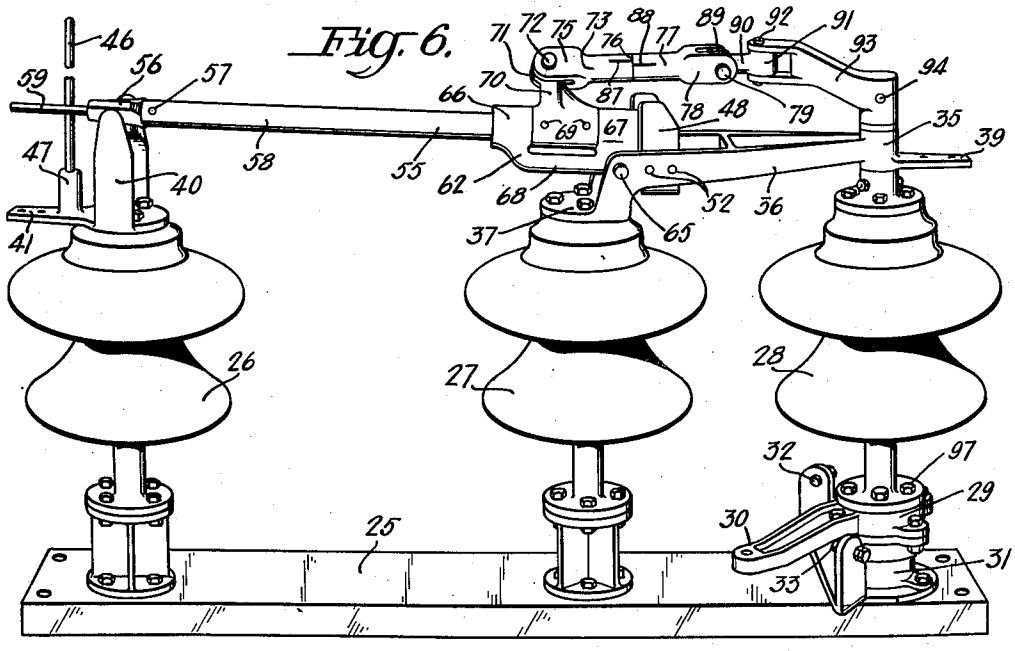


Fig. 6.



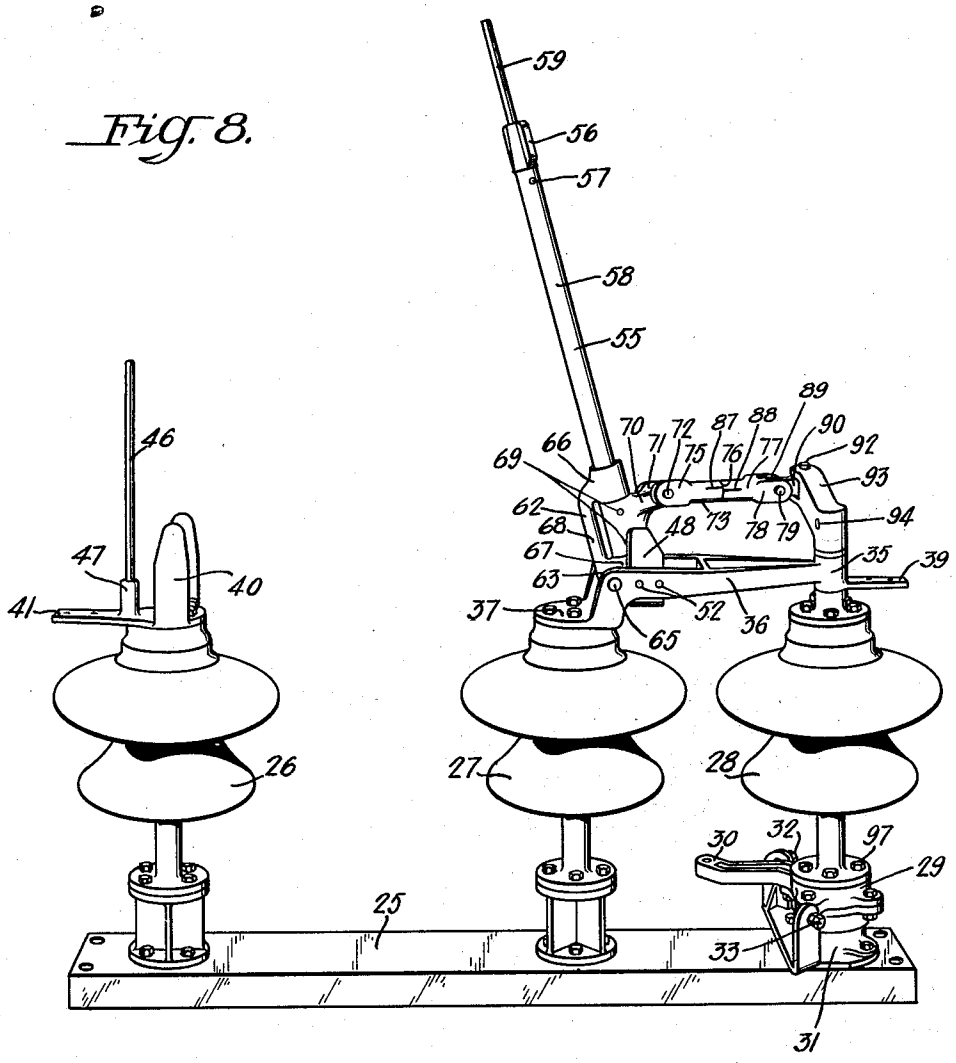
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Sept. 5, 1950 F. G. SCHMIDT 2,521,484

ELECTRIC SWITCH WHOSE BLADE SWINGS AND TWISTS

Filed Feb. 6, 1947 7 Sheets-Sheet 4

Fig. 8.



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Sept. 5, 1950 F. G. SCHMIDT 2,521,484

ELECTRIC SWITCH WHOSE BLADE SWINGS AND TWISTS

Filed Feb. 6, 1947 7 Sheets-Sheet 5

Fig. 9.

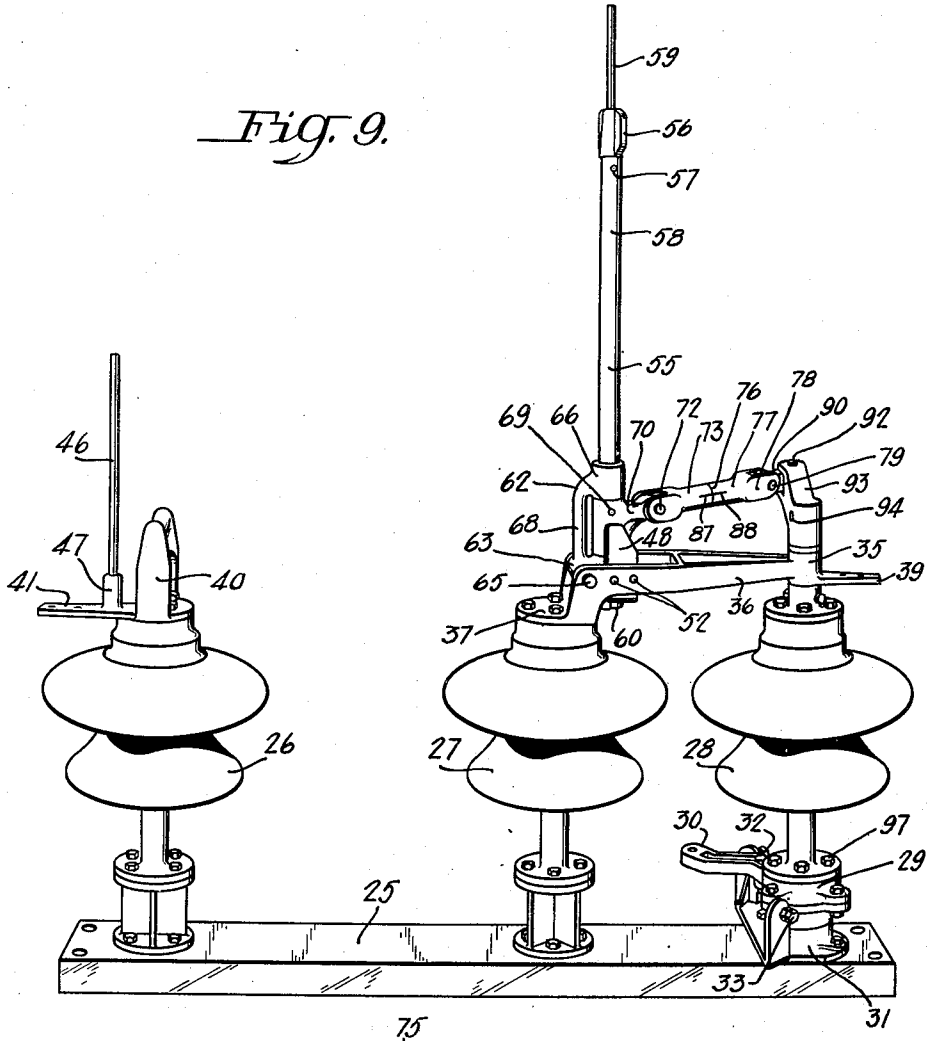


Fig. 10.

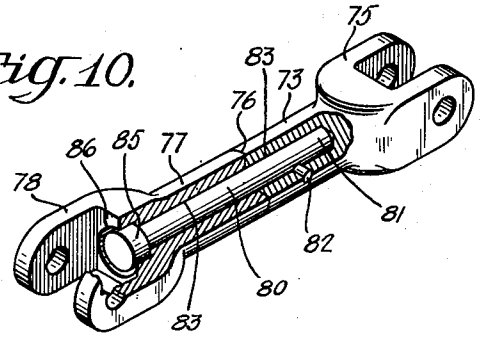
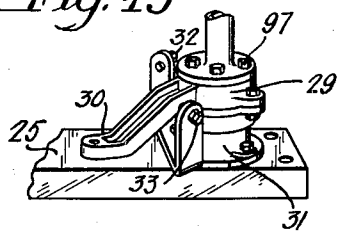


Fig. 13.



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Sept. 5, 1950 F. G. SCHMIDT 2,521,484

ELECTRIC SWITCH WHOSE BLADE SWINGS AND TWISTS

Filed Feb. 6, 1947 7 Sheets-Sheet 6

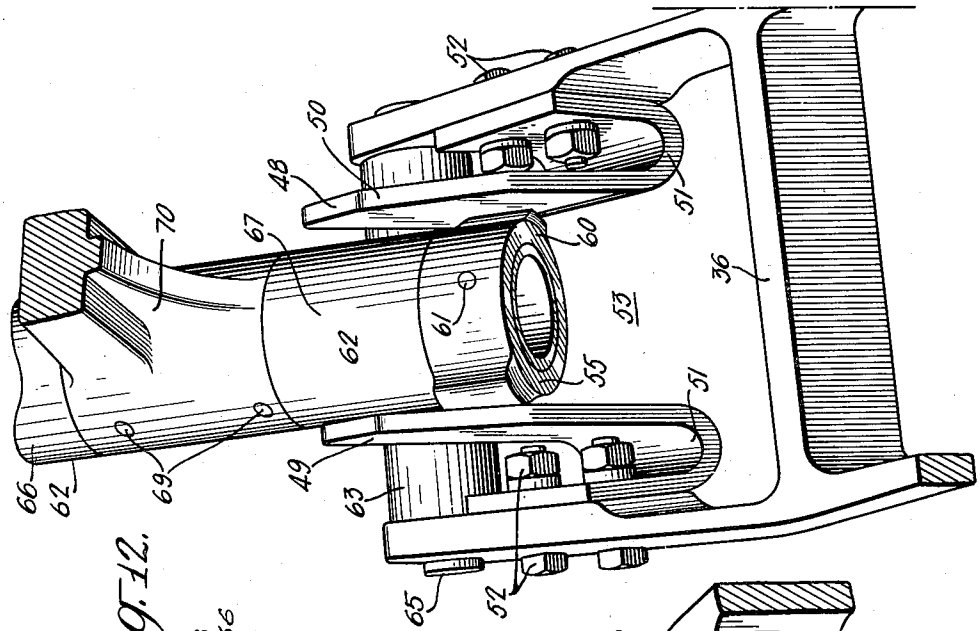


Fig. 12.

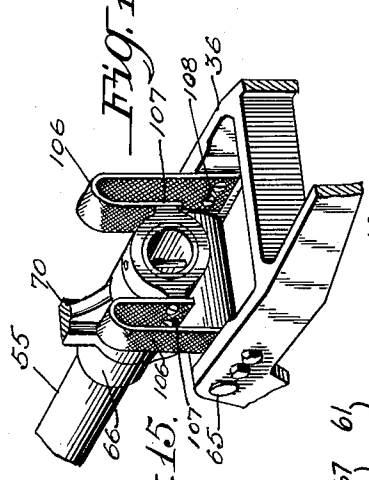


Fig. 15.

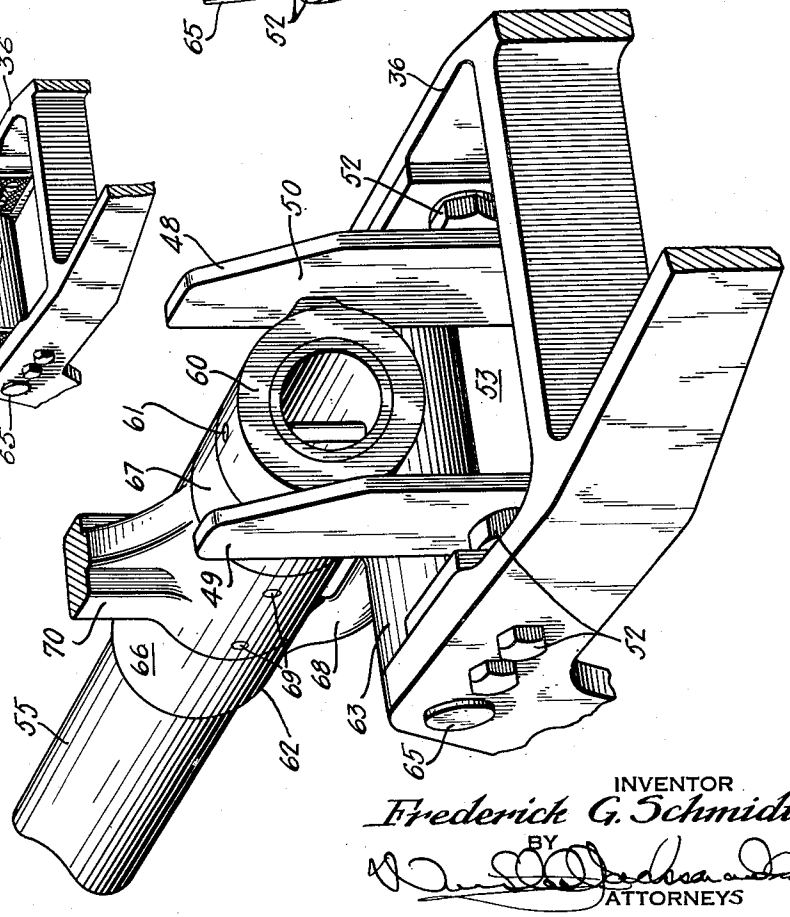


Fig. 11.

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Sept. 5, 1950 F. G. SCHMIDT 2,521,484

ELECTRIC SWITCH WHOSE BLADE SWINGS AND TWISTS

Filed Feb. 6, 1947 7 Sheets-Sheet 7

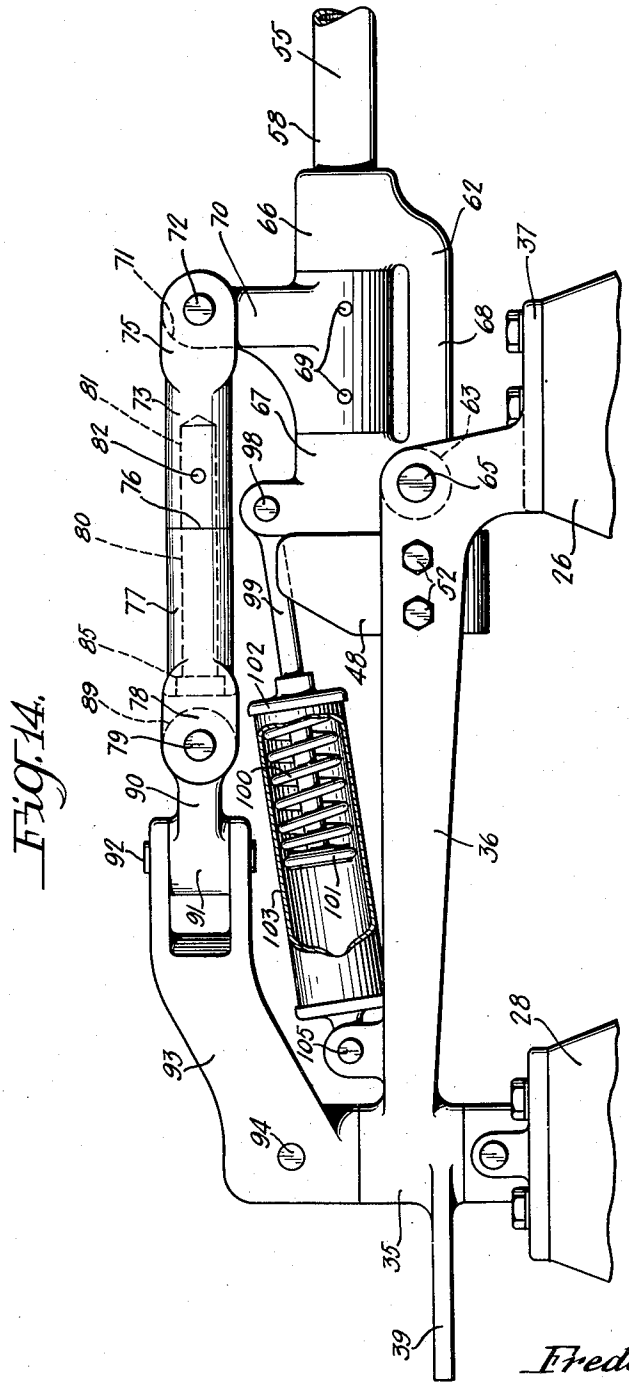


Fig. 14.

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Patented Sept. 5, 1950 2,521,484

UNITED STATES PATENT OFFICE

2,521,484

ELECTRIC SWITCH WHOSE BLADE SWINGS AND TWISTS

Frederick G. Schmidt, Philadelphia, Pa., assignor, by mesne assignments, to Electric Power Equipment Corporation, Philadelphia, Pa., a corporation of Pennsylvania

Application February 6, 1947, Serial No. 726,825

9 Claims. (Cl. 200—48)

1

My invention relates to electric switches of the type in which the switch blade swings and also twists during opening and closing movement.

A purpose of my invention is to eliminate abrupt stopping of the switch blade and other parts of comparatively large switches such as disconnect switches in which the switch blade twists and also swings in opening and closing, so as to avoid jarring, vibration, unnecessary distortion and flexing of operating parts, reduce faitgue failures, excessive wear and brinelling, and absorb energy incident to comparatively rapid motion of heavy parts throughout the entire structure.

A further purpose in disconnect switches and other comparatively large switches which twist as well as swing during opening and closing, is to simplify the operating mechanism both from the standpoint of manufacture and also from that of maintenance and initial installation.

A further purpose is to provide such effective absorption of energy during closing of a disconnect switch, of the type which twists as well as swings, that the necessity for cushioning by the contacts themselves is eliminated, and extremely sturdy and comparatively rigid contacts can be employed without the necessity of back-up springs.

A further purpose is to render a switch of the disconnect type which twists and swings in opening and closing, capable of substantial overtravel or undertravel without interference with functioning, to avoid the necessity for tedious and expensive field adjustments to prevent malfunctioning.

A further purpose is to produce a disconnect switch, of the type which twists and swings in opening and closing, which requires no adjustment of the parts between the operating crank and the switch blade, such reducing maintenance and installation costs, and avoiding the possibility of inexpert adjustment which will cause excessive jarring, vibration or distortion of parts.

Further purposes appear in the specification and in the claims.

In the drawings I have chosen to illustrate a single main embodiment of the invention, with minor variations, chosing the form shown and the variations from the standpoints of convenience in illustration, satisfactory operation, and clear demonstration of the principles involved.

Figure 1 is a fragmentary top plan view showing my switch in closed position, with the arcing horn sectioned away.

Figure 2 is a fragmentary side elevation of Figure 1.

2

Figure 3 is a right end elevation of Figure 2, looking at the outer contact.

Figure 4 is a section of Figure 2 on the line 4—4, looking at the inner or pivot contact.

Figures 5 to 9 inclusive are perspectives showing progressive steps of opening the switch of the present invention.

Figure 10 is a sectional perspective view showing the swivel.

Figures 11 and 12 are sectional perspective views to enlarged scale showing the jaw contact at the pivot end respectively in closed and in partially open positions.

Figure 13 is a fragmentary view corresponding to Figure 9 showing a different adjustment of the operating mechanism.

Figure 14 is a fragmentary enlarged side elevation, partially in section, showing a modification.

Figure 15 is a further fragmentary perspective of a modification.

Describing in illustration and not in limitation and referreing to the drawings:

In accordance with the present invention, abrupt stopping or jarring of the blade as it approaches the closed positions is prevented, without the necessity of complicated operating mechanism. In fact, the structure for opening, closing and twisting of the blade into its final high pressure contact position has been reduced to a very simple form as compared with prior art switches. As the contacts approach the closed position, both ends of the switch blade hit and make contact concurrently with the turning or twisting action, thus cushioning the downward movement, giving a wide contact area, and permitting absorption of the closing energy throughout the structure.

Without the necessity of using shock absorbers or the like, jarring, vibration, and abrupt stopping of the blade are reduced to a minimum, while distortion and flexing of operating arms and levers are prevented, and the likelihood of brinelling or fatigue failure of the parts is greatly reduced.

Since the energy is effectively dissipated without an abrupt stop, no need exists for back-up springs or other extremely resilient contact structures. In fact, both the front fixed contact and the rear fixed contact are desirably made from a strong heat treated copper alloy which will assure great contact pressure, and avoid the likelihood of failure and need for replacement of back-up springs.

The necessity for adjustment of the operating parts between the operating crank and the switch

blade is entirely eliminated, and all of the parts are machined for interchangeability and initially installed in the correct relationship. By this procedure the danger of having a switch stick or jam through inexpert adjustment of operating parts by maintenance personnel is greatly reduced, while the cost incident to manufacture of non-corrodible adjusting elements, and of employing expert personnel for field adjustment is avoided.

Minor inaccuracies in setting of interphase piping do no harm, since the switch will operate effectively with a considerable amount of overtravel or undertravel.

In the preferred embodiment of my invention, I provide a base **25** which supports rigid insulators **26** and **27** in suitable spaced relation to provide the gap between the contacts in open position of the switch. Behind the insulator **27** and suitably in line with the insulators **26** and **27**, I provide a rotatable insulator **28** which is mounted on a bearing **29** rotatable about a suitably vertical axis, under the action of a lever **30**, and supported from the base **25** by a bearing mounting **31**. The motion of the lever **30** is limited at the two extremities by adjustable stops **32** and **33**.

The top of the rotatable insulator **28** is journaled at **35** in a metallic saddle **36** which is supported at **37** on the top of the insulator **27**. A stub shaft **38** shown in Figure 2 extends from the top of the insulator **28** through the journal **35**. The saddle **36** may to advantage be a substantial casting of copper base alloy, which will give rigidity to the structure. Electrical connection to one side of the switch is conveniently made by a suitable terminal connected at **39** to an extension on the saddle. The contact **40** at the open end of the switch is mounted on insulator **26** and provided with a suitably integral extension **41** for connection to an opposite electrical terminal. As best seen in Figure 3, the contact **40** is of jaw form provided with opposite prongs **42** and **43** having interior contact faces **45** for engagement with a beaver tail on the switch blade. The contact **40** is desirably a one piece heat treated copper alloy casting, suitably of beryllium copper, Phosphor bronze, silicon bronze, or aluminum bronze. I find it desirable to employ a Rockwell hardness of approximately B100 on the contact **40** and the other fixed contact later to be mentioned. An arcing horn **46** is conveniently mounted at **47** on the contact **40**.

The opposite fixed contact **48** is likewise of jaw formation and consists of two prongs **49** and **50** as best seen in Figure 4, U-bent at **51** and secured to the saddle **36** at **52**. The saddle is provided with a space at **53** to permit access between the jaws of the contact **48**.

A switch blade **55** is provided at its outer end with a beaver tail **56** which may conveniently be of a suitable copper base alloy similar to the switch blade, extending within, silver brazed and suitably pinned at **57** to a tubular portion **58** of the blade.

The beaver tail is preferably made of a copper base alloy having a Rockwell hardness of approximately B88, to give a good combination of wearing properties with the fixed contact, and to secure most effective scouring to clean the contacts during opening and closing. For the purpose intended, I consider that a difference in hardness of at least 10 points is desirable, with the movable contact the softer of the two materials. A similar relationship should exist between the other beaver tail to be described, and the corresponding fixed contact.

At the extremity of the beaver tail I suitably provide a cooperating arcing horn element **59** which acts with the element **46** described, to reduce arcing as well known.

On the opposite end of the switch blade I provide a beaver tail **60** to cooperate with the inter-jaw contact **48**. The beaver tail **60** is also preferably of copper base alloy, suitably extending within, silver brazed and pinned to the tubular portion **58** of the switch blade at **61**, the pin suitably extending in a direction so as not to interrupt the contact portion of the beaver tail, as shown in Figure 2.

The beaver tails at the two ends of the switch blade are in angular alignment, and are parallel to the switch pivot when the switch is closed.

The switch blade is pivotally and twistably supported on a blade support **62** having a pivotal bearing portion **63** which swingably journals on a pin **65** extending across and supported in the saddle **36** on the side toward the contact **40** with respect to the contact **48**. The blade support has spaced longitudinal journals **66** and **67** for the tubular portion **58** of the blade **55**, the journals being connected and supported by a yoke portion **68**. Thus the blade is free to turn in the blade support as it swings. The beaver tail **60** acts in effect as a collar on the inner end of the blade and helps to prevent longitudinal displacement of the blade in the journals **66** and **67**.

Rigidly secured to the blade as by pins **69**, I provide a blade arm **70** extending transversely of the longitudinal axis of the blade and occupying the space on the blade between the journals **66** and **67**. The blade arm by fully occupying the space between the journals thus prevents longitudinal displacement of the blade with respect to the blade support.

Suitably at the outer end of the blade arm **70** I provide a journal portion **71** having a pivot extending parallel to the axis of the blade pivot in closed position of the blade, and making pivotal connection by a pin **72** with a first operating rod **73** at a clevis end portion **75**. It will be noted that the pivotal joint at the pin **72**, while yieldable about the axis of the pin, is rigid in the direction of the switch pivot, so that force can be applied laterally through this pivotal connection to turn the switch blade.

At the opposite end of the rod **73** from the pivotal connection to the pin **72** a swivel **76** is located, making connection to a second rod **77** whose opposite end **78** is of clevis formation, making pivotal connection to a pin **79**. The swivel is laterally rigid, but permits relative twisting of the rods **73** and **77** about their longitudinal axes, which are identical. The lateral rigidity which will permit transmission of lateral force components in the direction of the axis of the switch pivot through the rods **73** and **77** and the swivel is preferably achieved by providing a long swivel bearing **80** socketing at **81** in the rod **73** and secured therein by the pin **82** (Figure 10), and journalling in a bore **83** running longitudinally of the rod **77**, and terminating in a head **85** on the journal rod **80**, which fits into a socket **86** in the clevis end **78** of the rod **77**.

To illustrate swiveling action and for indication purposes, I provide cooperating marks **87** and **88** respectively on the rods **73** and **77**, matching at the closed position of the switch and at

any other positions indicating the extent of swivel action.

The pivot pin 79 is suitably parallel to the pivot pin 72 in closed position of the switch, and also parallel to the axis of the switch pivot. In opening positions the pivot pin 79 remains parallel to the axis of the switch pivot in the horizontal plane (where the switch is mounted horizontally) but in the transverse plane deviates from parallelism. The pivot pin 79 makes pivotal engagement with a pivot end 89 of a third rod 90, the pivot end 89 holding the pin 79 parallel with the axis of the switch pivot in closed position. This joint is also laterally rigid, but freely pivotal about its axis. The opposite end of the third rod 90 carries a pivotal journal at 91 transverse to that at 89, receiving a pivot pin 92 in the outer end of crank 93, which is secured at 94 to the upper end of the rotatable insulator 28, being mounted on the top of stub shaft 38 so as to turn with the insulator column.

It will be evident that the connections between the pivot pin 72 on the switch arm and the pivot pin 92 on the crank are longitudinally rigid for pushing and pulling, and are rigid in the direction of the axis of the switch pivot for transmission of lateral components to twist and untwist the switch, due to lateral rigidity at the pivotal joints with pins 72 and 79 and lateral rigidity in the swivel 73. However, there is freedom of the joints to swing about the pins 72 and 79, which in the closed position are parallel to the axis of the switch pivot, and to swing about the pin 92 on the crank. There is also freedom to swing about the longitudinal axis of rods 73 and 77 at the swivel, without, however, lateral freedom in the swivel in any direction.

As best seen in Figures 2 and 4, an emergency stop is provided at 96, immediately below the switch pivot and preferably integral with the saddle 36. During normal operation this stop will not be contacted by any of the operating parts, but in case of breakage of an operating member when the switch is in open position, it will permit the switch to fall back and engage the stop without short circuiting adjoining mechanism.

In the illustrations of Figures 5 to 9, the switch is shown as operating with the lever 30 toward the observer in closed position and at the opposite end of its stroke (away from the observer) in open position. It will be evident by examination of Figures 1 and 5 that the crank rods and switch arm are aligned in closed position, and that in opening they can equally well move in either direction. This is illustrated by Figure 13, which corresponds to Figure 9, but shows the operating lever toward the observer in Figure 13, to indicate that by simply resetting the bolts at 97 which position the operating lever with respect to the insulator 28, the switch may be made to open by moving the operating lever 30, the crank and the associated parts in the opposite direction. Of course the crank and levers and the switch arm will be in the reverse position from that of Figure 9.

In some of the heavier models it is desired to counterweight the moving parts, and this is shown in Figure 14. In this form the yoke 68 is extended beyond the journal 67 to provide pivotal engagement at 98 with a spring plunger 99 urged by a spring 100 between a plunger head 101 and a cylinder head 102 or a spring cylinder 103 pivotally supported at 105 on the saddle 36. As the switch closes it will act against the spring 100, which will tend to absorb some of the energy of closing and will counterbalance the operating parts.

While it is preferred to use jaw contacts at both ends of the switch, it is permissible to use a flexible connection rather than a jaw contact at the pivot end, as well known in the art. To illustrate this, I show in Figure 15 a modification of the form shown in the other views, in which the jaw contact at the pivot end is omitted and flexible braids 106 are bolted to the switch blade at 107 and to the saddle at 108, the braid providing electrical contact to the switch blade in all positions.

The rods 73 and 77 are preferably of about the same length, but the rod 90 is preferably shorter than either of the other two.

In operation, the switch may be seen in fully closed position in Figures 1, 2, 3, 4, 5, and 11. In this position the beaver tails at both ends of the switch extend substantially transversely across between the jaws, spreading the jaws to provide contact pressure. The device is not, however, sensitive to slight angular variation due to overtravel or undertravel, and good contact will be obtained if the beaver tail varies slightly from the transverse angular position as seen in Figures 3 and 4. This allows for slight errors in adjustment of the stops 32 and 33 or of the connection of the operating lever 30 to the in phase piping. It will be noted that the switch is entirely free from any other adjustment and errors in adjustment cannot be made in the crank or operating rods. This is a great economy and advantage. It will be seen that the pivot pin 65 on which the switch swings, and the pivot pins 72 and 79 of the rods, are parallel in this closed position, while the pivot pin 92 of the crank is transverse to the pivot pins just mentioned and parallel to the axis of the rotating insulator. The swivel 76 is aligned as indicated by the coincidence of the marks 87 and 88, and the switch blade, blade support, blade arm, rods and crank are entirely free from engagement with any stop which could jar the switch in closing, the only stop in engagement being that contacting the operating arm 30, which is remote from the switch blade itself. It will thus be seen that during closing action there is a minimum of jarring, vibration, and cause for brinelling or fatigue failure.

The first phase of opening movement is indicated in Figure 6 where the operating lever 30 has begun its travel from the stop 33 toward the stop 32, correspondingly moving the crank 93 and the crank end 92. Most of the action taking place is twisting of the switch blade, with very little swinging about the switch pivot, the twisting being accomplished by rod 73, swivel 76, rod 77 and rod 90, acting as rigid members in the direction of the axis of the switch pivot, to transmit the lateral component of the crank motion to the switch arm 70 and deflect the outer end of the swich arm away from the observer. Also to a slight extent the rod 73, the swivel 76, the rod 77 and the rod 90 have acted as tension members to pull on the outer end of the switch arm 70.

As shown in Figure 6, the swivel 76 is beginning to function, since the rod 73 is slightly turned with respect to the rod 77 about the longitudinal axes of the rods, as indicated by the displacement between the marks 87 and 88.

The next step of opening movement is shown in Figure 7 and to some extent in Figure 12. Between Figures 6 and 7 the primary function

of the rod 73, the swivel 76, the rod 77 and the rod 90 is as tension members to swing the switch blade further upward by pulling on the outer end of the switch arm 70. To some extent, however, the rod 73, swivel 76, rod 77 and rod 90 have transmitted a lateral component of the crank motion, as indicated by the fact that the beaver tails have turned further and the mark 87 is further displaced from the mark 88 at the swivel.

The next step of opening is indicated by Figure 8, which shows the switch almost fully open. Between Figures 7 and 8 the rod 73, the swivel 76, the rod 77, and the rod 90 have primarily acted as tension members, but they have also transmitted a lateral component to the end of the switch arm 70, in this case tending to decrease the angular displacement at the swivel, as shown by the fact that the mark 87 is now again closer to the mark 88 at the swivel.

A further opening action is shown in Figure 9, the rod 73, swivel 76, rod 77 and rod 90 having again exerted tension, bringing the switch blade to a vertical position. However, these members have also applied a lateral component of the crank motion to the outer end of the switch arm 70, further decreasing deflection on the two sides of the swivel so that the marks 87 and 88 are now again in line as they were in closed position.

Thus it will be evident that there is a duplex character to the angular twisting of the switch blade during the opening and closing. In opening, the two sides of the swivel first displace to a maximum and then twist back to their normal relation. This peculiar motion is considered to be characteristic of the structure here provided, and aids in achieving the double function of twisting and swinging the switch blade without the employment of any stops, cams or gearing.

In closing the exact reverse action takes place and this may be observed by reading Figures 5 to 9 in the reverse order.

As the switch closes, the beaver tails at both ends hit and make contact with the stationary contacts at the same time and begin turning motion simultaneously. The energy is distributed throughout the whole structure, part of it being used in the twisting of the blade against the pressure of the jaw contacts.

It will be evident that in the switch of the invention, the operating connections between the outer end of the switch arm and the crank are effectively tension and compression members, which are also capable of swinging at the end of the switch closing about an axis which in closed position is parallel to the switch pivot and which are capable of swinging at the crank about an axis transverse to the axis of the switch pivot. Between these limits there is a swivel which is rigid in the direction of the axis of the switch pivot, and a pivotal connection, which in closed position turns about an axis parallel to the switch pivot, and during opening remains in a plane parallel to that including the switch pivot and the opposite jaw contact.

In view of my invention and disclosures variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

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

1. In a switch, a jaw contact, a switch blade support, a switch blade twistably mounted in the support and having a beaver tail cooperating with the jaw contact, a switch pivot mounting the support and switch blade to swing about a pivotal axis, a blade arm extending transversely to the length of the switch blade and directly transverse to the beaver tail and adapted to twist the switch blade, a crank on the opposite side of the switch pivot from the jaw contact and swinging on an axis transverse to the axis of the switch pivot, and rod connections pivotally interconnected with the blade arm near its outer end and with the crank, laterally rigid intermediate the ends in the direction of the axis of the switch pivot and including a laterally rigid swivel which permits free twisting about a longitudinal axis in the connections, the crank and rod connections to the end of the blade arm in closed position of the switch extending straight in line with the switch blade and with one another.

2. In a switch, a jaw contact, a switch blade support, a switch blade twistably mounted in the support and having a beaver tail cooperating with the jaw contact, a switch pivot mounting the support and switch blade to swing about a pivotal axis, a blade arm extending transversely to the length of the switch blade and directly transverse to the beaver tail and adapted to twist the switch blade, a crank on the opposite side of the switch pivot from the jaw contact and swinging on an axis transverse to the axis of the switch pivot, a first rod pivotally connected to the switch arm near its outer end, in closed position of the switch on a pivotal axis parallel to the axis of the switch pivot, a swivel at the opposite end of the first rod rigid in the direction of the axis of the switch pivot, twisting on the longitudinal axis of the first rod, a second rod interconnected with the first rod by a swivel, and a third rod pivotally connected to the second rod on the end opposite from the swivel, in closed position of the switch on a pivotal axis parallel with the axis of the switch pivot and at the opposite end pivotally connected to the crank on a pivotal axis transverse to the axis of the switch pivot, the first, second and third rods being rigid in the direction of the axis of the switch pivot, the crank and rods in closed position of the switch extending straight in line with the switch blade and with one another.

3. In a switch, a jaw contact, a switch blade support, a switch blade twistably mounted in the support and having a beaver tail cooperating with the jaw contact, a switch pivot mounting the support and switch blade to swing about a pivotal axis, a blade arm extending transversely to the length of the switch blade and directly transverse to the beaver tail and adapted to twist the switch blade, a crank on the opposite side of the switch pivot from the jaw contact and swinging on an axis transverse to the axis of the switch pivot, a first rod pivotally connected to the switch arm near its outer end, in closed position of the switch on a pivotal axis parallel to the axis of the switch pivot, a swivel connecting to the opopsite end of the first rod, rigid in the direction of the axis of the switch pivot and freely twisting on the longitudinal axis of the first rod, a second rod interconnected in prolongation of the first rod by the swivel, and a third rod pivotally connected to the end of the

second rod opposite from the swivel, in closed position of the switch on an axis parallel to the axis of the switch pivot, and pivotally connected to the outer end of the crank on an axis transverse to the axis of the switch pivot, the switch closing in mid position of the blade arm, first, second and third rods and crank, being capable of adjustment to open by throw of the crank in either direction from the mid position, in opening the first rod initially gaining on the second rod at the swivel and subsequently losing in relation to the second rod at the swivel with further opening, and the switch being free from stop engagement of the blade and blade support during closing action, the crank and rods in closed position of the switch extending straight in line with the switch blade and with one another.

4. In a switch, a jaw contact, a switch blade support, a switch blade twistably mounted in the support and having a beaver tail cooperating with the jaw contact, a switch pivot mounting the support and switch blade to swing about a pivotal axis, a blade arm extending transversely to the length of the switch blade and directly transverse to the beaver tail and adapted to twist the switch blade, a crank on the opposite side of the switch pivot from the jaw contact and swinging on an axis transverse to the axis of the switch pivot, a first rod pivotally connected to the switch arm near its outer end, in closed position of the switch on a pivotal axis parallel to the axis of the switch pivot, a swivel connecting to the opposite end of the first rod, rigid in the direction of the axis of the switch pivot and freely twisting on the longitudinal axis of the first rod, a second rod interconnected in prolongation of the first rod by the swivel, and a third rod shorter than either of the other two, pivotally connected to the end of the second rod opposite from the swivel, in closed position of the switch on an axis parallel to the axis of the switch pivot and pivotally connected to the outer end of the crank on an axis transverse to the axis of the switch pivot, the switch closing in mid position of the blade arm, first, second and third rods and crank, being capable of adjustment to open by throw of the crank in either direction from the mid position, in opening the first rod initially gaining on the second rod at the swivel and subsequently losing in relation to the second rod at the swivel with further opening, and the switch being free from stop engagement of the blade and blade support during closing action, the crank and rods in closed position of the switch extending straight in line with the switch blade and with one another.

5. In a switch, a pair of spaced cooperating jaw contacts, a switch blade support, a switch blade twistably mounted in the support and having beaver tails cooperating with the jaw contacts, a switch pivot located adjacent one jaw contact on the side toward the other jaw contact, mounting the support and switch blade to swing about a pivotal axis, a blade arm extending transversely to the length of the switch blade and directly transverse to the beaver tail and adapted to twist the switch blade, a crank on the opposite side of the switch pivot from the jaw contact adjoining the switch pivot and swinging on an axis transverse to the axis of the switch pivot and rod connections pivotally interconnected with the switch arm near its outer end and with the crank, laterally rigid intermediate the ends in the direction of the axis of the switch pivot and including a laterally rigid swivel which permits free twisting about a longitudinal axis in the connections, the crank and rod connections to the end of the blade arm in closed position of the switch extending straight in line with the switch blade and with one another.

6. In a switch, a pair of spaced cooperating jaw contacts, a switch blade support, a switch blade twistably mounted in the support and having beaver tails cooperating with the jaw contacts, a switch pivot located adjacent one jaw contact, mounting the support and switch blade to swing about a pivotal axis, a blade arm extending transversely to the length of the switch blade and directly transverse to the beaver tail and adapted to twist the switch blade, a crank on the opposite side of the switch pivot from the jaw contact adjacent the pivot and swinging on an axis transverse to the axis of the switch pivot, a first rod pivotally connected to the switch arm near its end, in closed position on a pivotal axis parallel to the axis of the switch pivot, a swivel at the opposite end of the first rod rigid in the direction of the axis of the switch pivot, twisting on the longitudinal axis of the first rod, a second rod interconnected with the first rod by a swivel, and a third rod pivotally connected to the second rod on the end opposite from the swivel, in closed position of the switch on a pivotal axis parallel with the axis of the switch pivot and at the opposite end pivotally connected to the crank on a pivotal axis transverse to the axis of the switch pivot, the first, second and third rods being rigid in the direction of the axis of the switch pivot, the crank and rods in closed position of the switch extending straight in line with the switch blade and with one another.

7. In a switch, a jaw contact, a switch blade support, a switch blade twistably mounted in the support and having a beaver tail cooperating with the jaw contact, a switch pivot mounting the support and switch blade to swing about a pivotal axis, a blade arm extending transversely to the length of the switch blade and directly transverse to the beaver tail and adapted to twist the switch blade, a crank on the opposite side of the switch pivot from the jaw contact and swinging on an axis transverse to the axis of the switch pivot, a first rod pivotally connected to the switch arm near its outer end, in closed position of the switch on a pivotal axis parallel to the axis of the switch pivot, a swivel connecting to the opposite end of the first rod, rigid in the direction of the axis of the switch pivot and freely twisting on the longitudinal axis of the first rod, a second rod interconnected in prolongation of the first rod by the swivel, and a third rod shorter than either of the other two, pivotally connected to the end of the second rod opposite from the swivel, in closed position of the switch on an axis parallel to the axis of the switch pivot and pivotally connected to the outer end of the crank on an axis transverse to the axis of the switch pivot, the switch closing in mid position of the blade arm, first, second and third rods and crank, being capable of adjustment to open by throw of the crank in either direction from the mid position, the first, second and third rods and the swivel being invariable in length and free from adjustment, in opening the first rod initially gaining on the second rod at the swivel and subsequently losing in relation to the second rod at the swivel with further opening, and the switch being free from stop engage-

ment of the blade and blade supporting during closing action, the crank and rods in closed position of the switch extending straight in line with the switch blade and with one another.

8. In a switch, a switch pivot, open jaw contacts, the first spaced from the switch pivot and the second adjacent to the switch pivot on the side of the switch pivot remote from the first open jaw contact, a switch blade support pivotally mounted on the switch pivot and having longitudinal rotational bearings, a switch blade extending through the blade support, rotationally supported on the bearings and having one beaver tail at the end remote from the switch pivot cooperating in closed position with the first open jaw contact and another beaver tail on the side of the switch pivot remote from the first jaw contact cooperating in closed position with the second jaw contact, a switch blade arm extending transversely from the switch blade between the pivot and the first open jaw contact and crank and link means for swinging and rotating the switch blade.

9. In a switch, a switch pivot, open jaw contacts, the first spaced from the switch pivot and the second adjacent to the switch pivot on the side of the switch pivot remote from the first open jaw contact, a switch blade support pivotally mounted on the switch pivot and having longitudinal rotational bearings, a switch blade extending through the blade support, rotationally supported on the bearings and having one beaver tail at the end remote from the switch

pivot cooperating in closed position with the first open jaw contact and another beaver tail on the side of the switch pivot remote from the first jaw contact cooperating in closed position with the second jaw contact, a switch blade arm extending transversely from the switch blade between the pivot and the first open jaw contact, a first rod extending beside the second open jaw contact in closed position of the switch and making pivotal connection to the switch blade arm on an axis which in closed position is generally parallel to the switch pivot, a second rod extending in prolongation of the first rod and laterally rigid with respect thereto, an elongated swivel bearing on the first rod extending through the second rod, a third rod making pivotal connection with the second rod at the end remote from the first rod on an axis which in closed position is generally parallel to the switch pivot and a crank on an axis transverse to the switch pivot and pivotally connected to the third rod at the end remote from the second rod on an axis transverse to the switch blade pivot.

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REFERENCES CITED

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

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Number	Name	Date
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