July 21, 1931. S. M. VIELE 1,815,637

SWITCH

Filed March 11, 1926 3 Sheets-Sheet 1

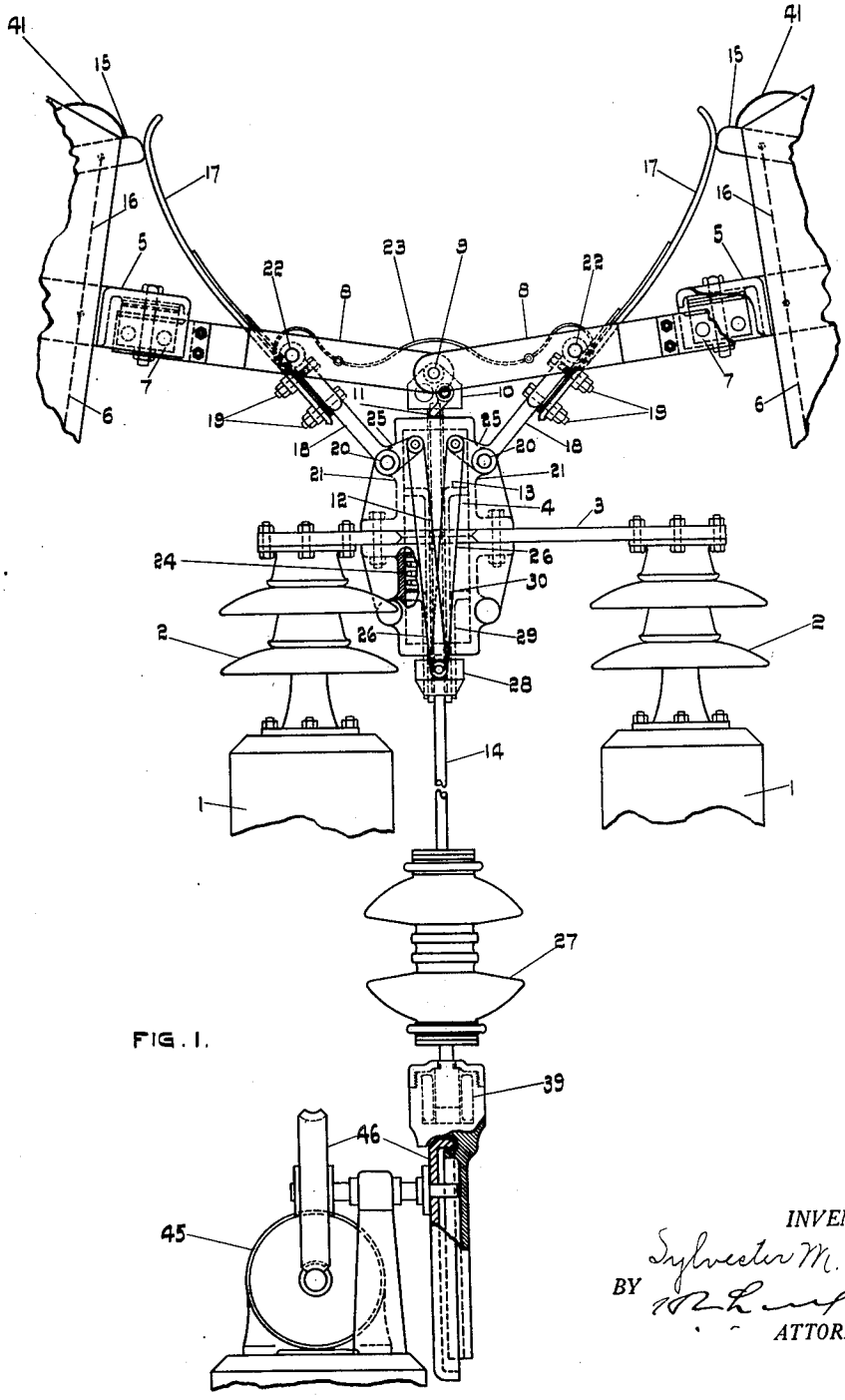


FIG. 1.

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SWITCH

Filed March 11, 1926 3 Sheets-Sheet 2

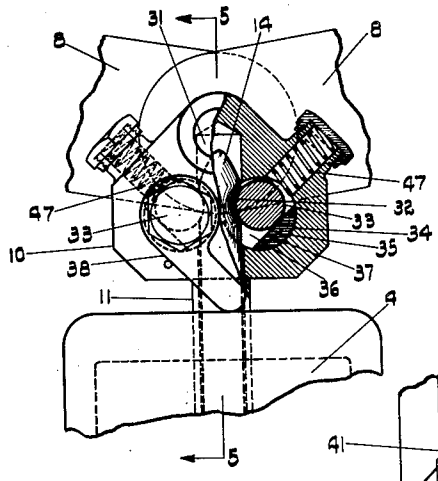


FIG. 4

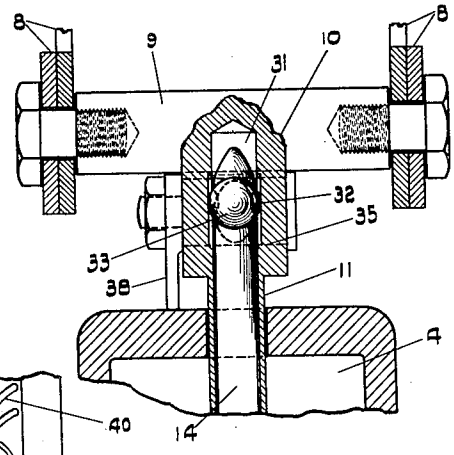


FIG. 5

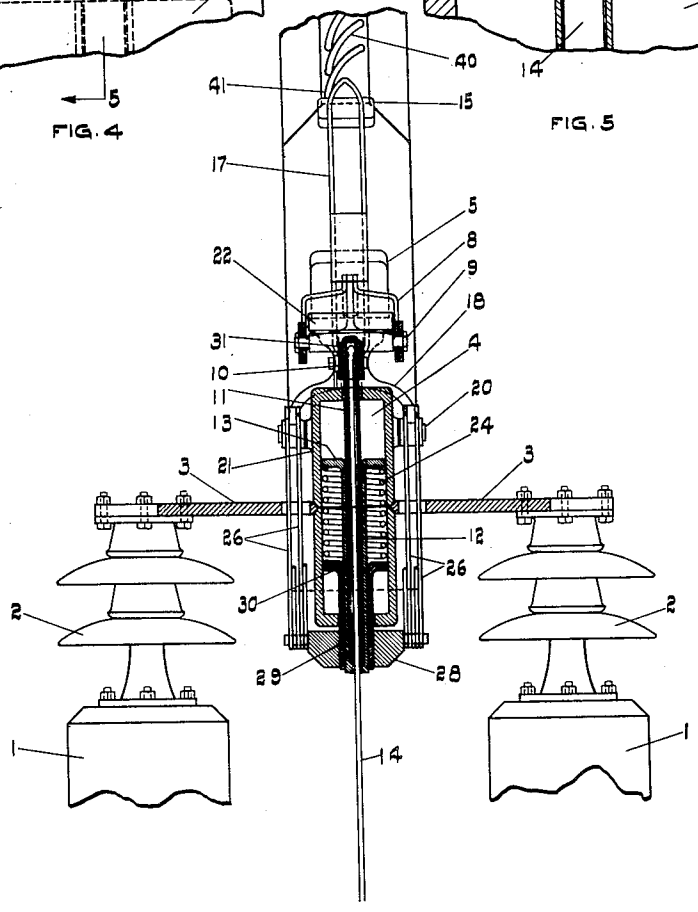


FIG. 2.

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July 21, 1931. S. M. VIELE 1,815,637

SWITCH

Filed March 11, 1926 3 Sheets-Sheet 3

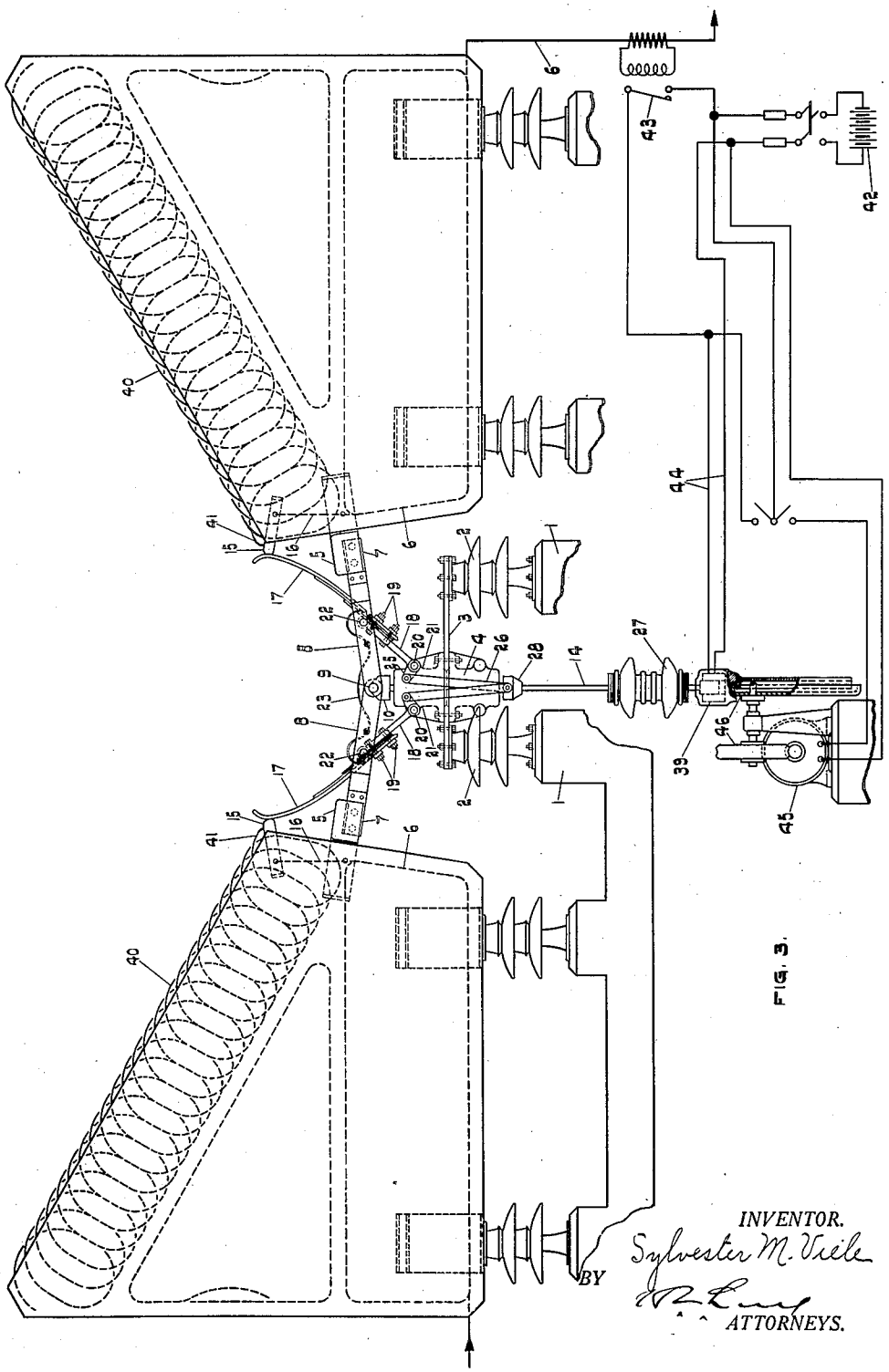


FIG. 3.

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Patented July 21, 1931 1,815,637

UNITED STATES PATENT OFFICE

SYLVESTER M. VIELE, OF ALTOONA, PENNSYLVANIA

SWITCH

Application filed March 11, 1926. Serial No. 93,329.

This invention relates to switches and is in some respects an improvement of the switch illustrated in my Patent 1,796,069 of March 10, 1931.

Switches or circuit breakers for use as air break devices for potentials which may be utilized for transmission purposes involve very wide distances between the terminals in order to assure a complete interruption of the current. In my former application I provided a main pair of contacts with main switch blades and auxiliary contacts with auxiliary blades, these being arranged to operate in sequence by a rotation of the blades on a vertical axis arranged in the plane of the contacts.

In the present invention opposing main contacts are arranged through which current normally passes and auxiliary contacts are provided, as in the former application. In opening the switch it is first opened at the main contact with very little sparking or damage to the contact, the current passing momentarily through the auxiliary contacts and the final break being made at the auxiliary contact. It is desirable that the break and the arc formed at the break should be extended as rapidly as possible and with these high potential currents and wide distances this involves a problem initially of power sufficient to break the contact with a means that will accelerate the moving parts with great rapidity and properly decelerate the parts when the opening is complete. This involves a desirable and rugged construction that may be made sufficiently light for high acceleration with the forces ordinarily available for this purpose.

It is also desirable that the arc formed by the break should be maintained in approximately the same plane as the terminals and this is particularly true where diverging terminals are used along which the arc progresses to the breaking point. Further the retaining of the moving parts within this plane reduces the space occupied by the material especially in one direction and when it is understood that these distances are very considerable this is of great advantage.

It is also desirable in an air breaker that the main switch contacts shall have bottom entrances so that they will be better protected against weather conditions and in the present invention the blades forming the switch members have the main switch blade make contact with a bottom entrance contact and are swung downwardly and inwardly from said contact with the initial opening movement.

With such a device also, due to the long reach of the switch members, the forces which tend to unbalance it in its action, particularly the disengaging of the main contacts, are designed to take place before the guiding parts of the apparatus are extended and consequently the parts may be made of relatively light material.

It is also desirable upon the breaking of the main contact, which ordinarily may be made with engaging walls, or knife-blade switch structure to exert upon the auxiliary blades which are preferably at pressure contact additional pressure upon the opening of the main switch blade members so as to assure a more certain current flow through the auxiliary blades rather than by an arc formed at the initial opening of the main blades. Features and details of the invention will appear from the specification and claims.

The invention is illustrated in the accompanying drawings as follows:—

Fig. 1 shows a side elevation of the switch proper.

Fig. 2 a central cross section of the switch.

Fig. 3 a side elevation showing the arc termini connected with the switch and in outline the electric controls.

Fig. 4 a side elevation of the switch locking cap, partly in section.

Fig. 5 a section on the line 5—5 in Fig. 4.

The switch is supported upon ground supports 1. Insulators 2 are mounted on the ground blocks 1 and support a base 3 of the switch. A cylinder 4 is mounted on the base 3 and forms the support, housing and guide for the moving members of the switch.

Main contacts 5 are opposingly placed and connected with conductors 6. The contacts 5 have contact sockets 7 which properly engage with the main switch arms 8 in the

usual manner. The contacts have bottom entrances and thus protect the contact surfaces from the weather. The main switch arms are pivotally connected at their inner ends by a pin 9. The pin 9 extends through a cross head 10. A sleeve 11 extends downwardly from the cross head through the top wall of the cylinder 4 into a socket 12 in a piston, or plunger 13 slidably mounted in the cylinder 4. A trip rod 14 extends from below the cylinder through the cylinder and the sleeve into the cross head 10 where it is locked by a trip or catch mechanism hereinafter described. Auxiliary contacts 15 are connected by conductors 16 with the main conductors 6. Auxiliary switch arms 17 are arranged to engage the contacts 15 and form a pressure contact. The arms 17 have the resilient extensions which form the immediate contact and the bases 18 to which the resilient portions are connected by bolts 19. The arms 17 are bifurcated as clearly shown in Fig. 2 and pivotally mounted by means of pins 20 on the sides of the cylinder 4, the lugs 21 projecting from the cylinder to receive the pins. The auxiliary arms are also pivotally connected at 22 with the main arms, this connection being intermediate the ends of both the auxiliary and the main arms. The auxiliary and main arms are electrically connected by a flexible conductor 23.

In the operation of the device the cross head 10 is forced upwardly initially and the main switch arms fulcrumed at the pivotal connection 22 on the auxiliary arms are forced out of engagement with the walls of the contact socket 7, thus making the initial opening or break in the switch. It will be noted that the mounting of the inner end of the arm 8 is below a line at right angles to the path of the cross head 10 and extending to the connection 22 while the contact 15 is above this. As a result of this arrangement the initial movement of the arms 8 tends to separate the pivotal connections 22 and thus press the auxiliary arms 17 into more intimate or pressure engagement with the contacts 15 and this also provides a sufficient opening movement of the main switch arms before the auxiliary arms are moved out of contact. This interval in the sequence of movements may be made more or less by flexing the yielding portions of the arms 17 a greater or less extent so that they will remain in contact a greater or less length of time after the pivotal pin 9 has passed above alinement between the connections 22. The movement of the arms is entirely accomplished by a single spring 24 arranged in the cylinder 4. This spring operates against and exerts upward pressure on the piston 13 so that as soon as the cross head 10 is released the upward movement of the piston operating through the sleeve 11 forces the inner ends of the arms 8 upwardly, thus swinging them and breaking their connections with their contacts. This movement is accomplished with the initial expansion of the spring and consequently with its greatest power and also by a direct thrust so that the desirable frictional engagement of the arms with the walls of the socket 7 may be had and at the same time the breaking of this contact assured with a spring, or force within reasonable limits.

The auxiliary arms are provided with bell crank arms 25 which are connected by links 26 to a cross piece 28. This cross piece is engaged by a sleeve-like extension 29 projecting from a plunger 30. The lower end of the spring 24 operates on the plunger 30 and exerts a downward thrust which through the mechanism just described is communicated to the bell crank arms and consequently such arms swing inwardly as soon as they are released from the separating influence of the portion of the arms 8 extending between the connections 22. The plungers 13 and 30 make a reasonable fit with the cylinder and thus act as dash pots toward the end of the movement to cushion the parts and the arms as they are arrested.

The upper end of the rod 14 extends into a socket 31 in the cross head 10. It is provided with an annular groove 32 and balls 33 arranged in sockets 34 are adapted to seat by adjustable springs 47 in the groove 32 to lock the trip rod with the cross head and consequently lock the switch in closed position. Pins 35 are journaled in the cross head and these have sockets 36 in which the balls are placed. The socket or base forming the shoulder 37 is so related to the diameter of the balls that when the shoulder is swung by the turning of the pins to the position shown in Fig. 4 the balls fall into the annular groove 32 and by reason of the direction of the shoulder 37 with relation to the direction of thrust on the balls locks the pin with the cross head. When, however, the pin 35 is swung so as to change the direction of the line of the shoulder 37 relatively to the balls, the balls immediately roll out on the shoulder and out of the groove releasing the catch. Operating trigger fingers 38 are fixed on the ends of the pins 35 in position to engage the upper wall of the cylinder when the cross head is drawn downwardly.

A solenoid or similar device 39 actuates the rod 14 in response to energizing current in the solenoid and thus draws the crosshead downwardly so that the trigger fingers 38 are swung sufficiently to swing the pins and release the ball catch. This release is accomplished when the thrust surface of the pin is swung out of alinement with the direction of thrust on the ball.

Immediately the catch is released the spring through its upward thrust on the plunger 13 forces the cross head upwardly opening the main contact. As soon as the distance between

the connections 22 is reduced by the swinging of the arms 8 sufficiently to permit of the movement of the arms 17 these arms moving under the thrust of the lower end of the spring and through the bell cranks are forced inwardly. The upward movement of the upper plunger 13 is arrested by the upper end of the cylinder after the pivot of the pin 9 has passed above the line between the connections 22, thus making the further movement of the parts subject to the closing action of the lower plunger 30 acting through the bell cranks. It will be noted that while the upward direct thrust on the arms 8 is of the full force of the spring the thrust on the lower plunger and on the bell cranks has a very much smaller lever advantage assuring a continued very rapid acceleration of the collapsing movement of the switch arms.

I have shown somewhat in outline in Fig. 3 the diverging arc termini 40 which are in the form of a series of overlapping coils as set forth in my former application, these being connected through the conductor 41 with the conductor 16 and thence with the main conductor. Through the action of these coils the termini of the arc formed by the opening of the switch move rapidly along the diverging coils 40 extending the arc. It will be noted that as the auxiliary arms move from their contact the arc formed between the auxiliary arms and diverging coils is extended in both directions from the auxiliary contacts, one end of the arc moving upwardly on the coils and the other end following the rapidly accelerating arm. The initial movement of the termini end of the arc along the coils forming the termini is somewhat more rapid than the succeeding movement. On the other hand, the movement of the auxiliary arms is more rapid as they move from the auxiliary contact, the result being to maintain approximately the same speed of extension in the formation of the arc. As the arc is united through the contact of the auxiliary arms it immediately is forced upwardly to the breaking point. It will be noted that the arc, or arcs, are maintained substantially in the same plane as the termini throughout the opening of the switch and it will also be noted that the operating mechanism when collapsed occupies a very small part of the gap between the contacts, thus assuring a break between the contacts.

The switch may be operated by rod 14 connected to insulator 27, cam and gearing 46, motor 45, by a storage battery 42 or other source of electrical supply. The switch is latched in closed position by engagement of the balls 33 with notches 32 in rod 14, triggers insuring the engagement of the balls. In opening the rod 14 is moved downwardly carrying with it the crosshead 10 and triggers 38 until triggers 38 engage with top of cylinder 4, whereupon they are so rotated as to release the balls. This releases the latch and spring 24 throws toggle pin 9 upwardly carrying with it the inner ends of the arms 8 and breaking the contact at the outer ends of the arms 8. During this initial upward movement of the arms 8 the auxiliary arms 17 are maintained in spring-pressed contact with the contacts 15. After the inner ends of the arms 8 have moved up so as to bring the pivot 9 above the pivots 22, the further movement of the pin 9, acting as a toggle, permits the inward movement of the pivots 22 and consequently the spring fingers 17. In closing the rod 14 is raised to engage the socket 31. The trigger arms 11 have returned to the position shown in Fig. 4 as the head is thrown up so that the balls are forced forward simply by the action of the springs. As the rod engages the balls, the balls yield against the springs 47 as the pin advances and then snap back into the sockets 33 on the rod. The rod is then lowered to lower cross head 10 to closed position and the switch is thus latched in closed position with the main arms in all contacts 5 and the auxiliary arms in engagement with the contact 15.

Automatic opening of the switch may be obtained through the use of current transformer on main lead 6 (or other current or potential sensitive device) operating relay switch 43 and conductors 44 to solenoid 39 to shorten operating rod 14 by an amount sufficient to bring into play triggers 38. The swinging of the triggers as hereinbefore described releases the rod, cross head 10 and the opening movement of the arms follows as heretofore described.

A rudimentary diagram has been shown to give remote controlled opening of the switch by the solenoid 39 and closure of the switch by motor 45 through the gearing 46.

While I have shown my invention as an air break switch it will be understood that I do not wish to be limited to such an adaptation of my invention.

What I claim as new is:—

1. In a switch, the combination of a main contact; an auxiliary contact separated from the main contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms being pivotally connected together intermediate their ends; mountings for the ends of the arms remote from the contacts; and means separating the ends of the arms to open the switch.

2. In a switch, the combination of a main contact; an auxiliary contact separated from the main contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms being pivotally connected together intermediate their ends; mountings for the ends of the arms remote from the contacts; and means separating the ends of the arms and swinging the same into approxi-

mate alinement remote from the contacts to open the switch.

3. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact and having face to face contact in the direction of movement, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means separating the ends of the arms by an initial movement of the main arm to open the switch.

4. In a switch, the combination of a main bottom entrance contact; an auxiliary contac ; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact and having face to face contact in the direction of movement, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means separating the ends of the arms to open the switch.

5. In a switch, the combination of a main bottom entrance contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact and having face to face contact in the direction of movement, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means separating the ends of the arms by an initial movement of the main arm to open the switch.

6. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means for separating the ends of the arms by relative movement of the mounting ends in opposite directions, the mounting ends of the arms being at one side of a line at right angles to the path of relative movement and the contact ends of the arms at the opposite side of said line.

7. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; a yielding auxiliary arm in pressure contact with the auxiliary contact, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means for separating the ends of the arms by relative movement of the mounting ends in opposite directions, the mounting ends of the arms being at one side of a line at right angles to the path of relative movement and the contact ends of the arms at the opposite side of said line.

8. In a switch, the combination of a main bottom entrance contact; an auxiliary contact; a main switch arm co-acting with the main contact; a yielding auxiliary arm in pressure contact with the auxiliary contact, said contact being face to face in the direction of movement, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means for separating the ends of the arms by relative movement of the mounting ends, the mounting ends of the arms being at one side of a line at right angles to the path of relative movement and the contact ends of the arms at the opposite side of said line.

9. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means moving the mounting ends of both arms to open the switch.

10. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means moving the mounting ends of both arms in sequence to open the switch.

11. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means moving the mounting ends of both arms to open the switch, the mounting ends of said arms being at one side of a line at right angles to the path of movement of said mounting ends, and the contact ends of said arms being at the opposite sides of said lines, said means moving the mounting ends of the arms in sequence, the initial movement carrying the main arm across the line and the movement on the mounting end of the auxiliary arm following.

12. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; means moving the mounting ends of both arms to open the switch; and a pressure device exerting opposing force on the mounting ends of the arms.

13. In a switch, the combination of a main contact; an auxiliary contact; a main switch

arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; means moving the mounting ends of both arms to open the switch; and a pressure device exerting opposing force on the mounting ends of the arms with a lever advantage to the main arm.

14. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; means moving the mounting ends of both arms to open the switch; a pressure device exerting opposing force on the mounting ends of the arms with a lever advantage to the main arm whereby the movement incident to the opposing force of the device is transferred from the mounting end of the main arm to the auxiliary arm.

15. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; pressure-actuated means separating the arms to open the switch; a trigger mechanism locking said arms in contact; and a current responsive means controlling the trigger mechanism.

16. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; pressure-actuated means separating the arms to open the switch; a trigger mechanism comprising a catch on the mounting end of the main arm; and a current responsive means controlling the trigger mechanism.

17. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; pressure-actuated means separating the arms; a movable mounting for the main arm; a locking pin; a catch between the mounting and the locking pin; a trigger controlling the catch; and current responsive means operating the rod to actuate the trigger.

18. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; a mounting for the mounting end of the main arm comprising a sleeve, a switch carrier in which the sleeve is slidingly mounted; a locking rod operating through the sleeve and forming a guide for the mounting with the sleeve; and a spring operating against the sleeve to move the main arm.

19. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; a mounting for the mounting end of the main arm comprising a sleeve; a switch carrier in which the sleeve is slidingly mounted; a locking rod operating through the sleeve and forming a guide for the mounting with the sleeve; a spring operating against the sleeve to move the main arm; a mounting for the auxiliary arm; and a lever connection subjected to the opposing spring action operating on the auxiliary arm.

20. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; an auxiliary switch arm co-acting with the auxiliary contact, said arms having a pivotal connection intermediate their ends; a mounting for the mounting end of the main arm comprising a sleeve; a switch carrier in which the sleeve is slidingly mounted; a locking rod operating through the sleeve and forming a guide for the mounting with the sleeve; a spring operating against the sleeve to move the main arm; a mounting for the auxiliary arm; and a lever connection subjected to the opposing spring action operating on the auxiliary arm, the main arm having a lever advantage from the thrust of the spring.

21. In a switch, the combination of a main contact; an auxiliary contact; a main switch arm co-acting with the main contact; a movable mounting for the main switch arm; an auxiliary switch arm co-acting with the auxiliary contact; a stationary pivotal mounting for the auxiliary arm; a pivotal connection intermediate the ends of said arms; and means for moving the mounting of the main arm to separate the contact ends of the arms and open the switch.

22. In a switch, the combination of a bottom entrance main contact; an auxiliary pressure contact; a main switch arm co-acting with the main contact; an auxiliary arm co-acting with the auxiliary contact; a movable mounting for the main switch arm; a stationary pivotal mounting for the auxiliary arm; and means for moving the mounting end of the main arm to separate the arms and break the contacts in sequence.

23. In a switch, the combination of a main

contact; an auxiliary contact separated from the main contact; a main switch arm; an auxiliary switch arm; and means operating on said arms to break the contacts in sequence, the main contact first and then the auxiliary contact, said means increasing the pressure contact between the auxiliary arm and the auxiliary contact as the main arm is moved.

24. In a switch, the combination of two main contacts opposingly placed; two auxiliary contacts opposingly placed above the main contacts; and a collapsing blade mechanism having main switch blades and auxiliary switch blades operating on said main and auxiliary contacts and breaking the contacts by a movement of the blades toward the center of the gap.

25. In a switch, the combination of two main contacts opposingly placed; two auxiliary contacts opposingly placed above the main contacts; a collapsing blade mechanism comprising main switch blades and auxiliary switch blades pivotally connected together intermediate their ends; and means separating the ends of the blades to break the contact.

26. In a switch, the combination of opposed bottom entrance contacts; opposed auxiliary contacts above the main contacts; a switch blade mechanism comprising main switch blades swinging into the main contacts from below and auxiliary switch blades swinging outwardly against the auxiliary contacts; and means for retracting said blades toward the center of the gap to open the switch.

27. In a switch, the combination of opposed main contacts; opposed auxiliary contacts above and separated from the main contacts; main switch arms coacting with the main contacts; auxiliary switch arms coacting with the auxiliary contacts, each pair of main and auxiliary arms being pivotally connected together intermediate their ends; mountings for the ends of the arms remote from the contacts; and means separating the ends of the arms to open the switch.

28. In a switch, the combination of opposed main contacts; opposed auxiliary contacts above the main contacts; main switch arms coacting with the main contacts; auxiliary switch arms coacting with the auxiliary contacts, each pair of main and auxiliary arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means separating the ends of the arms and swinging the same into approximate alinement remote from the contacts to open the switch.

29. In a switch, the combination of opposed main contacts; opposed auxiliary contacts above and separated from the main contacts; main switch arms coacting with the main contacts; auxiliary switch arms coacting with the auxiliary contacts, each pair of main and auxiliary arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means separating the ends of the arms by an initial movement of the main arms to open the switch.

30. In a switch, the combination of bottom entrance contacts opposingly placed; opposed auxiliary contacts above the main contacts; main switch arms coacting with the main contacts; auxiliary switch arms coacting with the auxiliary contacts, each pair of main and auxiliary arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means separating the ends of the arms by an initial movement of the main switch arms to open the switch.

31. In a switch, the combination of opposed main contacts; auxiliary contacts opposingly placed above the main contacts; main switch arms coacting with the main contacts; yielding auxiliary arms in pressure contact with the auxiliary contacts, each pair of main and auxiliary arms having a pivotal connection intermediate their ends; mountings for the ends of the arms remote from the contacts; and means for separating the ends of the arms by relative movement of the mounting ends, the mounting ends of the arms being at one side of a line at right angles to the path of relative movement and the contact ends of the arms at the opposite side of said line.

32. In a switch, the combination of main contacts opposingly placed; auxiliary contacts opposingly placed above the main contacts; main switch arms coacting with the main contacts; auxiliary switch arms coacting with the auxiliary contacts, each pair of auxiliary and main arms having a pivotal connection intermediate their ends; mountings for the inner ends of the arms remote from the contacts; means moving the mounting ends of both arms to open the switch; and a pressure device exerting opposing forces on the mounting ends of the arms.

33. In a switch, the combination of main contacts opposingly placed; auxiliary contacts opposingly placed above the main contacts; main switch arms coacting with the main contacts; auxiliary switch arms coacting with the auxiliary contacts, each pair of auxiliary and main arms having a pivotal connection intermediate their ends; mountings for the inner ends of the arms remote from the contacts; means moving the mounting ends of both arms to open the switch; and a pressure device exerting opposing forces on the mounting ends of the arms with a lever advantage to the main arms.

34. In a switch, the combination of main contacts opposingly placed; auxiliary contacts opposingly placed above the main contacts; main switch arms coacting with the main contacts; a movable mounting for the main switch arms; auxiliary switch arms co-

acting with the auxiliary contacts; a stationary pivotal mounting for the auxiliary arms; a pivotal connection intermediate the ends of each pair of main and auxiliary arms; and means for moving the mounting of the main arms to separate the contact ends of the arms and open the switch.

35. In a switch, the combination of main contacts opposingly placed; opposed auxiliary contacts above the main contacts; main switch arms coacting with the main contacts; auxiliary arms coacting with the auxiliary contacts; pivotal connections between each pair of main and auxiliary arms intermediate the ends of said arms; a movable mounting for the inner ends of the main switch arms; stationary pivotal mountings for the auxiliary arms; bell crank arms on the auxiliary arms; means for initially moving the movable mounting to open the switch; and means operating on the bell crank arms to continue the opening movement of the switch.

36. In a switch, the combination of diverging arc termini of increasing distances; means causing the formed arc to progress along said termini; and a switch between the termini adapted to initiate the arc, said switch having at each terminus a pair of arms comprising a main arm and an auxiliary arm, each pair of arms being connected intermediate their ends, a mounting for said arms, and means spreading the ends of the arms of each pair to retract the arms from the contacts.

37. In a switch, the combination of diverging arc termini of increasing distances; means causing the formed arc to progress along said termini; and a switch between the termini adapted to initiate the arc, said switch having at each terminus a pair of arms comprising a main arm and an auxiliary arm, each pair of arms being connected intermediate their ends, a mounting for the arms, and means for spreading the ends of the arms of each pair to retract the arms from the contacts, said arms swinging in the plane of the termini.

In testimony whereof I have hereunto set my hand.

SYLVESTER M. VIELE.