

Jan. 23, 1945.

H. S. GATES

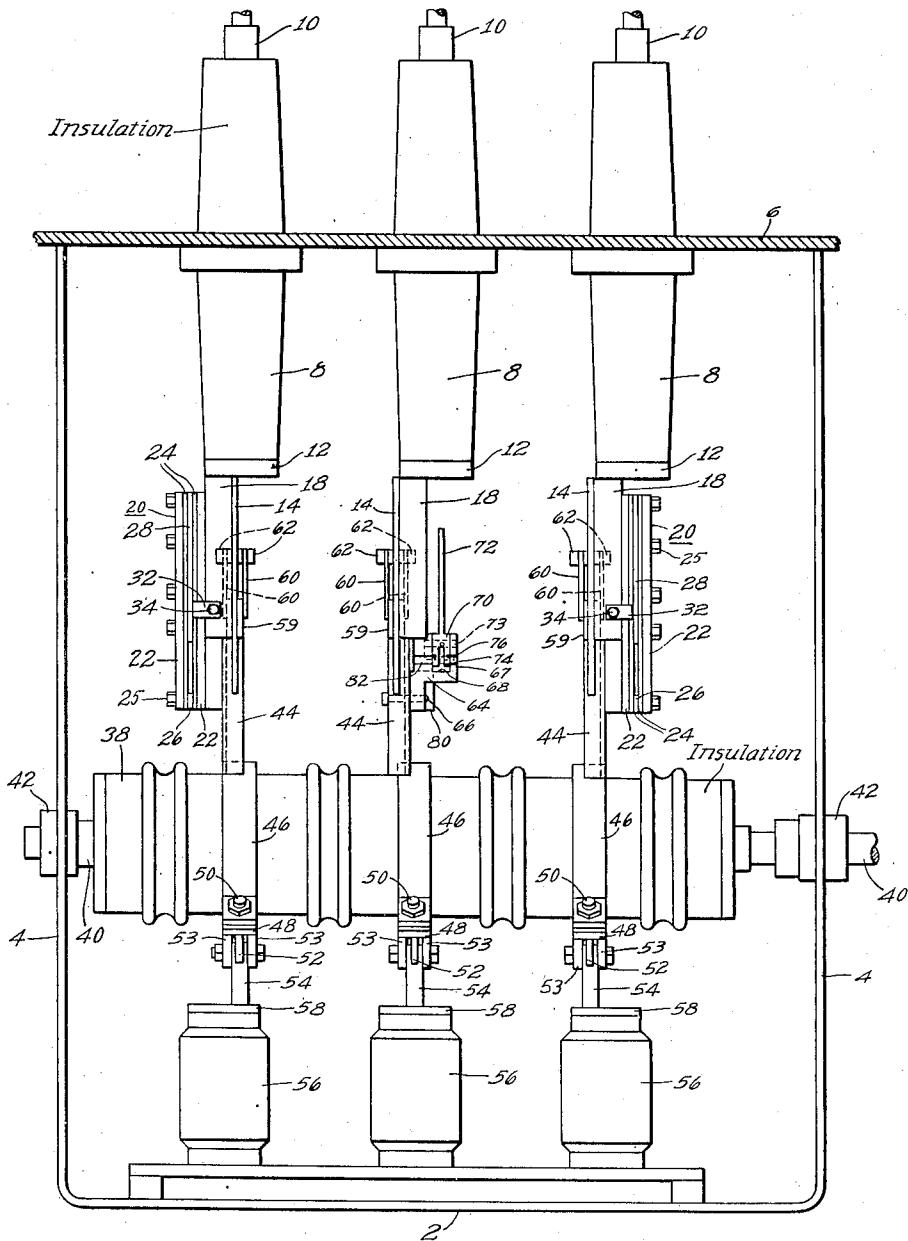
2,367,937

CIRCUIT INTERRUPTER

Filed June 24, 1942

3 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

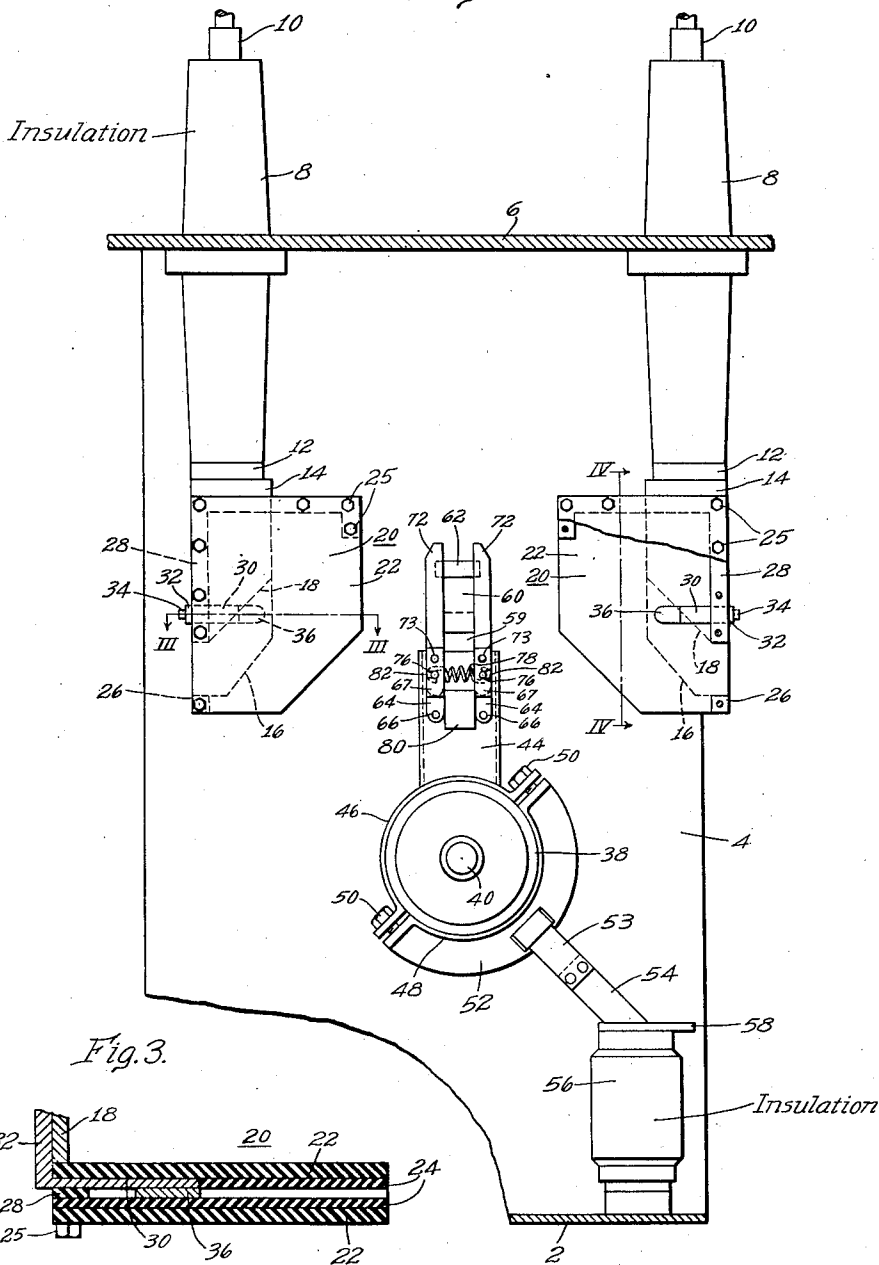
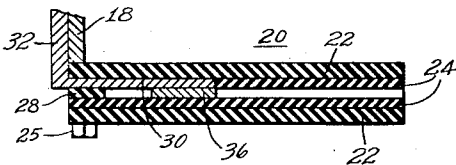


Fig. 3.



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Fig. 4.

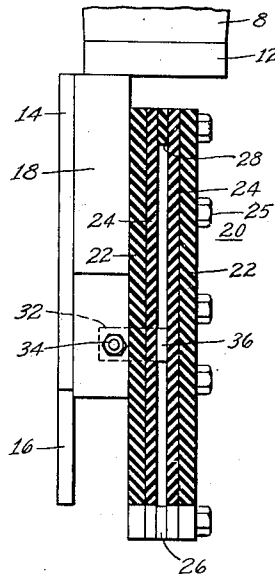


Fig. 5.

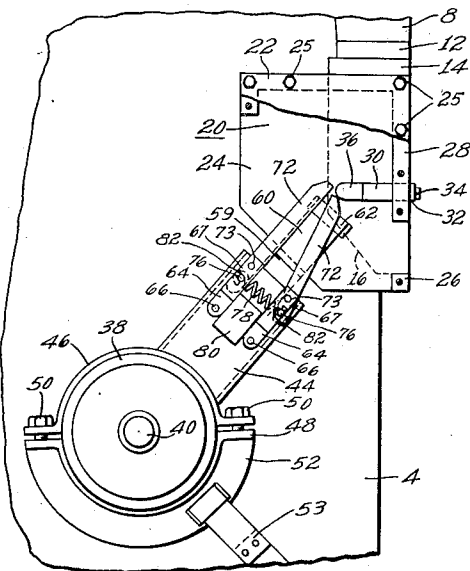
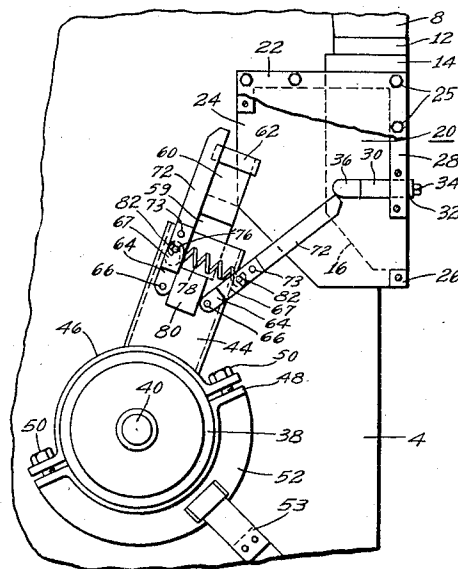


Fig. 6.



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UNITED STATES PATENT OFFICE

2,367,937

CIRCUIT INTERRUPTER

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Application June 24, 1942, Serial No. 448,245

19 Claims. (Cl. 200—146)

This invention relates generally to electric circuit interrupters, and more specifically to disconnect switches.

Although disconnect switches are expected to open the circuit only under conditions of no-load, nevertheless, in modern practice these switches are often called upon to open considerable values of line-charging currents and transformer magnetizing currents after the operation of circuit breakers to interrupt the load circuits. Also on rural lines, where the load is so light as not to justify the investment in circuit breakers, it is desirable to use disconnect switches to open load currents. A disconnect switch which is capable of efficiently interrupting load currents without external display is disclosed in the copending application of H. L. Rawlins, for "Circuit interrupters," Serial No. 319,897, filed February 20, 1940, now Patent No. 2,308,026, issued January 12, 1943, and assigned to the same assignee as this invention. The switch disclosed in the Rawlins application uses an auxiliary spring-biased blade for rapidly drawing out the arc through an arc chute after the main blade has separated from its contact, and the auxiliary blade is frictionally held between switch jaws while its biasing spring is stressed during the first part of the opening movement of the switch. This invention relates to certain modifications and improvements in a switch of this type.

Accordingly, one object of this invention is to provide a novel disconnect switch of the type described, which is capable of efficiently interrupting load currents and currents of the type described without external display.

Another object of this invention is to provide a novel contact construction for cooperation with a snap-acting switch blade.

Another object of this invention is to provide a novel double-throw disconnect switch construction which is capable of efficiently interrupting load currents and currents of the type described without external display upon opening the circuit at each switch contact.

Another object of this invention is to provide a novel selector switch construction which is capable of efficiently interrupting currents of the type described without external display at each contact thereof.

Another object of this invention is to provide a novel type of spring-biased snap-acting blade structure, wherein the effect of the spring bias is reduced upon closing the switch.

Another object of the invention is to provide

a novel arrangement of arc chute and contact structure.

These and other objects of this invention will become more apparent upon consideration of the following description of a preferred embodiment thereof when taken in connection with the accompanying drawings, in which:

Figure 1 is a front view of a switch constructed in accordance with this invention, with certain parts thereof removed for purposes of illustration;

Fig. 2 is an end view of the switch shown in Fig. 1 with the supporting frame shown in section;

Fig. 3 is an enlarged section through an arc chute used with the switch shown in Figs. 1 and 2, taken substantially on the line III—III of Fig. 2;

Fig. 4 is an enlarged section through an arc chute like Fig. 3, only taken substantially at right angles to the section of Fig. 3 substantially on the line IV—IV of Fig. 2;

Fig. 5 is a partial end view of the switch shown in Fig. 2 with the switch blade shown in substantially its closed circuit position; and

Fig. 6 is a view similar to Fig. 5 but showing the switch blade at an initial stage of a circuit opening operation.

The switch illustrated herein is a double-throw selector switch of the disconnect type, such as might be used for selecting a feeder circuit to be connected to a step-down transformer. Such a transformer of large capacity and high voltage will have an appreciable exciting current, so that when the secondary breakers are opened, the selector switch will still have to interrupt these currents at the high feeder voltage. The switch constituting this invention is disclosed as mounted in an open frame comprising a substantially U-shaped portion having a base 2 and spaced sides 4. The open side of the U-shaped frame may be closed by a top wall 6, preferably secured thereto as by welding or the like, and where the switch is to be mounted in a metal enclosure, top wall 6 may constitute the top wall of the enclosure. It is to be understood, of course, that the switch frame may be mounted in an exposed location as well as in metal enclosures.

The top wall 6 of the supporting frame has a plurality of apertures for receiving spaced pairs of spaced insulator bushings 8. The switch illustrated is provided with three pairs of insulating bushings for three phase applications. The bushings 8 have a bore therethrough in the con-

ventional manner for receiving a conductor rod 10 or the like, which is conductively associated at its inner end with a bushing cap 12, also of a good conducting material such as copper or the like. Contact means, including a projecting part comprising a fixed contact plate 14 is secured, as by welding or brazing, at one end thereof to bushing cap 12 of each bushing, and this plate extends downwardly between side walls 4 of the supporting frame and has the inner lower corner thereof cut off diagonally as shown at 16, for a purpose to be hereinafter described. A reinforcing plate 18 is also secured at one end to bushing cap 12 and along one edge to contact plate 14, with the reinforcing plate 18 arranged substantially at right angles to contact plate 14 to stiffen the contact plate against lateral bending forces and to provide a support for arc chute 20.

The arc chute 20 comprises spaced outer plates 22 of insulating material, such as Bakelite, Mica, or the like, with insulating liner plates 24 of a material which is capable of evolving an arc-extinguishing gas when in proximity to an electric arc, such for example, as fiber, boric acid or the like. Plates 22 and 24 are maintained in fixed spaced relation by securing bolts 25 and spacers 26 and 28. As shown, the spacer 26 is located at the lower outer corner of the plates, and spacer 28 extends between outer edges of the plates from a point spaced from the lower edges, along the top edges of the plates and a short distance down the inner edges of the plates to close off these edges, as well as to maintain the plates in a predetermined spaced relation to form a narrow slot therebetween. As shown in Figs. 3 and 4, the space between plates 24 is relatively small and preferably is just wide enough to receive a cooperating switch blade so that any arc drawn therein will intimately contact the inner surfaces of plates 24. A conductor strip 30 extends between plates 22 and is received in a slot cut out of one plate 24 so as not to obstruct the slot between the plates. The slot for receiving conductor strip 30 closely fits the strip so that no opening is provided in the outer edge of the slot through which the strip extends, and the strip is angularly bent to provide a supporting part 32 for securement to contact reinforcing strip 18. The arc chute is secured in position in engagement with the side edge of reinforcing strip 18 to thereby prevent rotation of the chute about bolt 34. Within the arc chute conducting strip 30 is provided with an unyielding contact element 36 which extends transversely across the slot between plates 24 at a point spaced from the edges of the chute. Contact element 36 is, therefore, a part of the contact means which includes contact part or plate 16.

An insulator 38 which may be of any desired insulating material, such as porcelain or the like, is provided at its ends with stud shafts 40 rotatably mounted in bearings 42 provided in opposite sides 4 of the switch supporting frame. A blade supporting channel member 44 is rigidly secured at one end to a substantially semi-cylindrical clamping member 46 adapted to fit over insulator 38, for cooperation with another semi-cylindrical clamping member 48 to form a clamping collar for securely clamping blade supporting channel 44 to the insulator, for example, as by machine screws 50 adapted to draw the clamping members tightly against the periphery of insulator 38. Clamping member 48 is provided with a substantially central, radially extending

contact flange 52 adapted to be received between stationary spaced resilient contact means or jaws 53 for conducting current to blade support 44. Resilient contact jaws 53 are preferably secured to opposite sides of a contact support 54 at the outer end thereof, and the contact support, in turn, is carried upon an insulator 56 secured in any desired manner to the bottom wall 2 of the supporting frame. Contact support 54 may include a laterally extending terminal pad 58 for the connection of a line conductor thereto.

Resilient contact jaws 53 resiliently press against opposite sides of contact flange 52, and since the flange extends substantially 180° about the axis of insulator 38, it will be apparent that the insulator may be rotated this amount and current will be conducted from terminal pad 58 through contact support 54, contact jaws 53, contact flange 52 on clamping member 48, to clamping member 46 and contact supporting channel 44.

A supporting member 59 for main blade contacts is preferably secured as by welding or brazing within blade supporting channel 44, and projects outwardly therefrom to carry at the outer end thereof spaced contact supporting members 60 which may be of any good resilient conducting material, such for example, as a copper alloy. The spaced contact supports 60 are provided at the outer ends thereof with contact engaging means or projections 62 for engagement with opposite sides of contact plates 14 mounted on a pair of opposed insulator bushings 8. A pair of auxiliary switch blades or relatively movable contact portions 72 are mounted on each blade supporting channel 44 at the outside thereof, and for supporting each auxiliary blade, a supporting bracket or inner portion 64 is provided pivotally mounted at the lower end thereof on blade supporting channel 44, as by the pivot bolt 66. Each bracket 64 includes an outwardly and upwardly extending integral portion 67 defining a channel 68 for receiving the enlarged inner end 70 of an auxiliary switch blade 72. The switch blade enlargement 70 is apertured for the reception of a pivot pin 73 for pivotally mounting blade 72 on bracket 64, and the inner end of blade enlargement 70 is slotted as at 74, and a spring anchoring pin 76 is provided through the blade enlargement 70 spanning slot 74 thereof. A resilient means such as a coil tension spring 78 has the opposite ends thereof hooked over spring anchoring pins 76 on both auxiliary blade assemblies on each blade support 44, and this spring normally urges the blades towards each other. Movement of brackets 64 towards each other is limited by a laterally extending stop means or member 80 fixed on supporting channel 44, to the position shown in Fig. 2 of the drawings. However, spring 78 is secured to pins 76 on blades 72 so as to tend to rotate the blades proper outwardly and away from each other. However, the ends of pins 76 are received in arcuate slots 82 so that movement of the inner ends of the blades towards each other and consequently, the outer ends of blades 72 away from each other about pivot 73, is limited to the positions shown in Fig. 2 relative to brackets 64 by the inner ends of slots 82 which constitute a stop means. From the foregoing, it will be observed that auxiliary switch blades 72 are pivotally mounted on pivot pins 73 for movement of the outer ends thereof inwardly towards each other from the position shown in Fig. 2, but cannot move outwardly from this position about pivots 73 due to the engagement of pins 76 with

the inner ends of arcuate slots 82. However, blades 72 may move outwardly with respect to each other with brackets 64 about pivots 66. Normally, spring 78 yieldably maintains both blades 72 at their intermediate positions shown in Fig. 2 wherein they are spaced apart a distance approximately equal to the thickness of contact portion 36. Blade 72 together with bracket 64 constitutes a blade portion which is movable relative to blade support 44, and any or all of these parts as well as parts 60 and 62 and blade support 44, constitute movable switch blade means.

In the operation of the switch described above, assuming the switch to be in the neutral position shown in Fig. 2 wherein blade contacts 62 and auxiliary blades 72 are in a position intermediate opposing contacts 14 and 36, and it is desired to close the circuit to the right-hand contacts, insulator 38 will be rotated in a clockwise direction as viewed in Fig. 2 and contacts 62 will engage the inner edge of contact plate 14 at about the same time that the right-hand auxiliary blade 72 engages transverse contact 36 within the arc chute. Continued rotation of insulator 38 in the clockwise direction will cause relative counter-clockwise movement of right-hand auxiliary blade 72 about its pivot 73 on supporting bracket 64 in the manner shown in Fig. 5, until this auxiliary blade rotates sufficiently to clear the lower surface of contact 36, whereupon spring 78 will cause it to move rapidly to a position below contact 36 with a snap action. At this time, contacts 62 will be in full engagement with contact plate 14, and left-hand auxiliary blade 72 will have engaged transverse contact 36 to oppose further movement of insulator 38 in the clockwise direction. Now, if it is desired to restore the switch to the position shown in Fig. 2, insulator 38 will be rotated in a counter-clockwise direction and this will cause contact 62 to be moved out of engagement with contact plate 14 of the right-hand bushing, as viewed in Figs. 2, 5 and 6. However, right-hand auxiliary blade 72 is caught beneath transverse contact 36 so that the outer end thereof cannot follow contacts 62 and it will, therefore, be caused to move pivotally in a clockwise direction about pivot pin 66 with bracket 64, until the parts attain substantially the position shown in Fig. 6 of the drawings, wherein continued movement in a counter-clockwise direction will permit the right-hand auxiliary blade to escape from beneath the transverse contact 36. Up to this point, relative movement of the right-hand auxiliary blade 72 and bracket 64 with respect to insulator 38 and parts secured thereto, has caused tensioning of spring 78 so that as soon as the right-hand auxiliary blade 72 escapes from under contact 36, spring 78 will quickly move it to its normal position substantially parallel with the other auxiliary blade and through the narrow slot in arc chute 20 to quickly draw out and extinguish the arc. It will be noted that this snap-action of the auxiliary blade in a circuit interrupting operation does not occur until contacts 62 have substantially reached the edge of the arc chute, so that the snap-acting movement of the auxiliary blade is for a distance at least equal to the distance between contact 36 and the inner edge of arc chute 20. Thus in opening the circuit, the arc is very rapidly elongated to increase the arc voltage and at the same time, restricted in section to further increase the arc voltage, while the arc is simultaneously rapidly exposed to surfaces of a material capable of

evolving an arc-extinguishing gas so that evolution of such gas will prevent rapid recombination of the ionized particles and thereby deionize the arc path. All of these effects mutually contribute to assist in efficiently and quickly extinguishing any arc drawn between contact 36 and auxiliary blade 72 during the snap-acting movement of the auxiliary blade, so that the arc will be confined within the arc chute and no external display will occur.

It will be noted that in closing the switch, the auxiliary blade pivots about pin 73 so that a relatively great mechanical advantage is available for overcoming the resistance of tension spring 78. However, during opening movement of the switch, the auxiliary blades are caused to pivot about pin 66 which is closer to the pivot axis of insulator 38 to not only provide a greater lever arm and thereby obtain greater speed and amount of snap-acting movement of the outer end of the auxiliary blade under the influence of the spring than in the circuit closing operation, but also the point at which the spring force is exerted is shifted so that it is stressed a greater amount and hence has stored therein more force available for moving the auxiliary blade through the arc chute.

It is believed apparent that blade contacts 62 are engageable with either of an opposed pair of contact plates 14, and that auxiliary blades 72 on each contact supporting channel 44 are for engagement with the opposed contacts 36 within opposed arc chutes 20, respectively. The operation of the switch when moved to the left into engagement with the contact structure carried by the left-hand insulating bushing 8 is identical with the operation described above except that the left-hand auxiliary switch blade 72 will move relative to insulator 38 rather than the right-hand blade as was the case when the blade structure was moved to the right to close the circuit to conductor 10 carried by the right-hand insulating bushing 9.

From the foregoing, it is believed obvious that this invention provides for obtaining a positive snap-acting movement of a switch blade to draw out and extinguish the arc within an arc chute at a high speed, due to the fact that the blade must move relative to its movable support in order to bypass contact 36. In closing the switch, the positive means is reset because the blade is again required to pass by contact 36. Moreover, this invention includes means whereby the force required to reset the positive snap-action means is less than that required to be stored in the snap-action spring in opening the switch, and the travel of the blade under the influence of the snap-acting spring in bypassing contact 36 in closing the switch is less than in opening the switch. Furthermore, there has been disclosed herein a novel arrangement of main contacts 62 and auxiliary arc-extinguishing blades 72 in cooperation with a particular type of stationary contacts and arc-extinguishing chutes. The stationary contacts together with their particular arrangement and manner of support of contact 36 and arc chute 20 by a single securing means, as well as the particular mounting of the movable blade structure, are all considered as novel and a part of the invention.

Having described a preferred embodiment of the invention as required by the patent statutes, it is desired that the invention be not limited to the particular embodiment disclosed herein inasmuch as it will be obvious, particularly to per-

sons skilled in the art, that many modifications and changes may be made in this specific embodiment without departing from the broad spirit and scope of this invention as defined in the appended claims.

I claim as my invention:

1. In a switch, pivotally mounted switch blade means, contact means, said blade means having a contact portion pivotally movable relative to said blade means in opposite directions about pivots spaced from each other and from the pivot of said blade means in a direction radially of said blade means pivot, respectively, resilient means normally maintaining said contact portion in a normal position wherein it is engageable with opposite sides of said contact means upon movement of said blade means in opposite directions about its pivot, whereby said contact portion pivotally moves relative to said blade means in opposite directions about said spaced pivots, respectively, upon engagement with opposite sides of said contact means.

2. In a switch, pivotally mounted switch blade means, contact means, said blade means having a contact portion pivotally movable relative to said blade means in opposite directions about pivots spaced from each other and from the pivot of said blade means in a direction radially of said blade means pivot, resilient means normally maintaining said contact portion in a normal position wherein it is engageable with opposite sides of said contact means upon movement of said blade means in opposite directions about its pivot, and stop means for preventing movement of said contact portion when at its normal position about said spaced pivots, respectively, in directions opposite to the respective directions it is movable by engagement with said contact means, whereby said contact portion pivotally moves relative to said blade means only in opposite directions about said spaced pivots, respectively, upon engagement with opposite sides of said contact means.

3. In a switch, spaced contact means, blade means including a blade support pivotally mounted for movement between said contact means, said blade means further including spaced blade portions engageable with said contact means, respectively, each of said blade portions including an inner portion pivoted on said support and pivotally carrying a contact portion, means biasing said inner portions towards each other and said contact portions away from each other, stop means on said support limiting movement of said inner portions towards each other, and stop means on said inner portions limiting outward movement of said contact portions, whereby when either of said blade portions is moved into engagement with said contact means, said contact portion moves about its pivot to pass to the other side of said contact means, and when said blade portion is moved away from said contact means said contact and inner portions move together relative to said support while stressing said biasing means to pass by said contact means and be separated therefrom with a snap action.

4. In a switch, spaced contact means, blade means including a blade support pivotally mounted for movement between said contact means, said blade means further including spaced blade portions engageable with said contact means, respectively, each of said blade portions including an inner portion pivoted on said support and pivotally carrying a contact portion, means biasing said inner portions towards each other and said contact portions away from each

other, stop means on said support limiting movement of said inner portions towards each other, stop means on said inner portions limiting outward movement of said contact portions, whereby when either of said blade portions is moved into engagement with said contact means, said contact portion moves about its pivot to pass to the other side of said contact means, and when said blade portion is moved away from said contact means said contact and inner portions move together relative to said support while stressing said biasing means to pass by said contact means and be separated therefrom with a snap action, and the lever arm to the pivot of said inner portion being greater than to the pivot of said contact portion whereby the length of the snap-acting path of movement of said contact portion is greater in a circuit opening operation than in a circuit closing operation.

5. In a switch, spaced contact means, blade means including a blade support pivotally mounted for movement between said contact means, said blade means further including spaced blade portions engageable with said contact means, respectively, each of said blade portions including an inner portion pivoted on said support and pivotally carrying a contact portion, means biasing said inner portions towards each other and said contact portions away from each other, stop means on said support limiting movement of said inner portions towards each other, stop means on said inner portions limiting outward movement of said contact portions, whereby when either of said blade portions is moved into engagement with said contact means, said contact portion moves about its pivot to pass to the other side of said contact means, and when said blade portion is moved away from said contact means, said contact and inner portions move together relative to said support while stressing said biasing means to pass by said contact means and be separated therefrom with a snap action, and the mechanical advantage of said biasing means resisting movement about the pivot of said contact portion being greater than that for movement about the pivot of said inner portion, whereby a greater force is required to open the switch than to close it.

6. In a switch, spaced contact means, blade means including a blade support pivotally mounted for movement between said contact means, said blade means further including spaced blade portions engageable with said contact means, respectively, each of said blade portions including an inner portion pivoted on said support and pivotally carrying a contact portion, means biasing said inner portions towards each other and said contact portions away from each other, stop means on said support limiting movement of said inner portions towards each other, stop means on said inner portions limiting outward movement of said contact portions, whereby when either of said blade portions is moved into engagement with said contact means, said contact portion moves about its pivot to pass to the other side of said contact means, and when said blade portion is moved away from said contact means, said contact and inner portions move together relative to said support while stressing said biasing means to pass by said contact means and be separated therefrom with a snap action, the lever arm to the pivot of said inner portion being greater than to the pivot of said contact portion whereby the length

of the snap-acting path of movement of said contact portion is greater in a circuit opening operation than in a circuit closing operation, and the mechanical advantage of said biasing means resisting movement about the pivot of said contact portion being greater than that for movement about the pivot of said inner portion, whereby a greater force is required to open the switch than to close it.

7. In a switch, contact means, blade means including a blade support mounted for movement toward and away from said contact means, said blade means also including a blade portion adapted to engage said contact means, said blade portion including an inner portion pivotally mounted on said blade support and pivotally carrying a contact portion, means biasing said inner portion and contact portion in opposite directions about their respective pivots, stop means limiting relative movement of said parts in said opposite directions, whereby when said blade means moves said contact portion into engagement with said contact means in one direction, said contact portion moves on its pivot while stressing said biasing means to pass by said contact means with a snap action, and when moved into engagement with said contact means from the opposite direction said contact portion and inner portion move together about the pivot of said inner portion while stressing said biasing means to pass by said contact means and be separated therefrom with a snap action.

8. In a switch, spaced contact means, blade means including a blade support pivotally mounted for movement between said contact means, said blade means further including spaced blade portions engageable with said contact means, respectively, each of said blade portions including an inner portion pivoted on said support and pivotally carrying a contact portion, means biasing said inner portions towards each other and said contact portions away from each other, stop means on said support limiting movement of said inner portions towards each other, stop means on said inner portions limiting outward movement of said contact portions, whereby when either of said blade portions is moved into engagement with said contact means, the contact portion thereof moves about its pivot to pass to the other side of said contact means so that said contact means will be received between said contact portions at the closed position of the switch, and when said blade portion is moved away from said contact means said contact and inner portions move together relative to said support while stressing said biasing means to pass by said contact means and be separated therefrom with a snap action.

9. In a switch, contact means, blade means including a blade support mounted for movement toward and away from said contact means, said blade means also including a blade portion adapted to engage said contact means, said blade portion including an inner portion pivotally mounted on said blade support and pivotally carrying a contact portion, means biasing said inner portion for movement in a direction away from said contact means and said contact portion in an opposite direction about their respective pivots, stop means limiting relative movement of said parts in said opposite directions, whereby when said blade means moves said contact portion into engagement with said contact means said contact portion moves on its pivot while stressing said biasing means to pass by said contact means with a

5 snap action, and when moved out of engagement with said contact means said contact portion and inner portion move together about the pivot of said inner portion while stressing said biasing means to pass by said contact means and be separated therefrom with a snap action.

10. In a switch, contact means, blade means including a blade support mounted for movement toward and away from said contact means, said blade means also including a blade portion adapted to engage said contact means, said blade portion including an inner portion pivotally mounted on said blade support and pivotally carrying a contact portion, means biasing said inner portion for movement in a direction away from said contact means and said contact portion in an opposite direction about their respective pivots, stop means limiting relative movement of said parts in said opposite directions, whereby when said blade means moves said contact portion into engagement with said contact means said contact portion moves on its pivot while stressing said biasing means to pass by said contact means with a snap action, means opposing continued movement of said blade means in the same direction, and when said blade means moves said contact portion in a direction out of engagement with said contact means said contact portion and inner portion move together about the pivot of said inner portion while stressing said biasing means to pass by said contact means and be separated therefrom with a snap action.

11. In a switch, spaced contact means, blade means including a blade support pivotally mounted for movement between said contact means, said blade means further including spaced blade portions engageable with said contact means, respectively, each of said blade portions including an inner portion pivoted on said support and pivotally carrying a contact portion, means biasing said inner portions towards each other and said contact portions away from each other, stop means on said support limiting movement of said inner portions towards each other, and stop means on said inner portions limiting outward movement of said contact portions, whereby when either of said blade portions is moved into engagement with said contact means, said contact portion moves about its pivot to pass to the other side of said contact means, and when said blade portion is moved away from said contact means said contact and inner portions moved together relative to said support while stressing said biasing means to pass by said contact means and be separated therefrom with a snap action, spaced means of insulating material defining a narrow slot adjacent each contact means extending toward the other, and said snap-action movement of said contact and inner portions together being substantially equal to the extent of said slots.

12. In a switch, contact means, blade means including a blade support mounted for movement toward and away from said contact means, said blade means also including a blade portion adapted to engage said contact means, said blade portion including an inner portion pivotally mounted on said blade support and pivotally carrying a contact portion, means biasing said inner portion for movement in a direction away from said contact means and said contact portion in an opposite direction about their respective pivots, stop means limiting relative movement of said parts in said opposite directions, whereby when said blade means moves said contact portion into engagement with said contact means said contact

portion moves on its pivot while stressing said biasing means to pass by said contact means with a snap action, and when moved out of engagement with said contact means said contact portion and inner portion moves together about the pivot of said inner portion while stressing said biasing means to pass by said contact means and be separated therefrom with a snap action, spaced means of insulating material defining a narrow slot adjacent said contact means extending in path of opening movement of said blade means, and said snap-action movement of said contact and inner portions together being substantially equal to the extent of said slot.

13. In a switch, contact means, blade means including a blade support mounted for movement toward and away from said contact means, contact engaging means secured to the outer end of said support so as to be engageable with a portion of said contact means in the closed circuit position of the switch, a blade portion also mounted on said support at one side of said contact engaging means, said blade portion including an inner portion pivotally mounted on said blade support and pivotally carrying a contact portion, said contact means including another portion projecting transversely across the path of movement of said contact portion adjacent the end thereof, means biasing said inner portion and contact portion in opposite directions about their respective pivots, stop means limiting relative movement of said parts in said opposite directions, whereby when said blade means moves to the closed circuit position said contact portion moves on its pivot while stressing said biasing means to pass by said other portion of said contact means with a snap action just prior to full engagement of said contact engaging means and said one portion of said contact means, and when moved to open circuit position said contact engaging means disengages said one portion of said contact means while said contact portion and inner portion move together about the pivot of said inner portion while stressing said biasing means to pass by said contact means and be separated therefrom with a snap action.

14. In a switch, contact means, blade means including a blade support mounted for movement toward and away from said contact means, spaced contact engaging means secured to opposite sides of said support so as to frictionally receive a projecting portion of said contact means, a relatively movable contact portion mounted on one side of said support, said contact means having an unyielding portion extending transversely of the path of movement of said movable contact engaging portion, means yieldably maintaining said movable contact portion in a normal position such that upon movement of said blade to closed circuit position said movable contact portion will engage said transverse contact portion and be moved relative to said blade means to snap past said transverse contact portion prior to full engagement of said contact engaging means with said one portion of said contact means, and on circuit opening movement of said blade means said contact engaging means separates from said contact means a predetermined distance while said movable contact portion moves relative to said blade due to engagement with said transverse contact portion and finally opens the circuit with a snap action.

15. In a switch, contact means, blade means including a blade support mounted for movement toward and away from said contact means,

contact engaging means secured to the outer end of said support so as to be engageable with a portion of said contact means in the closed circuit position of the switch, a relatively movable contact portion mounted on said support, said contact means having an unyielding portion extending transversely of the path of movement of said movable contact engaging portion, means yieldably maintaining said movable contact portion in a normal position such that upon movement of said blade to closed circuit position said movable contact portion will engage said transverse contact portion and be moved relative to said blade means to snap past said transverse contact portion prior to full engagement of said contact engaging means with said one portion of said contact means, and on circuit opening movement of said blade means said contact engaging means separates from said contact means a predetermined distance while said movable contact portion moves relative to said blade due to engagement with said transverse contact portion and finally opens the circuit with a snap action, an arc chute having spaced walls of insulating material forming a narrow slot, said chute mounted on said contact means so that said transverse contact portion is in said slot and extends transversely thereof, and said slot extending in the path of opening movement of said movable contact portion a distance at least equal to the circuit opening snap-acting movement thereof.

16. In a double-throw switch, a rotary insulator, blade means extending substantially transversely of said insulator and having a clamping collar for said insulator to secure said blade means thereto, a radially extending flange on said collar, stationary contact means frictionally engaging said flange for conducting current to said blade means, and spaced contacts at opposite sides of said blade means and located in the path of movement thereof.

17. In a switch, spaced contact means, blade means including a blade support pivotally mounted for movement between said contact means, said blade means further including spaced blade portions engageable with said contact means, respectively, each of said blade portions including an inner portion pivoted on said support and pivotally carrying a contact portion, stop means on said support limiting movement of said inner portions toward each other, stop means on said inner portions limiting outward movement of said contact portions, and a single spring reacting between said contact portions for biasing said contact portions away from each other and said inner portions toward each other, whereby when either of said blade portions is moved into engagement with said contact means, said contact portion moves about its pivot to pass to the other side of said contact means, and when said blade portion is moved away from said contact means said contact and inner portions move together relative to said support while stressing said biasing means to pass by said contact means and be separated therefrom with a snap action.

18. In a switch, movably mounted switch blade means, spaced contact means disposed in the path of movement of said blade means adjacent opposite ends thereof, said blade means having relatively movable contact portions adapted to engage said contact means, respectively, means normally yieldably maintaining said contact portions spaced apart substantially in the plane of

said contact means a distance substantially the same as the thickness of said contact means, whereby upon continued movement of said blade means in each direction one of said contact portions will engage one of said contact means and be moved relative to said blade means to a position where it can pass by said contact means whereupon said yieldable means will restore said contact portion to its normal position and said contact means will be positioned between said contact portions.

19. In a switch, a movably mounted switch blade support having a contact portion mounted thereon for movement relative to said support, resilient means normally holding said contact portion at an intermediate position relative to said blade support, said contact portion being movable in opposite directions relative to said support from said normal position, stationary contact means positioned in the path of movement of said contact portion with said support

adjacent but spaced from one end thereof so that upon continuous movement of said contact portion with said blade support in each direction toward said contact means, said contact portion will engage said contact means, and upon continued movement of said blade support in the same direction relative movement of said contact portion and blade support will occur while stressing said resilient means until said contact portion passes by said contact means, after which said contact portion will be restored to its normal position by said resilient means, and means for causing said contact portion to have a greater amount of movement relative to said blade support upon engagement with said contact means when said blade support and contact portion are moved in a direction away from said one end of its path than when moved in the opposite direction.

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