Sept. 6, 1938. O. FROLAND 2,129,270

ELECTRICAL SWITCH

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Fig. 1

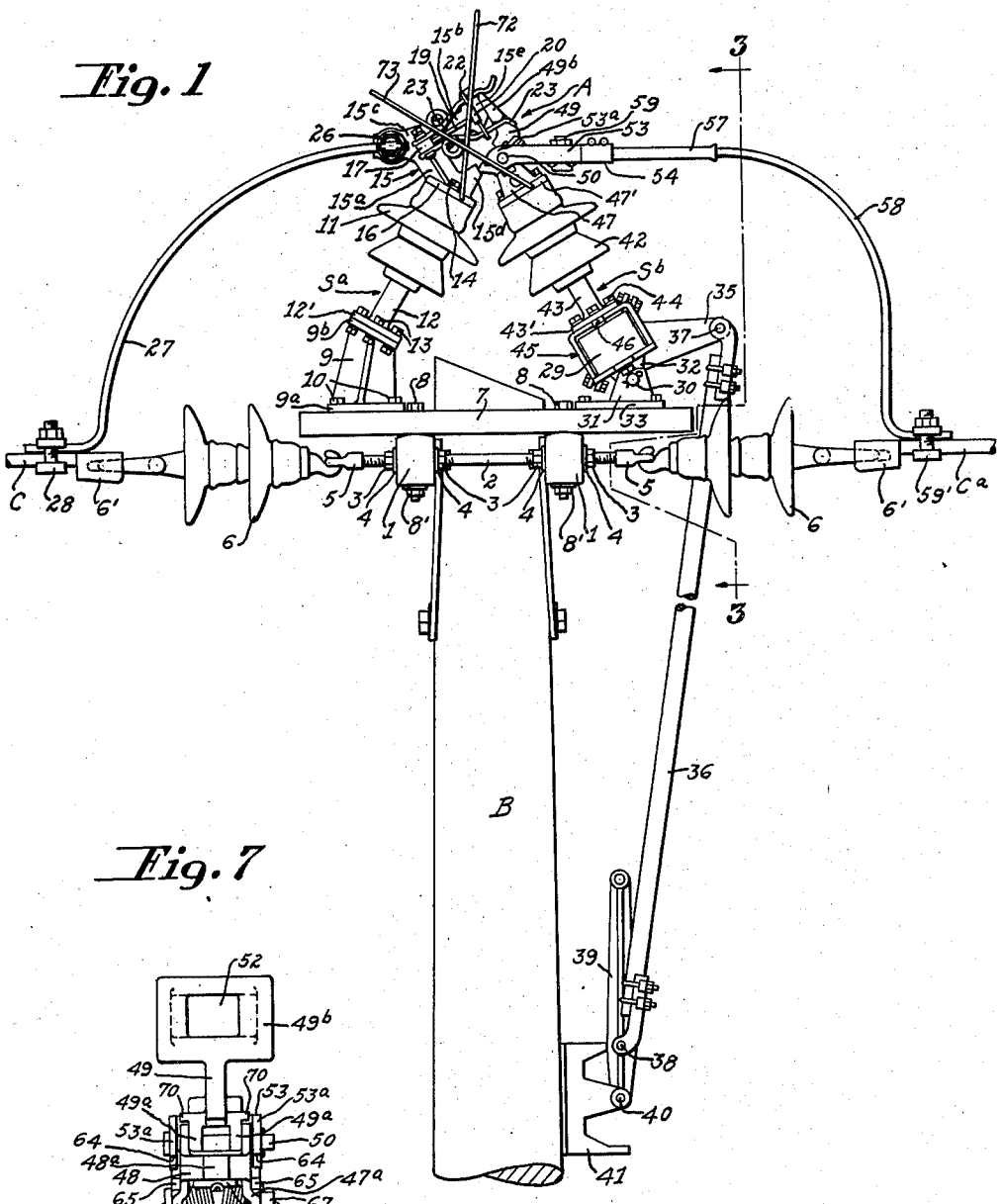


Fig. 7

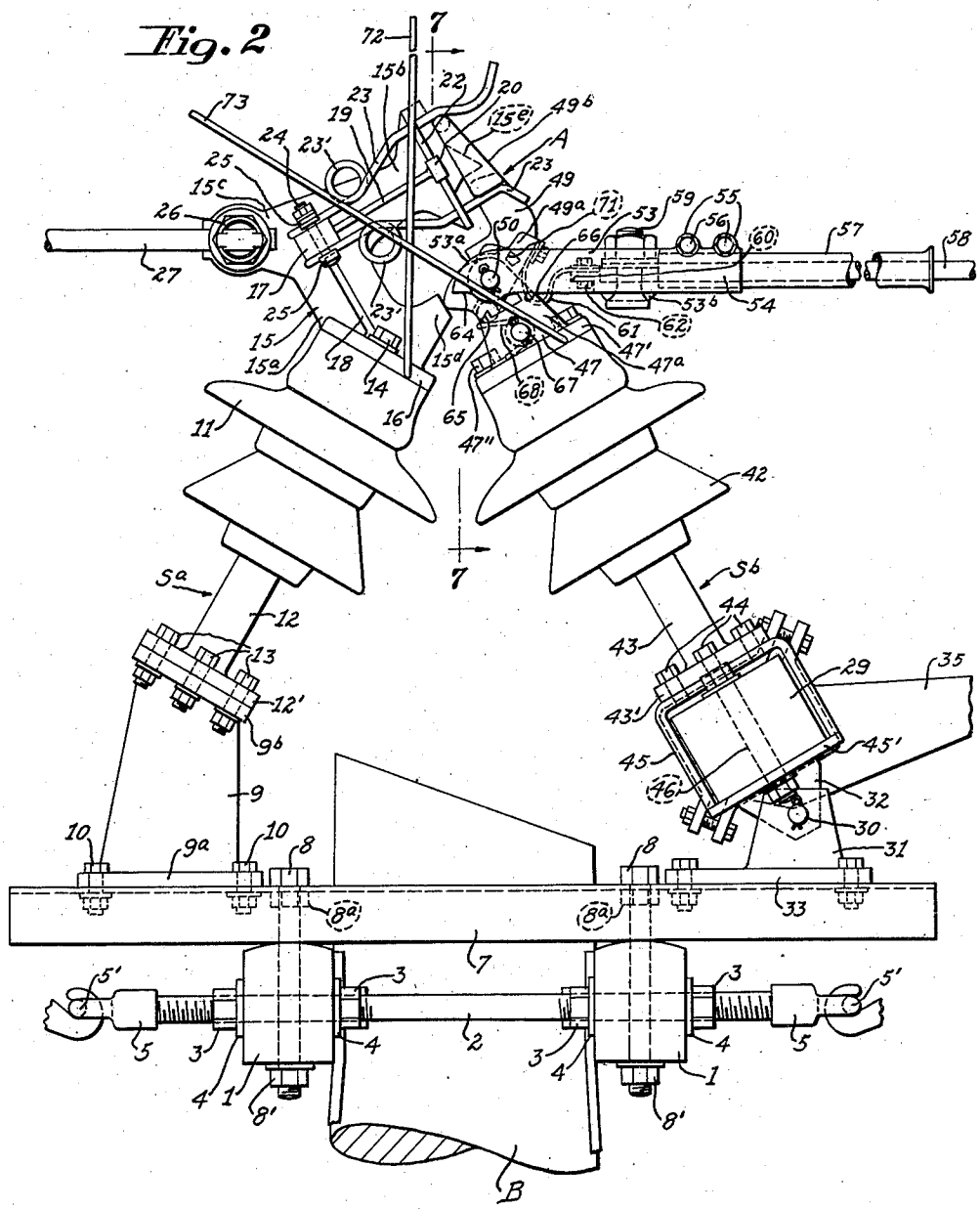
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ELECTRICAL SWITCH

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Fig. 2



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Fig. 3

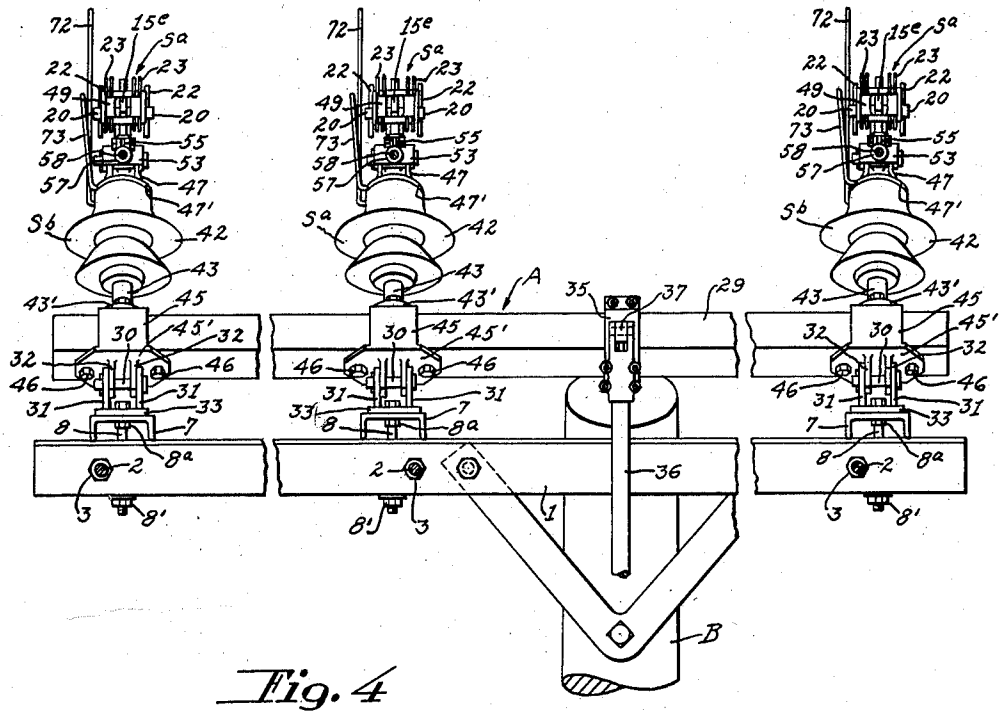
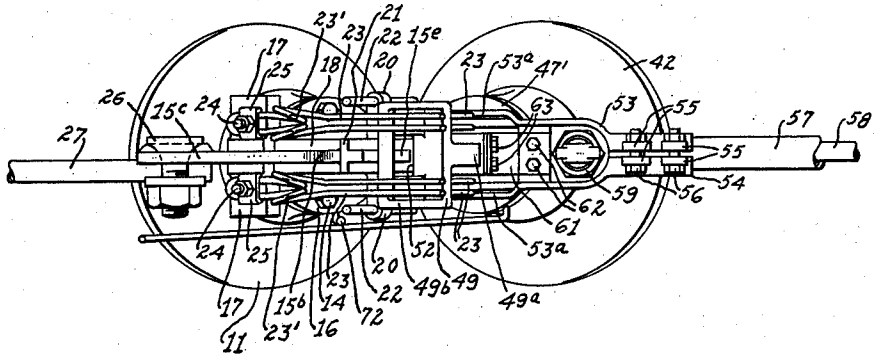


Fig. 4



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Fig. 5

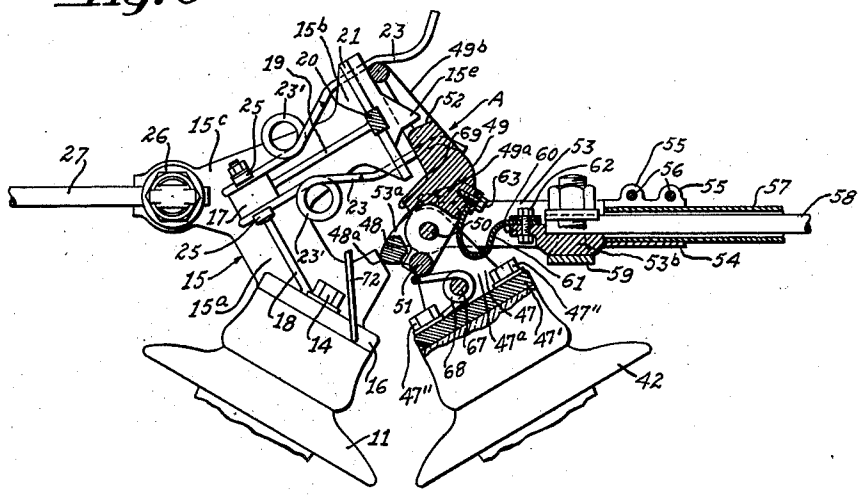
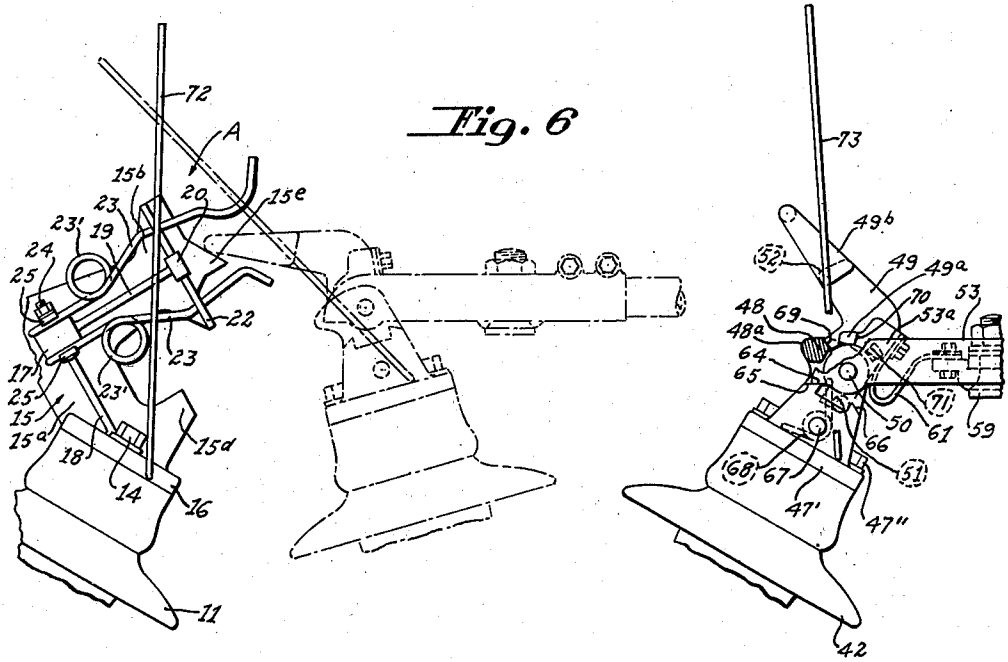


Fig. 6



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2,129,270

UNITED STATES PATENT OFFICE

2,129,270

ELECTRICAL SWITCH

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Application March 9, 1936, Serial No. 67,807

5 Claims. (Cl. 200—48)

This invention relates generally to electrical switches, and more specifically to electrical switches intended particularly for use as parts of gang-operated switch structures adapted for disposition adjacent to the tops of conductor-supporting poles and operable to simultaneously make and break electrical connections between portions of a plurality of conductor lines, the predominant object of the invention being to provide a switch having such improved contacting mechanism that positive point pressure contact is provided between the co-operating contact elements when the switch mechanism is in the closed position.

Another important object of the invention is to provide a switch mechanism which includes contact elements movable into and out of electrical contact one with the other, one of which moves slidably with respect to the other to produce a wiping action. Because of this arrangement scale or corrosion will be removed from the contact elements by the wiping action, whereby clean, bright points of contact are obtained with every operation of the switch. Also this wiping action of the contact elements serves to shatter even the heaviest coatings of ice on the contact elements and guarantees free working of the switch under the worst conditions of ice and sleet.

Fig. 1 is a side elevation of a gang-operated switch provided with the improved switching mechanism to which the present invention relates, parts of the structure illustrated in this view being broken away to conserve space.

Fig. 2 is an enlarged side elevation of the structure shown in the upper portion of Fig. 1, here also parts of the structure being broken away to conserve space.

Fig. 3 is a sectional elevation on line 3—3 of Fig. 1.

Fig. 4 is a plan view of one of the improved switching mechanisms.

Fig. 5 is a fragmentary view similar to Fig. 2, but shown partly in elevation and partly in section.

Fig. 6 is a fragmentary elevation of parts of the improved switching mechanism showing said switch parts in full lines as they appear when the switching mechanism is in the open position, and by dotted lines illustrating one of said switch parts as it appears when it is moving into the closed position.

Fig. 7 is an elevation of a part of the improved switching mechanism showing one of the contact elements thereof.

In the drawings, wherein is shown for the purpose of illustration, merely, one embodiment of the invention, A designates generally a gang-operated switch structure, which is shown as being mounted at the top of a pole B. The gang-operated switch structure A is secured to the pole B through the instrumentality of cross members 1 which are disposed at opposite sides of the pole, as shown clearly in Figs. 1 and 2, said cross members being secured to the pole by means of one or more bolts which pass into or through the pole, and being held horizontal by suitable diagonal braces. The cross members 1 are provided with transversely extended openings through which rods 2 extend, and said rods are provided with screw-threaded portions that receive nuts 3 and washers 4, the nuts 3 jambing the washers 4 into close contact with the opposite faces of the cross members so as to securely fasten the rods 2 to said cross members. At the opposite ends of each of the rods 2 are mounted elements 5, which include eye portions 5' that receive hooks forming parts of insulator structures 6, these insulator structures being attached through the instrumentality of suitable means 6' to electrical conductor sections C and C^a. The particular embodiment of the invention illustrated in the drawings includes three of the rods 2, and a pair of conductor sections C and C^a is associated with each rod in the manner illustrated in Fig. 1, wherein only one of such rods is shown.

Supported upon and secured to the cross members 1 is a plurality of channel beams 7, which extend transversely of the cross members as shown in Figs. 1, 2, and 3. Each channel beam is disposed with its bridge portion arranged horizontally and with its parallel legs extended vertically, said legs contacting at their lower edges with the tops of the cross members. The channel beams are secured to the cross members by bolts 8 which pass through openings formed through the bridge portions of said channel beams and extend through vertically disposed openings formed through the cross members, said bolts having nuts 8' associated therewith which force associated washers into contact with the lower faces of the cross members, and being provided with jamb nuts 8^a which contact with the lower faces of the bridge portions of the channel beams.

Supported by each channel beam 7 is a switch unit which comprises a stationary contact assembly S^a and a movable contact assembly S^b. The stationary contact assembly S^a includes a support 9 which is provided with a lower horizontal flange 9^a and an upper, angularly disposed flange 9^b. The support is secured to the beam 7 by bolts 10

which are extended through apertures formed through the flange 9a and through the bridge portions of the channel beam 7. Secured to the flange 9b of the support 9 is an insulating structure which includes an upper portion 11 formed of suitable electrical insulating material from which is extended in a downward direction a rod 12 provided at its lower end with a flange 12'. The flange 12' of the rod 12 contacts with the flange 9b of the support 9, and bolts 13 which extend through alined apertures formed in said flanges secure the insulating structure to the support.

Secured by means of bolts 14 to the top portion of the insulating structure of each stationary contact assembly Sa is a supporting plate 15, which is shaped in side elevation as shown in Figs. 1, 2, 5, and 6; that is to say, said supporting plate includes a portion 15a which extends upwardly and rearwardly from a flange 16 located at the lower end of the supporting plate through which the bolts 14 pass, a portion 15b which extends upwardly and forwardly from the upper portion of the plate portion 15a, a rearwardly extended portion 15c, an upwardly and forwardly projected extension 15d located at the lower end of the portion 15a, and a nose portion 15e located at the forward end of the plate portion 15b. Extended transversely in opposite directions from the supporting plate 15a is a pair of alined lugs 17 of rectangular cross-section. Extended longitudinally of the supporting plate portion 15a at the opposite sides thereof are strengthening ribs 18, and extended longitudinally of the supporting plate portion 15b are similar strengthening ribs 19 which terminate at bars 20 which are extended in opposite directions from the supporting plate 15. The outer end portion of the portion 15b of the supporting plate is provided at its opposite sides with strengthening ribs 21 which are extended at an approximate right angle with respect to the line of extension of the strengthening ribs 19, said ribs 21 being extended from opposed faces of the bars 20 to the outer edges of portions of the supporting plate 15. The bars 20 are provided at their outer ends with apertures which receive rods 22.

Fixed to the lugs 17 at opposite sides of the supporting plate 15 are pairs of contact elements 23, each pair of contact elements comprising a contact element secured at the top face of a lug 17 and a similar contact element secured at the bottom face of said lug. Each contact element is of substantially U-shaped formation when viewed in plan as shown in Fig. 4, and each leg of each U-shaped contact element has a coil 23' formed therein in order to impart to said leg the required resiliency. The legs of the uppermost contact elements 23 at opposite sides of the supporting plate 15 are inclined upwardly from the coils 23' thereof for a short distance and extend forwardly from such inclined portion in substantial parallelism with respect to the rear portion of the contact element. Also at the extreme forward end portion of the upper contact elements the legs thereof are curved downwardly and then upwardly, said curved portions terminating in substantially straight portions which are inclined forwardly and upwardly, as shown in Figs. 1, 2, 5, and 6. The lowermost contact elements 23 at opposite sides of the supporting plate 15 are shaped to correspond more or less to the shape of the uppermost contact elements, with the exception that the legs of the lowermost contact elements are not provided with the curved portions adjacent to their outer ends. In other words, the lowermost contact elements are substantially U-shaped in plan and each leg of said lowermost contact elements is provided with a coil 23' to provide said leg with the required resiliency. Also, each of said legs is provided with a portion that inclines downwardly and forwardly from the coil thereof, a substantially straight portion extended forwardly from the forward end of said inclined portion, and a substantially straight, downwardly and forwardly extended portion at the extreme outer end of said leg.

The associated upper and lower contact elements 23 at each side of the supporting plate 15 are secured to the associated lug 17 by means of a bolt 24 which passes between the legs of said contact elements and extends through an opening formed through said lug. Also, this bolt has associated with it a pair of clips 25 of substantially U-shaped formation which straddle the upper and lower contact elements at the location of the bolt 24 and are provided with apertures through which said bolt passes. Due to the fact that the bolt 24 draws the bridge portions and the side flanges of the clips 25 into close contact with the legs of the contact elements 23, said contact elements are very securely fixed to the lug 17.

The rearwardly extended portion 15c of the supporting plate 15 has attached to it a suitable electrical connecting device 26 which serves to electrically and mechanically attach an electrical conductor 27 to said plate portion 15c, the opposite end of this electrical conductor being electrically connected, as shown in Fig. 1, to the conductor section C through the instrumentality of a suitable electrical connecting device 28.

Referring now to the contact assembly Sb, this assembly, in the embodiment of the invention illustrated, is mounted on a wood bar 29. The wood bar 29 is supported for rocking movement about a plurality of alined pivot pins 30, these pivot pins serving to rockably connect together extensions 31 and 32 formed, respectively, on members 33 secured to the channel beams 7 and members 45 secured to wood bar 29. Also the wood bar 29 has fixed to it an arm 35 to which the upper end of an operating element 36 is pivotally attached at 37, said operating element being pivotally attached at its lower end as indicated at 38 to an operating lever 39 which is pivotally secured at 40 to a supporting element 41 fixed to the pole B.

Because of the arrangement just described, the wood bar 29 may be rocked about the pivot pins 30 by moving the operating lever 39 about its pivot 40, such movement being transmitted from the operating lever to the arm 35 which, as already stated, is fixed to the wood bar. In this manner the contact assembles Sb supported by the wood bar 29 may be moved into and out of contact with the contact assemblies Sa supported by the channel beams 7.

Each of the contact assemblies Sb includes a portion 42 formed of suitable electrical insulating material from which a rod 43 is extended in a downward direction, said rod being provided at its lower end with a flange 43'. The flange 43' is provided with apertures through which are extended bolts 44 which serve to secure the entire contact assembly to a structure 45 that embraces the wood bar 29, as shown in Figs. 1, 2, and 3. The wood bar-embracing structure 45 of each contact assembly Sb includes a plate portion 45' which contacts with the lower

face of the wood bar 29, said plate being provided with lateral extensions having apertures formed therethrough through which are extended bolts 46, which pass also through openings formed through the wood bar so as to secure the structure 45 to the wood bar.

Mounted at the upper end of the insulating portion 42 of each contact assembly S^b is a contact support 47 which includes at its lower end a flange 47', this flange being provided with apertures through which bolts 47'' are extended that serve to secure the contact support to the insulating portion. Extended upwardly from the flange 47' of each contact support 47 is a pair of spaced plates 47^a, said spaced plates being joined by a transversely extended bar 48 which at its center is of the cross-sectional shape illustrated in Figs. 5 and 6 (see also Fig. 7). The transversely extended bar 48 of each contact assembly S^b is located at the side of the contact support 47 adjacent to the associated contact assembly S^a and the center portion of said bar contacts with the forward edge of the portion 15^d of the supporting plate 15 of said associated contact assembly S^a when the associated contact assemblies S^a and S^b are in the closed switch position, as shown in Fig. 5.

Pivotally supported by the contact support 47 of each contact assembly S^b is a blade contact 49, such pivotal relation of said parts being accomplished by a pivot pin 50 which passes through apertures formed in parts of the spaced plates 47^a of the contact support and in parts of the blade contact. The blade contact 49 of each contact assembly S^b is of the angular shape illustrated to the best advantage in Fig. 5, said blade contact including a bifurcated lower portion 49^a, the spaced apart side portions of which are joined by a short bar 51. The upper portion 49^b of each blade contact 49 is shaped as shown in Fig. 7; that is to say, said upper portion is of considerably increased width and an opening 52 is formed therein. It is to be noted that portions of the upper portion 49^b of each blade contact above and below the opening 52 thereof are provided with curved surfaces which, as will hereinafter appear, facilitate movement of the blade contact with respect to the contact elements 23 of the associated contact assembly S^a.

Pivotally attached to each contact support 47 through the instrumentality of the pivot pin 50 is a conductor or cable support 53. The forward portion of each cable support is of bifurcated formation as shown at 53^a in Fig. 4, the spaced apart legs of said bifurcated portion being joined by a transversely extended bar 53^b. The rear portion of each cable support 53 is in the form of a split tube 54 which is provided with ears 55 that receive suitable bolts 56 for contracting the split tube so as to clamp same as an elongated tubular element 57 through which a conductor or cable 58 passes. The forward end of the conductor or cable 58 is mechanically and electrically connected to the transverse bar 53^b of the cable support through the instrumentality of a suitable electrical connector 59, and the opposite end of this conductor or cable is mechanically and electrically connected to an associated conductor section C^a by means of another suitable electrical connector 59'. The transverse bar of each cable support includes a forwardly extended portion 60 to which a flexible electrical current-carrying connection 61 is attached by suitable means 62, the opposite end of this connection 61 being secured by suitable means 63 to the associated blade contact 49. The forward ends of the spaced legs of the bifurcated portion of each cable support are provided with abutment faces 64 (see Fig. 2, wherein only one side of the cable support is shown). These abutment faces 64 contact with abutment faces 65 formed on the opposed outer faces of the associated contact support 47 when the movable contact assembly S^b is moved to the open switch position, as shown in Fig. 6. The opposed outer face of each contact support 47 is provided also with another abutment face 66 with which the associated cable support contacts when the movable contact assembly S^b is in the closed switch position, as shown to the best advantage in Fig. 2. Thus the abutment faces 65 and 66 serve to limit movement of the cable support and support said cable support when the switch is in the closed and open positions.

Extended transversely of each contact support 47 between the spaced plates 47^a thereof is a rod 67, which supports a torsional coil spring 68. This torsional coil spring includes a coiled portion through which the rod 67 extends, one end of said torsional coil spring being in contact with the top face of the flange portion 47' of the contact support and the other end of said torsional coil spring being in contact with the transverse bar 51 of the associated blade contact 49. The torsional coil spring 68 tends to move the blade contact about the pivot 50 from the position of said blade contact shown in Fig. 5 to the position of said blade contact shown in Fig. 6 by exerting rearward pressure against the transverse bar 51. The forward movement of the upper portion of the blade contact is limited by the abutment face 69 formed on said blade contact coming in contact with the abutment face 48^a of the transverse bar 48 of the contact support 47, while rearward movement of the upper portion of the blade contact is limited by abutment faces 70 formed on opposite sides of the blade contact coming in contact with abutments 71 formed on the inner faces of the spaced legs of the bifurcated forward portion of the cable support 53 (see Fig. 6).

Each switch unit of the improved structure disclosed herein is provided with a pair of arcing horns 72 and 73 which are carried by the switch assemblies S^a and S^b. The associated arcing horns of each switch unit contact with each other when the switch units are in the closed switch position, and remain in contacts as the contact elements of the switch unit are drawn apart, whereby arcing at the contact elements of the switch units is eliminated.

When, in the use of the improved structure, the switch units are in the open position illustrated by full lines in Fig. 6, and it is desired to close the switch units, the operating lever 39 is moved upwardly about its pivot 40 with the result that the bar 29 is rocked about the pivot pins 30 so as to move the upper parts of the movable contact assemblies S^b of the switch units toward the stationary contact assemblies S^a. It is to be noted that when the switch units are out of contact, the torsional coil springs 68 maintain the blade contacts of the movable contact assemblies in the position shown by full lines in Fig. 6, where the abutment faces 64 of the blade contacts contact with the abutment faces 65 of the contact supports 47. When the movable contact assemblies S^b move into the closed switch position, the top portions of the blade contacts 47 first strike the inclined edges of the nose por-

tions 15e of the supporting plates 15 of the stationary contact assemblies, as shown by dotted lines in Fig. 6, and as forward movement of the movable contact assemblies continues the top portions of the blade contacts are guided upwardly by the inclined edges of the nose portions and by the outer edges of the supporting plates 15 which are located above said inclined edges of said nose portions, until the top portions of the blade contacts make point contact with the upper spring contacts 23. Continued movement of the movable contact assemblies causes the lower faces of the wider, upper portions of the blade contacts to move into contact with the lower spring contacts 23, and said wider upper portions of said blade contacts are forced between the upper and lower spring contacts so as to produce firm point pressure contact between the upper and lower spring contacts and the blade contacts. When the forward faces of the bars 48 contact with the front edges of the portions 15d of the supporting plates 15 of the stationary contact assemblies, the switch units are in the closed switch position. It is to be noted that when the switch units are in the closed switch position, the direction of the spring pressure exerted by the torsional coil springs 68 against the lower ends of the blade contacts 49 passes slightly to the left of the pivots 50. This provides a toggle action that holds the blade contacts 49 in the position shown in Figs. 1, 2, and 5, and which, because the blade contacts are approximately 10° out of toggle, prevents any possibility of the switch throwing itself open should the operating mechanism fail.

When the switch is drawn to the open position the operating lever 39 is moved downwardly about its pivot 40 to rock the bar 29 rearwardly and thereby cause the pivots 50 to move rearwardly. This has the effect of breaking the toggles produced by the torsional coil springs acting against the lower ends of the blade contacts. Continued rearward movement of the contact assemblies S^b causes the blade contacts to move about the pivots 50, whereby the lower faces of the wider, upper portions of said blade contacts move outwardly out of contact with the lower spring contacts 23 and the top portions of said blade contacts move downwardly and outwardly out of contact with the top spring contacts 23. As the blade contacts are freed from the spring contacts 23, the torsional coil springs 68 move said blade contacts about the pivots 50 until they reach the position shown in full lines in Fig. 6, where the abutment faces 69 on the blade contacts contact with abutment faces 48a on the transverse bars 48 of the contact supports 47.

A distinct advantage of the improved switch structure disclosed herein is that the switch is easy to close, due to the fact that when the blade contacts are forced between the spring contacts 23 the blades go into toggle, thereby decreasing the required force on the operating lever 39. Also, when the switch is being opened the toggles are easily broken and under severe ice conditions the toggle action provides an excellent ice-breaking medium. Also, because of the wiping action between the blade contacts and the spring contacts, the contacts are wiped clean with every operation of the switch, and this wiping action also aids in breaking any ice which may form on the contacts.

It is to be noted that the downwardly curved, outer portion of the upper spring contacts 23 serve to lock the tops of the blade contacts in close contact with the adjacent edges of the supporting plates 15 of the stationary contact assemblies from the beginning of the contact engagement, thereby preventing the blade contacts from being disengaged from the upper spring contacts during the switch-closing operations. Also, the rods 22 heretofore mentioned prevent the upper and lower spring contacts 23 from spreading outwardly to such extent that they would be out of alinement with respect to the upper portions of the blade contacts.

I claim:

1. A switch comprising a stationary contact assembly, a movable contact assembly, a pair of yieldable contact elements supported by said stationary contact assembly, a contact element pivotally supported by said movable contact assembly and movable into position between and in contact with both of the contact elements of said pair of yieldable contact elements so as to provide point pressure contact between said pivotally supported contact element and said pair of yieldable contact elements, said pivoted contact element being provided with portions spaced longitudinally of said contact element which are forced between and in contact with the contact elements of said pair of yieldable contact elements to provide said point pressure contact between said pivoted contact element and said pair of yieldable contact elements, and means mounted on said movable contact assembly and arranged in engagement with the contact element pivotally supported thereby so as to provide a toggle action between said movable contact assembly and said pivotally supported contact element when the switch is moved into and out of the closed switch position.

2. A switch comprising a stationary contact assembly, a movable contact assembly, a pair of yieldable contact elements supported by said stationary contact assembly, a contact element pivotally supported by said movable contact assembly and movable into position between and in contact with both of the contact elements of said pair of yieldable contact elements so as to provide point pressure contact between said pivotally supported contact element and said pair of yieldable contact elements, said pivoted contact element being provided with portions spaced longitudinally of said contact element which are forced between and in contact with the contact elements of said pair of yieldable contact elements to provide said point pressure contact between said pivoted contact element and said pair of yieldable contact elements, and spring means mounted on said movable contact assembly and arranged in engagement with the contact element pivotally supported thereby so as to provide a toggle action between said movable contact assembly and said pivotally supported contact element when the switch is moved into and out of the closed switch position.

3. A switch comprising a stationary contact assembly, a movable contact assembly, pairs of yieldable contact elements supported at opposite sides of a portion of said stationary contact assembly and projected therefrom, and a contact element pivotally supported by said movable contact assembly and movable into position between and in contact with the contact elements of said pairs of yieldable contact elements so as to provide point pressure contact between said pivotally supported contact element and said pairs of yieldable contact elements, said pivoted con-

tact element being provided with portions spaced longitudinally of said contact element which are forced between and in contact with the contact elements of said pairs of yieldable contact elements to provide said point pressure contact between said pivoted contact element and said pairs of yieldable contact elements.

4. A switch comprising a stationary contact assembly, a movable contact assembly, pairs of yieldable contact elements supported at opposite sides of a portion of said stationary contact assembly and projected thereform, and a contact element pivotally supported by said movable contact assembly and movable into position between and in contact with the contact elements of said pairs of yieldable contact elements so as to provide point pressure contact between said pivotally supported contact element and said pairs of yieldable contact elements, said pivoted contact element being provided with portions spaced longitudinally of said contact element which are forced between and in contact with the contact elements of said pairs of yieldable contact elements to provide said point pressure contact between said pivoted contact element and said pairs of yieldable contact elements, said contact element of said movable contact assembly being connected to said movable contact assembly in a manner to provide a toggle action between said contact element and said movable contact assembly when the switch is moved into or out of the closed switch position.

5. A switch comprising a stationary contact assembly, a movable contact assembly, pairs of yieldable contact elements supported at opposite sides of a portion of said stationary contact assembly and projected therefrom, a contact element pivotally supported by said movable contact assembly and movable into position between and in contact with the contact elements of said pairs of yieldable contact elements so as to provide point pressure contact between said pivotally supported contact element and said pairs of yieldable contact elements, said pivoted contact element being provided with portions spaced longitudinally of said contact element which are forced between and in contact with the contact elements of said pairs of yieldable contact elements to provide said point pressure contact between said pivoted contact element and said pairs of yieldable contact elements, and spring means mounted on said movable contact assembly and arranged to engage the contact element pivotally supported thereby whereby a toggle action between said movable contact assembly and said pivotally supported contact element is provided when the switch is moved into or out of the closed switch position.

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