Feb. 27, 1934. C. G. KOPPITZ 1,949,018

HIGH TENSION SWITCH

Filed May 29, 1929 2 Sheets-Sheet 1

Fig. 1.

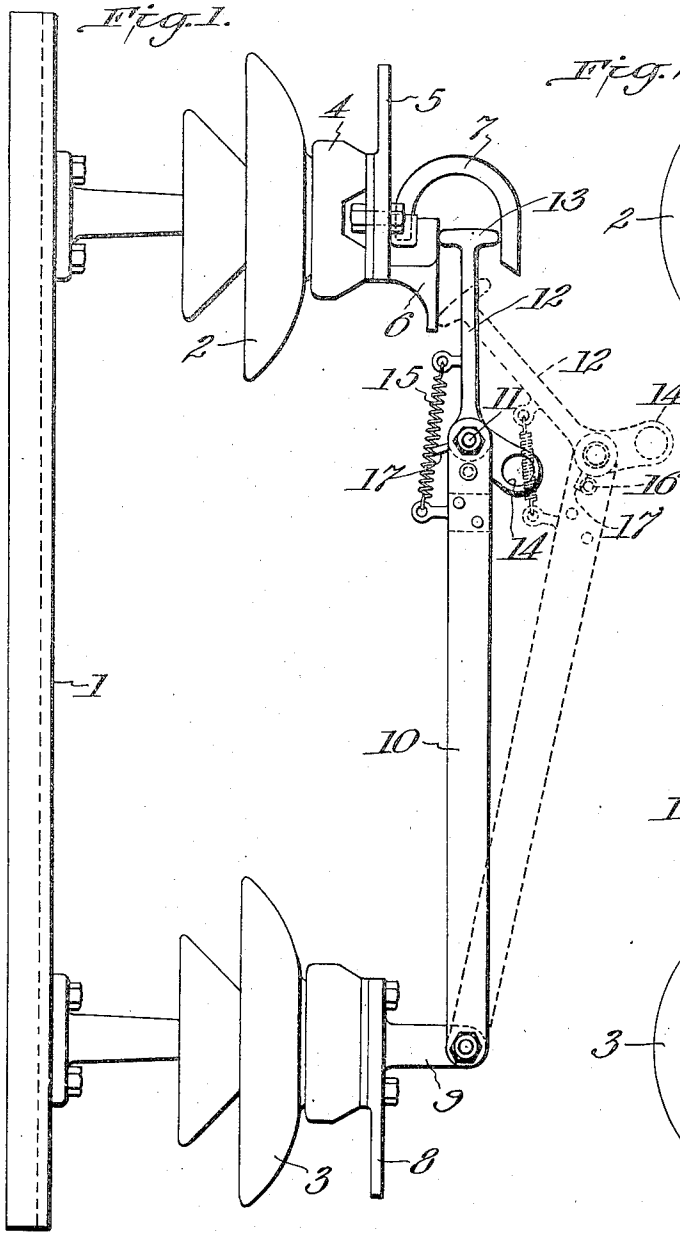
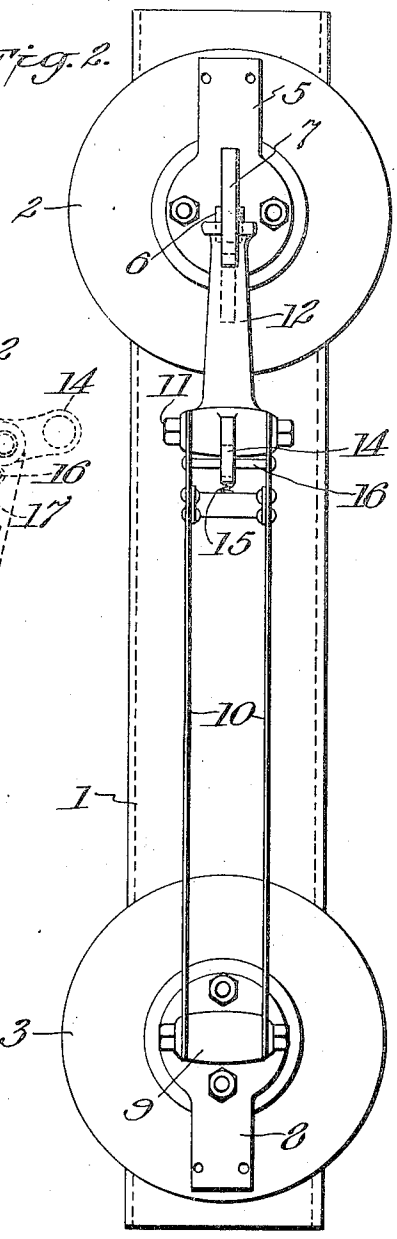


Fig. 2.



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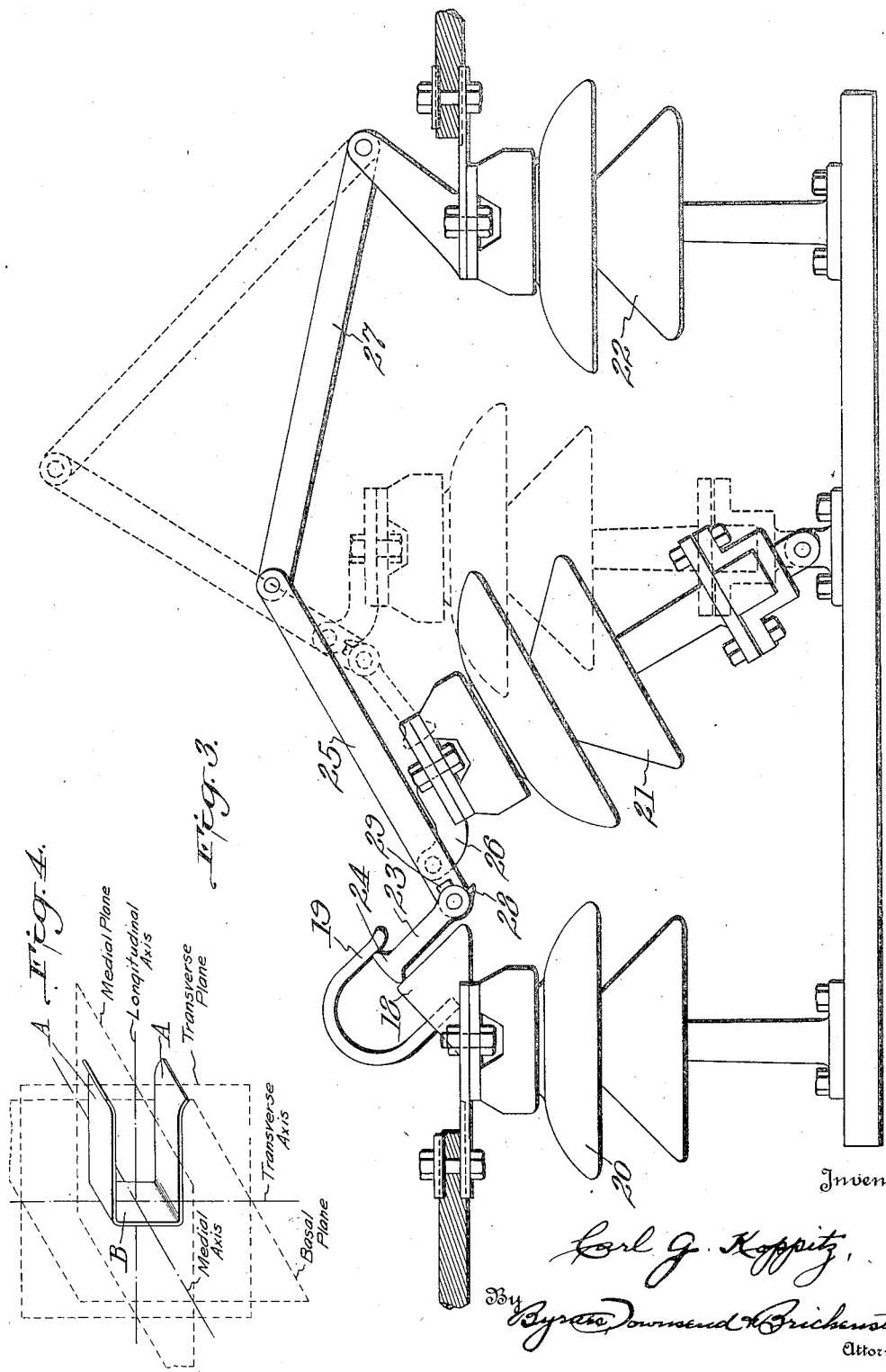


Fig. 3.

Fig. 4.

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HIGH-TENSION SWITCH

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Application May 29, 1929. Serial No. 367,014

11 Claims. (Cl. 200—48)

The present invention relates to high tension switch mechanism, and more particularly to a high contact pressure switch which is adapted for direct exposure to atmospheric conditions.

The method employed for introducing the movable element into the switch jaws and thereafter rotating the same to secure a high contact pressure is similar to the method employed in the switch construction described in my prior Patent, No. 1,560,998, November 10, 1924. In my prior patent I have described a contact element of non-circular transverse cross-section which is held in inclined position during the introduction of the non-circular element into the space between the switch jaws, the final closing movement of the switch effecting the rotation of the non-circular element to bring its major dimension transversely of the switch jaws.

An object of the invention is to provide a simple and relatively inexpensive construction for effecting the introduction of a flattened contact element within a switch jaw, and thereafter rotating the contact element to position the same transversely of the switch jaw. A further object is to provide a high contact pressure switch in which the movable elements have the general form of a toggle linkage, the toggle linkage being adapted to position the contact element within the switch jaw, and to effect relative angular movement of the contact element and the switch jaw during the final closing movement of the switch.

These and other objects of the invention will be apparent from the following description when taken with the accompanying drawings in which:

Fig. 1 is a side elevation of a disconnect switch embodying the invention;

Fig. 2 is a front elevation of the same;

Fig. 3 is a side elevation of a rocker switch embodying the invention; and

Fig. 4 is a diagram of a switch jaw and reference planes and axes which are referred to in the specification and claims.

In the drawings, the numeral 1 identifies a base plate of channel form upon which are mounted the insulator columns 2, 3, which carry the respective contact members of the switch. The customary metal cap 4 of the insulator 2 is provided with a plate 5 for receiving a terminal and with a contact lug 6 of soft metal which cooperates with the spring arm 7 to provide the two parallel members of a switch jaw.

The insulator column 3 carries blade 8 for connection to a line terminal and a lug 9 upon which are pivotally mounted the straps 10 which form the switch blade. The upper ends of the straps 10 are connected by a bolt 11 which provides a pivotal support for the lower end of a contact arm 12 which terminates in a flattened contact element 13. The contact arm is provided with the usual apertured lug 14 for receiving the end of an operating rod, and a spring 15 is connected between the parts 10 and 12 for normally retaining the linkage in the "broken" position which is shown in dotted lines in Fig. 1. To limit the relative angular movement of the links 10, 12 of the toggle linkage, the parts are provided with cooperating stop members 16, 17, respectively.

The operation of the switch will be apparent from Fig. 1. When upward pressure is applied to the operating lug 14, the blade and contact arm 12 move as a unit about the lug 9 until the flattened contact head 13 engages the contact member 6 of the switch jaw. The continued application of the upward pressure causes the toggle linkage to flatten and the spring 15 yields to permit the combined sliding and rotary movement of a flattened contact 13 within the switch jaw. The maximum dimension of the contact element 13 is so chosen, with reference to the transverse width of the switch jaw, that the contact element is tightly wedged between the opposite sides of the jaw when the switch members occupy their final position, as shown in Fig. 1. The exact form of the flattened contact element is subject to wide variation. The essential requirement is that the contact element shall have such cross-section, on planes normal to its axis which is parallel to the axis of the pivotal support 11, that the width of the projection of the element upon the basal plane of the jaw varies with the angular adjustment of the element about the pivotal support 11.

The location of the plane which I have designated as the basal plane will be apparent from Fig. 4, which is a perspective view of a simple switch jaw formed by bending the ends A of a metal strap at right angles to the central or base portion B of the strap. As indicated by the legends on this view, the basal plane includes the base B and is normal to the longitudinal axis of the switch jaw; the medial plane of the jaw is that plane through the longitudinal axis which is parallel to the jaws A, and the transverse plane passes through the longitudinal axis and is normal to the basal and medial planes.

While the switch jaw formed by the soft metal contact 6 and spring arm 7 differs substantially from the simplified jaw structure shown in Fig.

4, the same reference planes and axes apply equally well to any switch jaw of the same general construction.

During the final closing movement of the switch, the flattening of the toggle linkage carries the contact element 13 into the jaw by a translatory motion substantially along the longitudinal axis of the jaw, and also effects rotation of the contact element about an axis parallel to the medial axis of the jaw. The combined rotary and sliding movement of the element provides a cleaning action which ensures good electrical contact. The spring arm 7 may be formed of stainless iron, spring steel or the like and the pressure exerted upon the contact arm varies in accordance with the size and ampere rating of the switch. The contact element 13 is formed of relatively hard metal of lower thermal and electrical conductivity than the contact 6, suitable metals being phosphor bronze and soft copper respectively. With contact pressures of several hundred pounds and exceedingly small contact areas, heavy current densities are possible when one of the contact elements, such as contact 6, has high electrical and thermal conductivity. As explained in applicant's copending application, the contact area is only a small fraction of a square inch, hence with a contact pressure of the order of 25 to 100 pounds a pressure of 20,000 to 30,000 pounds per square inch is obtainable. With such a unit pressure, a current of several hundred amperes, having a current density of several thousand amperes per square inch, may be carried with safety.

As shown in Fig. 3, the switch contact block 18 and cooperating spring arm 19 are carried by a fixed insulator column 20, and the operating mechanism is carried by the rocking insulator column 21 and fixed column 22. The contact blade 23 with its flattened contact element 24 is pivoted upon the arm 25 which, in turn, is pivoted upon lug 26 mounted on the rocking column 21. The contact element 23 and arm 25 cooperate to form a floating toggle linkage, the relatively fixed end of arm 25 being connected by a link 27 to the top of the fixed insulator column 22. When the switch is open, as shown in dotted lines, the toggle linkage is in the flattened position and stop members 28, 29 are provided on blade 23 and arm 25, respectively, to retain the parts in such angular relationship that the contact element 24 will strike the lower end of contact 18 as the column 21 is rocked towards the left to close the switch. After element 24 engages the contact block 18, the further movement of the rocker insulator breaks the toggle linkage, carrying the element 24 into the switch jaw and simultaneously rotating the element within the jaw.

In both types of switches, a relatively small movement of the contact element corresponds to a relatively large angular movement of the operating mechanism during the final closing and inital opening movement of the switch. This decided mechanical advantage in the operating mechanism makes possible high contact pressures with relatively small operating forces and, upon opening of the switch, insures heavy forces for dislodging ice which may have formed in the contacts.

It will be understood that the invention is not limited to the specific constructions herein described and illustrated since various forms of supporting and operating mechanism may be designed for producing relative translatory motion of a switch jaw and flattened contact element to insert the element within the jaw and thereafter rotate the element about an axis parallel to the medial axis of the jaw to effect a high pressure contact.

I claim:

1. In a high contact pressure switch, the combination with U-shaped switch jaw defined by two substantially parallel surfaces, and a flattened contact element, of means including a toggle linkage supporting said jaw and element for relative translatory motion, said contact element being so positioned on said supporting means that it enters between the said substantially parallel surfaces of the switch jaw with the plane of its major dimension inclined to the basal and medial planes of said jaw, and means for actuating said toggle linkage to translate said element into said jaw and for effecting simultaneously with the final period of said translatory motion, relative rotary motion of said jaw and element about an axis parallel to the medial axis of said jaw the bondaries of said flattened contact element adjacent said jaw being convex surfaces, whereby the areas of contact with said jaw are of the order of line contacts.

2. In a switch of the high contact pressure type, a switch blade terminating in a flattened contact member of T-shape and with the head thereof arranged transversely of the axis of the blade, a switch jaw, and operating means including a toggle linkage for effecting relative translation of said blade and jaw to carry the head of said contact member through the mouth of and into position within said jaw, said operating means being effective upon further operation thereof to produce relative rotation of said contact member and jaw about an axis parallel to the medial axis of said jaw to position the head of said T-shaped contact member transversely of said jaw.

3. In a switch of the high contact pressure type, a pair of contact members comprising a switch jaw and a flattened contact element having an enlarged T-head of a width greater than the mouth of said jaw, means including a toggle linkage supporting said members for relative translatory motion to carry the T-head of said element through the mouth of said jaw and inclined to the medial plane of said jaw, and operating means for continuing the relative translatory motion of said toggle linkage after said element enters said jaw, to effect thereby relative rotary motion of said members to position said element transverse to the medial plane of said jaw, and to effect wiping engagement between said contact element and the cooperating surfaces of said jaw.

4. A disconnecting switch for an electric circuit including a pivoted insulating column having a T-shaped hinged contact member thereon connected by a flexible conductor to the electric circuit, a second insulating member having a U-shaped contact member thereon cooperating with the first said contact member by pressure engagement when the switch is in closed position, and an operating mechanism adapted to actuate the said pivoted insulator column to closed and to open positions.

5. A disconnecting switch for an electric circuit including an insulator column, a T-shaped hinged contact member supported thereon, a second insulating member having a U-shaped contact member thereon, and toggle mechanism

adapted to move said members into and out of pressure engagement.

6. The invention as set forth in claim 5, wherein said toggle mechanism effects relative movement of said members to position the head of said T-shaped contact within said U-shaped contact upon closing movement of said mechanism and to thereafter effect relative rotation of said members to wedge said head transversely of said U-shaped contact during the final closing movement of said mechanism.

7. In a high pressure contact switch, a switch jaw defined by substantially parallel surfaces, a contact element of T-shape with the head thereof arranged transversely of the axis of the contact element, a pair of insulators, means mounting the jaw on one insulator, means pivotally mounting said contact element on the second insulator, means supporting the second insulator for tilting movement about an axis parallel to the medial axis of the jaw, and operating means for tilting said second insulator to position said T-head freely within said jaw and then to continue said tilting movement to effect relative rotation of said T-head within said jaw.

8. In a high pressure contact switch, a switch jaw defined by substantially parallel surfaces, a contact element having a flattened head arranged transversely of the axis of the contact element, the flattened head having a transverse dimension greater than the normal opening of said jaw, a member carrying said contact element, means supporting said jaw and member for relative translatory movement in the transverse plane of the jaw, means pivotally mounting upon said member that end of said contact element which is remote from the flattened head, means yieldingly retaining said contact element in such position upon said member that the flattened head may enter freely within said jaw, and operating means for effecting relative translatory movement of said member and jaw to position said flattened head within said jaw and thereafter to effect relative rotation of said head within said jaw.

9. In a high pressure contact switch, a switch jaw element defined by substantially parallel contact surfaces, a T-shaped contact element, means supporting said elements and including a toggle linkage permitting relative translatory motion thereof, said elements being so positioned on said supporting means that the head of said T-shaped element will be introduced into the jaw element with the plane of the major dimension of said head inclined to the medial plane of said jaw element, and operating means for actuating said toggle mechanism to introduce said contact element within said jaw element and then to effect relative rotation of said jaw and contact elements about an axis parallel to the medial axis of said jaw element, thereby to position said contact element wholly within said jaw element and with the plane of its major transverse dimension substantially normal to the contact surfaces of said jaw element.

10. In a high pressure contact switch, a switch jaw having substantially parallel members, a flattened contact element having a pair of convex contact surfaces for engagement with said jaw members, said contact element having the plane of its greatest transverse dimension passing through said convex contact surfaces, and a toggle linkage supporting said contact element for movement into and out of said jaw, said contact element being so supported on said toggle linkage that said element enters said jaw freely before the toggle linkage completes a closing movement of the switch and is thereafter rotated into wedging engagement with said jaw members by continued movement of said toggle linkage.

11. In a high pressure contact switch, the combination with a contact element comprising a body member having a plane surface constituted by a soft metal of high electrical and thermal conductivity, and a resilient member spaced from and extending parallel to said plane surface, of a contact element comprising an arm having a flattened head provided with opposed convex surfaces for engagement with said jaw members, said contact element being formed of a relatively hard metal, and toggle mechanism for introducing said contact element into said jaw prior to the final movement of said toggle mechanism to close said switch, said contact element being so positioned on said toggle mechanism that final closing movement thereof rotates said contact element to carry the convex surfaces thereof into wedging engagement with said jaw members.

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