

Aug. 20, 1940.

W. H. LINDAE

2,211,955

ELECTRICAL SWITCHING AND CONNECTING APPARATUS

Filed Dec. 24, 1936

3 Sheets-Sheet 1

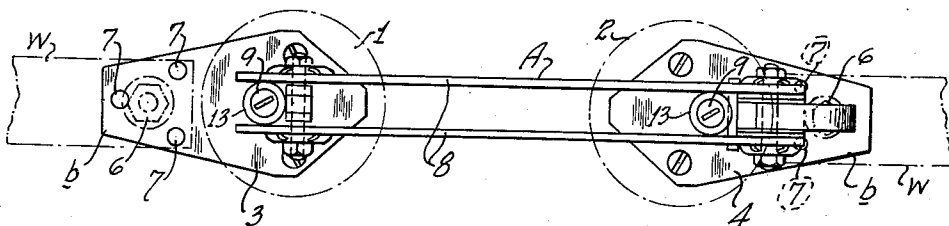


Fig. 1.

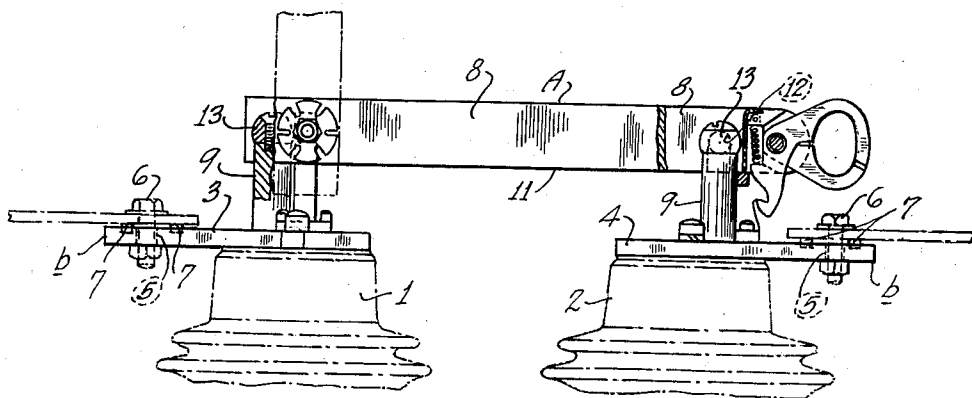


Fig. 2.

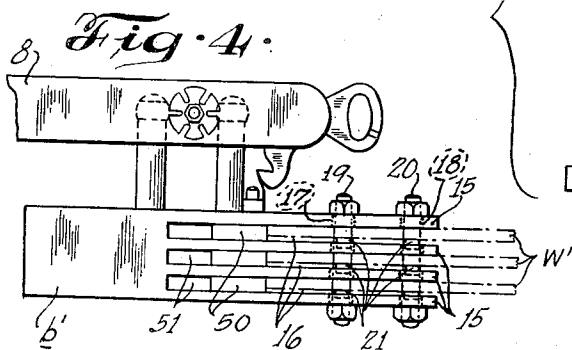


Fig. 4.

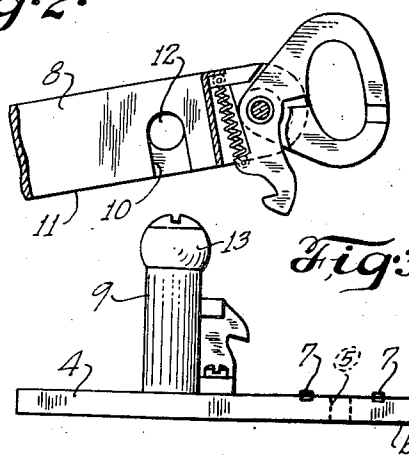


Fig. 3.

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3 Sheets-Sheet 2

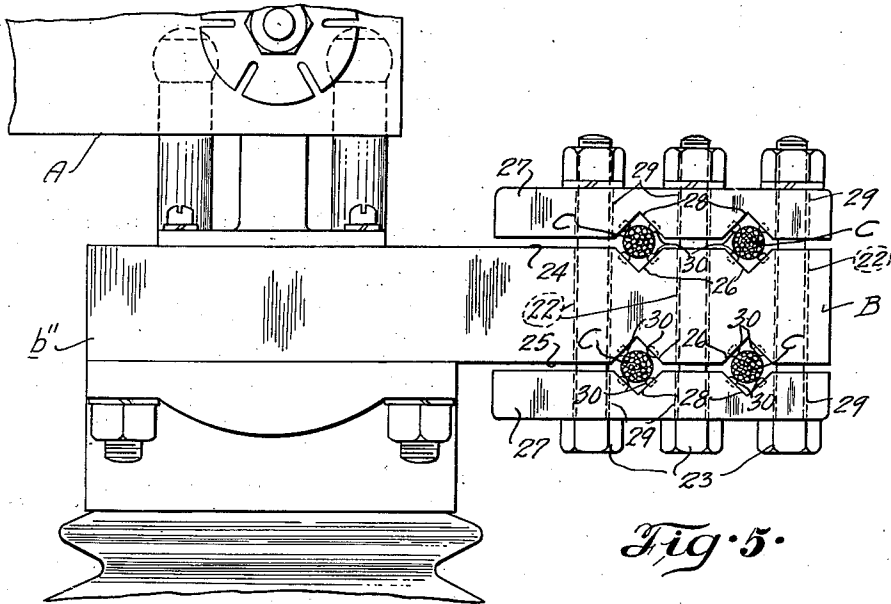


Fig. 5.

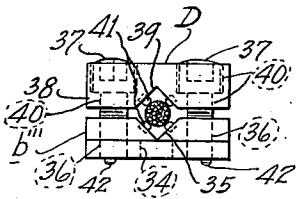


Fig. 6.

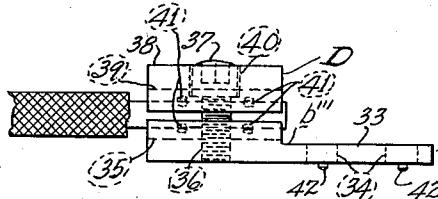


Fig. 7.

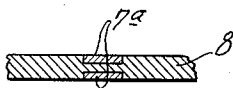


Fig. 8.

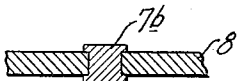


Fig. 9.

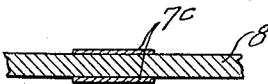


Fig. 10.

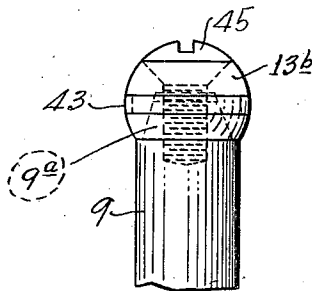


Fig. 11.

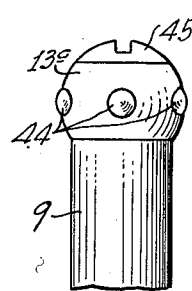


Fig. 12.

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ELECTRICAL SWITCHING AND CONNECTING APPARATUS

Filed Dec. 24, 1936

3 Sheets-Sheet 3

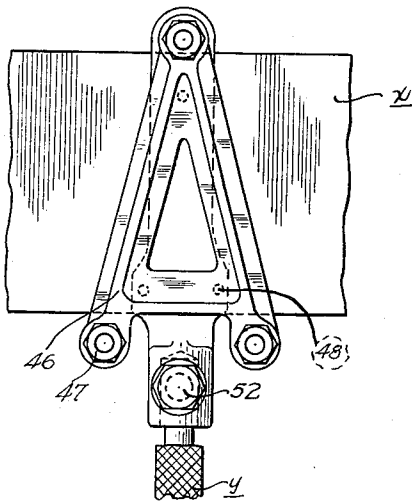


Fig. 13.

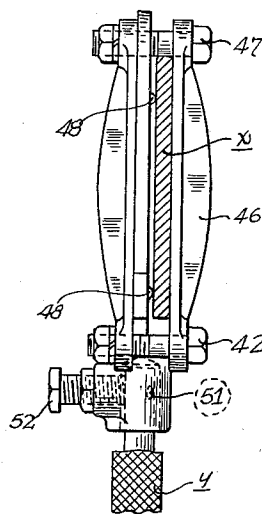


Fig. 14.

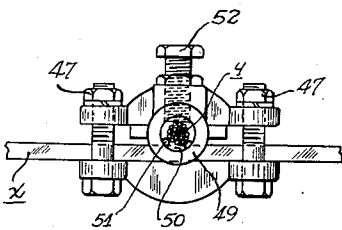


Fig. 15.

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UNITED STATES PATENT OFFICE

2,211,955

ELECTRICAL SWITCHING AND CONNECTING
APPARATUS

William H. Lindae, St. Louis, Mo.

Application December 24, 1936, Serial No. 117,603

6 Claims. (Cl. 200-166)

This invention relates generally to electrical switching and connecting apparatus and, more particularly, to a new and useful improvement in contacts for cooperative embodiment in apparatus of the type mentioned.

It is known that contact resistance is a function of pressure and not of area, and that by decreasing the contact area to a point or a line and increasing the pressure, greater contact efficiency is obtained. Nevertheless, high contact pressures produce difficulty in switch operation. Moreover, the limited contact surface which accompanies point contact area necessarily occasions relatively high temperature at the point of contact, which must, of course, be dissipated through the metal-work of the switch structure.

My present invention, hence, has for its primary object the provision in electrical switching and connecting apparatus of point contacts of unique formation presenting low resistance with superior current-carrying characteristics.

My invention has also for an object the provision, in electrical switching and connecting apparatus of the type stated, of means for the connection of the switch elements to the bus or line uniquely constructed not only for the elimination of preliminary preparations for the prevention of a high resistance therebetween, but also for facile clampwise connection for obtaining ample and adequate current-carrying capacity with minimum resistance losses.

My invention has for a further object to generally improve upon, and reduce the cost of manufacture, installation, and maintenance of, electrical switching and connecting apparatus of the type stated.

And with the above and other objects in view, my invention resides in the novel features of form, construction, arrangement, and combination of parts presently described and pointed out in the claims.

In the accompanying drawings (three sheets):

Figure 1 is a top plan view of a single pole single throw disconnecting switch embodying one form of my invention, the insulation supports and bus-bars or line terminal connections being shown by dot-dash lines;

Figure 2 is a side elevational view, partly broken away and in section, of the switch of Figure 1;

Figure 3 is an enlarged fragmentary side elevational view of the latch end of the swingable blade and its associated stationary contact post of the switch of Figure 1, other parts of the structure being omitted and the blade being

shown in opened position, that is, disengaged from the contact-post;

Figure 4 is a fragmentary side elevational view of a disconnecting switch of my invention having a base adapted for connection to a plurality of bus-bars or feeder lines;

Figure 5 is a fragmentary side elevational view of an electrical disconnecting switch of my invention having another form of base adapted for connection to a plurality of bus-bars or feeder lines;

Figure 6 is an end elevational view of an electrical connector clamp embodying my present invention;

Figure 7 is a side elevational view of the connector clamp of Figure 6;

Figures 8, 9, and 10, respectively, illustrate a series of fragmentary sectional views of various modified contacts for providing low resistance contact areas in accordance with my present invention;

Figures 11 and 12 are, respectively, enlarged fragmentary side elevational views of contact post constructions embodying my present invention; and

Figures 13, 14, and 15 are, respectively, front, side, and end elevational views of a bus-bar cable connector embodying my present invention.

Referring now in more detail and by reference characters to the drawings, which illustrate practical embodiments of my invention, A, in Figures 1 and 2, designates a disconnecting switch of the type more particularly described and disclosed in my co-pending application, Serial No. 71,665, filed March 30, 1936, of which this present application is a continuation in part, the switch A including a pair of spaced insulator stands or supports 1, 2, common in such constructions and well known to those skilled in the art.

Disposed rigidly upon corresponding faces of the insulator stands 1, 2, are electrically conductive base or terminal plates 3, 4, upon which the operating parts of the switch A are mounted, as described in my said co-pending application, each of the plates 3, 4, being provided with a preferably integral laterally projecting connection-area or extension b having an aperture 5 for receiving a suitable connection-bolt 6.

Disposed in each extension b around its aperture 5, is a series of contact-plugs 7, in the present instance three in number, of relatively small diameter or area and formed of suitable highly conductive material whose sulphide is also preferably conductive, such as silver or the like.

The plugs 7 are welded or otherwise attached to, or inset into, one or both faces of the extension b to project outwardly therefrom a small, but yet appreciable, distance, so that, when the particular bus-bars, as, for instance, bars W, are mounted on the terminal plates 3, 4, the plugs 7 will be compressed therebetween for establishing a substantially small contact area under heavy pressure and, at the same time, providing a small free or ventilating space between the relatively opposite faces of the bus-bar W and the particular terminal plate, thus providing a unique type of electrical joint construction having the characteristics of high current-carrying capacity with low resistance losses and high heat-dissipation efficiency.

In contrast to the usual and, so far as I am aware, heretofore necessary, laborious work and painstaking care required to insure perfectly flat contact surfaces between the conducting members to be connected, it will be seen that, in my construction, a highly efficient electrical joint connection may, with the greatest of ease and facility and with minimum expenditure of time and labor, be readily formed in the field during the installation of the switch or other structure.

The switch A also includes a plurality of transverse connection blades 8 and connector posts 9, as more fully described and disclosed in my said copending application, each of the blades 8 being formed upon its inner face with an arcuate depression or channel 10 extending upwardly or inwardly from the leading edge 11 thereof. Rigidly disposed or fixed in and at the base of the channel 10, is a contact-plug 12 formed in similar manner to the contact plugs 7 and arranged for contacting engagement with a spherical or ball-like end 13 of the contact post 9, which end 13 may, in turn, be formed integrally with the post 9 or may be provided with an inserted contact member of a type and in a manner presently fully described.

The switch illustrated in Figure 4 is especially designed for connection with a plurality of bus-bars or feeder lines, and accordingly the base or terminal member is in the form, as shown, of a suitably elongated or oblong-rectangular conducting block b' longitudinally slotted or furcated for a portion of its length and thereby preferably integrally provided with a series of suitably spaced parallel superposed tongues 15, the spaces between the respective tongues 15 providing channels 16 for accommodating respective bus-bars W' and the several tongues 15 being provided with pairs of perpendicularly aligned apertures 17, 18, for receiving suitable fastening elements in the form preferably of bolts 19, 20. Disposed in the contact faces of each of the tongues 15 around their respective apertures 17, 18, is a plurality of contact-plugs 21 of a character and type similar to the contact plugs 7 previously described and likewise formed of a suitable conductive material, such as silver or the like. The plugs 21, further, are similarly welded or otherwise attached to the tongues 15 and project outwardly therefrom a small, but yet appreciable, distance, so that, when the particular bus-bars W' are inserted into the channels 16 and the bolts 19, 20, tightened down, the plugs 21 will co-operatively form both securing and electrical connection with the bus-bars W' in the same manner as that previously described in connection with the contact plugs 7 and the bus-bars W. Preferably plates 50 are disposed and fixed in the channels 16 adjacent the base thereof, as

shown, for strengthening the block b', ventilating or air spaces, as at 51, however, being preferably provided at the base of the channels 16.

In electrically connecting the switch A with an electrical conductor of the multi-strand or cable type, the base or terminal b'' of the switch A is preferably integrally formed with a connector block B provided with a plurality of perpendicularly extending apertures 22 for receiving suitable attaching elements, such as bolts 23, and the upper and lower contact faces 24, 25, of the block B being, in turn, provided with a plurality of V-shaped transverse channels or notches 26.

Flatwise disposed upon the contact faces 24, 25, respectively, of the block B, is a pair of plate-sections 27 having complementary V-shaped channels or notches 28 and being also provided with a plurality of complementary apertures 29, the channels or notches 28 and the apertures 29 being, respectively, disposed for alignment with the channels or notches 26 and the apertures 22 of the block B, as best seen in Figure 5.

Disposed in, and extending perpendicularly outwardly from, the base wall of each of the channels 26, 28, is a plurality of plugs 30 of relatively small diameter or area and formed in a similar manner and of like material to that previously described in connection with the insert or plugs 7 and 21. It will be evident that, when the stripped ends of electrical cables C are inserted or laid in the channels 26 and the bolts 23 tightened to bring the engagement plates 27 down tightly thereupon, the plugs 30 will bite into the cables C and be compressed to form a high pressure small area contact therewith, thus establishing not only a firm, secure union between the parts, but also an electrical joint of a high current-carrying capacity with low resistance losses and excellent heat-dissipation efficiency.

Similarly, the present invention may be incorporated in a connector plate or bracket suitable for mounting on instrument panels and the like. Accordingly, D designates a connector bracket comprising, as shown in Figures 6 and 7, a base or terminal member b''' provided with a preferably integrally formed and somewhat enlarged lateral extension 33 having apertures 34 for accommodating suitable attaching members, such as screws or the like, not shown, for conveniently securing the base member b''' to a panel or other support. The base member b''' is also provided with a longitudinally extending V-shaped channel 35 and a pair of transverse internally threaded apertures 36 for receiving the threaded shanks of suitable attaching members, such as socket-headed bolts or the like 37. Adapted for disposition upon the upper face of the body-extension 32, is a top or engagement plate 38 having a complementary longitudinally extending V-shaped channel 39 and being also provided with a pair of complementary apertures 40 for alignment with the channel 35 and the apertures 36 in the terminal member extension 33.

Disposed in, and projecting perpendicularly upwardly from, the base wall of the channels 35 and 39, is a plurality of contact-plugs 41 formed in a similar manner and of like material to that previously described in connection with the contact-plugs 30.

Disposed in the under face of the extension 33 of the terminal member b''', is a plurality of contact-plugs 42 formed in a similar manner and of like material to that described in connection with the contact plugs 7 and 21.

The silver or other such inserts 7, 21, 30, 41, 75

and 42 may take various forms, more especially in the respect that such plugs may be provided on both sides, for instance, of the switch blades 8 in the switch A, or the tongues 15 in the multi-terminal base plate 6', as at 7^a in Figure 8; again, instead of the plug form of insert, a silver rivet having flattened heads, as at 7^b in Figure 9, or silver discs, as at 7^c in Figure 10, may be provided, as may best serve the purpose, all such several forms of silver contact-surfaces permitting the mere reversal of the bar for restoring the efficiency of the contact surface when the same is impaired by wear.

Further, in accordance with the present invention, I may provide variously constructed silver insert members in co-operation with the contact-post 9. Thus, a silver ring 43 may be incorporated in the spherical or ball-like head 13^b of the post 9 in Figure 11, or a plurality of segmental plug members 44 may be welded or otherwise attached to the face of the spherical or ball-like head 13^c in Figure 12. The heads 13^b and 13^c may also be formed separately from the post 9, and post 9 centrally apertured to accommodate attachment means, such as a round-headed screw 45 extending through the particular head and threadedly engaging in the post 9. Furthermore, the post 9 at its upper end may be provided with a frusto-conical upstanding shoulder 9^a for press-fit engagement with a complementarily shaped recess in the ball 13^b, as best seen in Figure 11. Thus, the heads 13^b or 13^c may be readily removed and replaced in efficient electrical contact with the post without the necessity of dismantling the entire switch or connector device.

I may still further provide a clamp type connector for connecting a cable to a bus-bar, which, as shown in Figures 13, 14, and 15, comprises a pair of A-shaped body members 46 shiftably held in parallel clamp-wise juxtaposition by bolts 47 and having a plurality of opposed contact inserts 48 mounted upon the respective inner faces thereof for engagement with the bus-bar *x*. Preferably integrally formed with one of the members 46 is a cable socket 49 having a cylindrical recess 50 and also having a plurality of contact inserts 51 disposed upon its inner face. Extending threadedly through the side wall of the socket into the recess 50 is a set screw 52 for retainingly forcing the cable *y* into engagement with the contact members 51.

It will be understood that changes and modifications in the form, construction, arrangement, and combination of the several parts of the structure may be made and substituted for those herein shown and described without departing from the nature and principle of my invention.

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

1. In an electrical device, an upstanding connector post having a threaded recess extending axially inwardly from an end thereof, an annular contact member mounted on the end of the post, and a headed screw extending through

the contact member and threadedly engaged in the post recess, the outer surface of the screw head and the annular member being arcuately contoured to form a substantially ball-shaped end member upon said post.

2. In an electrical device, an upstanding connector post having a threaded recess extending axially inwardly from an end thereof, an annular contact member mounted on the end of the post, and a headed screw extending through the contact member and threadedly engaged in the post recess, the outer surface of the screw head and the annular member being arcuately contoured to form a substantially ball-shaped end member upon said post, said annular contact member being provided in its outer face with a plurality of outwardly extending contact buttons formed of a low-resistance metal.

3. In an electrical device, an upstanding connector post having an upwardly extending frusto-conical tongue provided with a threaded recess extending axially inwardly from an end thereof, an annular contact member mounted on the frusto-conical member, and a headed screw extending through the contact member and threadedly engaged in the post recess, the outer surface of the screw head and the annular member being arcuately contoured to form a substantially ball-shaped end member upon said post.

4. In an electrical device, an upstanding connector post having a threaded recess extending axially inwardly from an end thereof, an annular contact member mounted on the end of the post, and a headed screw extending through the contact member and threadedly engaged in the post recess, the outer surface of the screw head and the annular member being arcuately contoured to form a substantially ball-shaped end member upon said post, said contact member being provided in its outer face with an annular silver band.

5. In an electrical device, an upstanding connector post having a recess opening to its upper end, an annular contact member disposed on said post, and a headed securing member extending through the contact member and engaged in the post recess, the outer surface of the contact member and of the head of the securing member being arcuately contoured to form a substantially ball-shaped end member upon said post.

6. In an electrical device, an upstanding connector post having a recess opening to its upper end, an annular contact member disposed on said post, and a headed securing member extending through the contact member and engaging in the post recess, the outer surface of the contact member and of the head of the securing member being arcuately contoured to form a substantially ball-shaped end member upon said post, said annular contact member being further provided in its outer face with a plurality of outwardly extending contact buttons formed of a low-resistance metal.

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