May 14, 1935. A. ALSAKER 2,000,909

METHOD OF MAKING SELF CLEANING CONTACTS

Original Filed Oct. 5, 1927 2 Sheets-Sheet 1

Fig. 1.

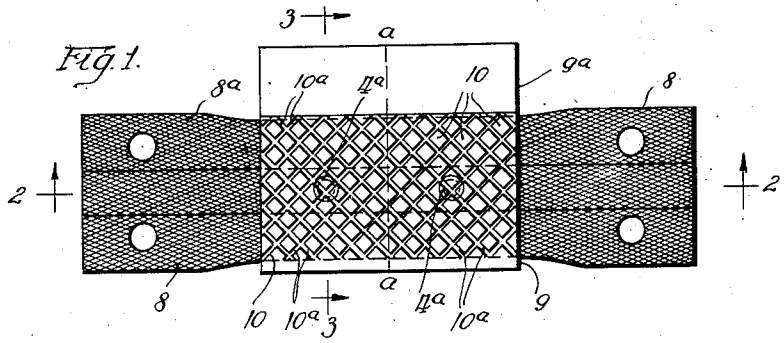


Fig. 2.

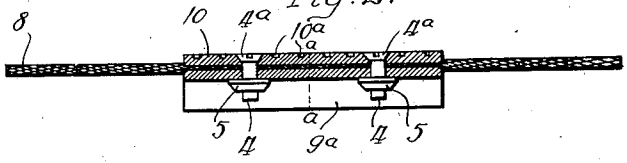


Fig. 3.

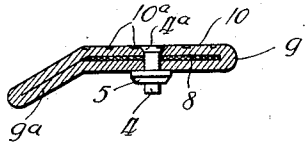


Fig. 4.

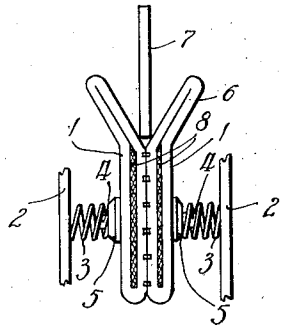


Fig. 5

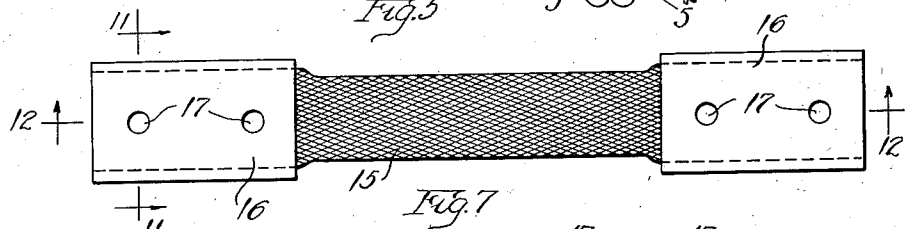


Fig. 7

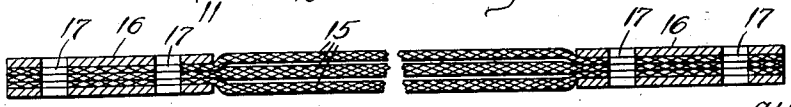
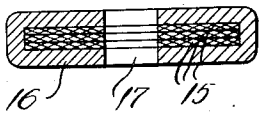


Fig. 6



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May 14, 1935. A. ALSAKER 2,000,909

METHOD OF MAKING SELF CLEANING CONTACTS

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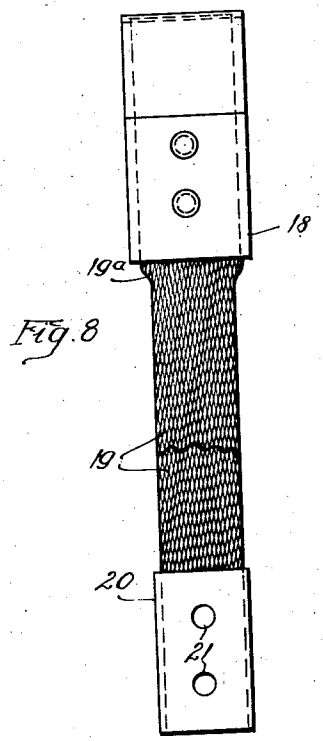


Fig. 8.

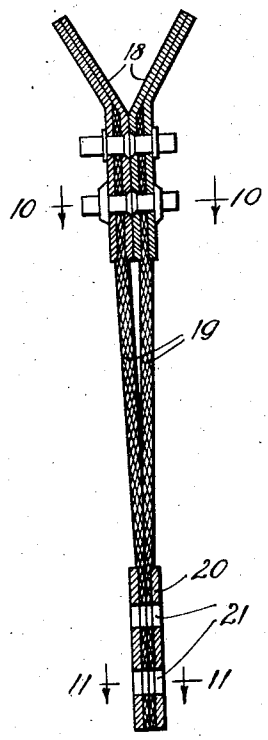


Fig. 9.

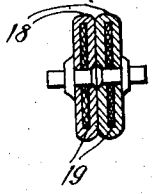


Fig. 10.

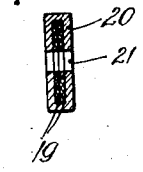


Fig. 11.

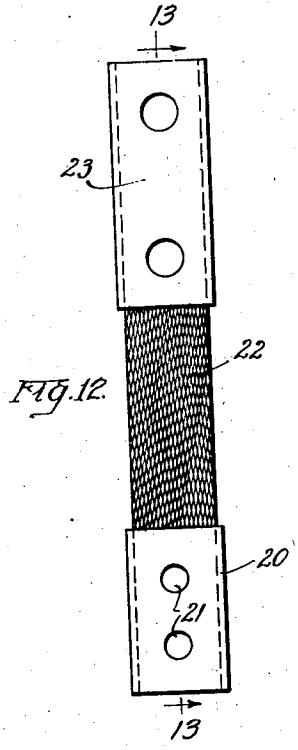


Fig. 12.

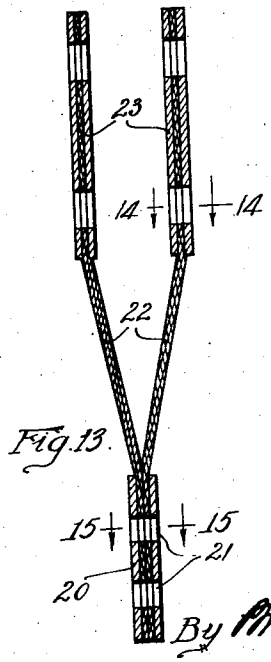


Fig. 13.

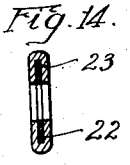


Fig. 14.

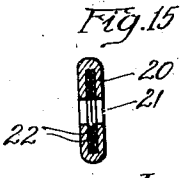


Fig. 15.

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Patented May 14, 1935

2,000,909

UNITED STATES PATENT OFFICE

2,000,909

METHOD OF MAKING SELF-CLEANING CONTACTS

Alfred Alsaker, Chicago, Ill., assignor to The Delta Star Electric Company, Chicago, Ill., a corporation of Illinois

Original application October 5, 1927, Serial No. 224,069. Divided and this application April 15, 1929, Serial No. 355,087

5 Claims. (Cl. 29—155.55)

This invention relates to a method of making contacts and terminal members generally for use in electrical work, and more particularly to self-cleaning contacts for use in electric switches.

My invention is particularly useful in outdoor disconnect or air brake switches, though it may be used for many other purposes. In such switches, when the switch is left in open position for a considerable period of time, as may often occur, the contact members of the switch become dirty and coated with oxides. This is particularly true of the switch blade which is exposed directly to elements. This coating of dirt and oxides on the switch blade is objectionable as it greatly increases the electrical resistance of the contacts and also materially increases the friction of the blade when the switch is again closed, making the switch hard to operate. The only satisfactory way in which a switch which has become coated with dirt and oxides can be rendered entirely satisfactory for use again is by putting the switch out of service and cleaning the contacts thoroughly as with sand paper. This is objectionable as causing delay and increased labor and, under some conditions, this condition seriously interferes with the proper operation of the switch at times when such operation is vital and the switch cannot be gotten out of service for cleaning. I have found that it is possible to avoid these objections to the ordinary type of outdoor high tension switch by providing contact members having means whereby the switch blade, or the contact jaws of the switch, as the case may be, are thoroughly scraped and cleaned by movement of the blade in contact with the cooperating jaws or contact members of the switch. This insures bright and clean contact surfaces at all times, avoiding objectionable resistances between such surfaces, and also insures easy operation of the switch. In addition to providing the contact jaws of the switch with means for scraping and cleaning the blade, I also provide improved means for securing flexible leads to these jaws in such manner as to effectually eliminate all possibility of the leads becoming loosened or detached from the jaw while also insuring intimate mechanical and electrical contact between the jaws and the leads. This method of forming the jaws or contact members and securing them to the leads is also well adapted for use in connection with other terminal members used in electrical work. Further objects and advantages will appear from the detailed description.

In the drawings:

Fig. 1 is an inner face view of a pair of contact jaws and their associated leads constructed in accordance with my invention before cutting the contact jaws apart;

Fig. 2 is a section taken substantially on line 2—2 of Fig. 1;

Fig. 3 is a section taken substantially on line 3—3 of Fig. 1;

Fig. 4 is a front edge view of a pair of contact jaws constructed in accordance with my invention, showing the leads in the jaws, and associated parts;

Fig. 5 is an elevation of a flexible lead and terminal member therefor constructed in accordance with my invention;

Fig. 6 is a section taken substantially on line 11—11 of Fig. 6;

Fig. 7 is a section taken substantially on line 12—12 of Fig. 5;

Fig. 8 is an inner face view of a second modified form of switch jaw and a lead therefor constructed in accordance with my invention;

Fig. 9 is a central longitudinal central section through a pair of jaws similar to that illustrated in Fig. 8, showing more clearly the manner of securing the leads together and to the jaws;

Fig. 10 is a section taken substantially on line 15—15 of Fig. 9;

Fig. 11 is a section taken substantially on line 16—16 of Fig. 9;

Fig. 12 is an elevation of a pair of leads and terminal members therefor illustrating a modified form in which the leads are secured together at one end;

Fig. 13 is a section taken substantially on line 18—18 of Fig. 12.

Fig. 14 is a section taken substantially on line 19—19 of Fig. 13; and

Fig. 15 is a section taken substantially on line 20—20 of Fig. 13.

Referring more particularly to Fig. 4 of the drawings, my invention is specially adapted for use in a switch having two opposed contact blocks or jaws 1 which are mounted in a suitable support or housing 2, these jaws being urged toward each other by extension coil springs 3 the inner end portions of which seat over rivet studs 4 secured in the jaws, the springs being confined between the lateral walls of the housing or support 2 and collars 5 of the studs. Each of these jaws is provided, at its upper end, with an angularly disposed lip or guide element 6, these elements converging downwardly to direct a switch

blade 7 between the jaws. This blade may be moved into and out of operative relation to the jaws by either a swinging movement or a rectilinear movement, or a combined swinging and plunging movement, as desired. A switch of this general construction in which the jaws are yieldingly urged toward each other for reception of a blade which enters between the jaws with a combined swinging and plunging movement is disclosed in the patent issued January 26, 1932 to Alfred Alsaker and Eric Nordhem for Switch, No. 1,842,707.

It is not thought necessary to illustrate or describe in detail the construction of the switch, it being sufficient to note that the contact jaws 1 are yieldingly urged toward each other so as to have their inner or contact faces held in close contact with each other when the switch is open, the jaws being yieldingly pressed into contact with the sides of the switch blade when the switch is closed. As the blade itself may be operated in various ways it is not necessary to describe in detail or illustrate the means for operating the blade, it being understood that the blade is moved between the jaws in any suitable manner entering by way of the diverging lips or guide elements 6. In switches of this general type the accumulation of dirt and oxides on the switch blade, when the switch is left open for a period of time, introduces objectionably high resistances between the contact surfaces and also interferes with the operation of the switch, as previously noted. An important feature of my invention is the provision of means for effectively cleaning the contact surfaces by the operation of the switch, avoiding these objections.

Referring to Fig. 1 of the drawings, I preferably construct the two jaws simultaneously and secure them to their associated leads in a single operation.

In accordance with my method a suitable length of flat copper braid 8, which is formed, in this instance, in three strips, or sections, is inserted through a piece of tubing 9, the length of this tubing being equal to twice the width of each of the jaws 1. The length of tubing is positioned centrally of the length of flat copper braid 8 which is of slightly less width than the height of the inner face, or, more correctly, of the contact face of jaw 1. The tubing is then flattened upon the central portion of the braid under pressure in a punch press. Simultaneously with flattening of the tubing a portion 9a thereof above the copper braid 8 is bent at an angle to the remainder of the tubing to form the lip or guide element 6. The flattened tubing 9 is then bored at points midway between a center line and each end for reception of the stud rivets 4 the inner ends of which are headed at 4a and ground off rough substantially flat with the tubing. The outer portions 8a of the copper braid 8 are then spread slightly and tinned to prevent fraying after which holes are punched for reception of screws or other suitable securing members by means of which the leads formed by this braid are secured to cooperating portions of the switch structure in close mechanical and electrical contact therewith. The tinned ends of the braid are then cut off. After this has been done, the face of the flattened tubing 9 which is to form the contact faces of the jaws 1 is cut by means of gang cutters which travel across the tubing in opposite directions to provide two series of grooves which intersect each other, the grooves of each series extending diagonally of the flattened tubing. These grooves form on the tubing a plurality of polygonal elements 10, each of which is approximately the shape of a square, the inner peripheries of these elements being defined by cutting edges formed by the intersecting grooves. The flattened tube 9 is then cut in half along the line a—a thus providing the jaws 1, the attached portion of the copper braid 8 forming a flexible lead for each jaw. By this method the two jaws can be quickly produced at small cost and the jaws are formed simultaneously with the operation which serves to flatten the tube 9 and compress the same firmly upon the leads so as to permanently secure the leads in the jaws in intimate mechanical and electrical contact therewith.

As the polygonal elements 10 of the jaws are disposed diagonally thereof, the edges of these elements act upon the blade 7, as it moves between the jaws, with a draw-cutting effect so as to scrape the contact faces of the blade and remove all dirt and oxides therefrom producing bright and clean contact faces. This avoids the introduction of objectionable resistances between the contact surfaces of the switch and also greatly facilitates operation of the switch blade. This scraping and cleaning operation of the jaws on the blade is facilitated by the operation of the springs 3 in urging the jaws toward each other. While I preferably employ the support illustrated in Fig. 4, any other suitable means for supporting the jaws and causing them to press against the contact surfaces of the blade 7 may be employed.

The material scraped from the blade falls into the grooves between the elements 10 and, due to vibration, air currents and other causes, work their way downwardly through the grooves and are discharged therefrom. Due to the fact that the inner faces of the jaws 1 are held in close contact with each other, when the switch is open, there is very little tendency for these surfaces to oxidize or accumulate dirt and foreign materials. The wiping action of the blade 7 as it enters between the jaws is sufficient to keep the contact surfaces thereof clean. Even if the grooves in the inner faces of the jaws 1 should become clogged with dirt, which would be exceptional, this would not interfere to any appreciable extent with the operation of the cutting elements 10 since the copper of these elements and the blade 7 would be materially harder than any dirt which might collect in the grooves.

In Figs. 5 to 7 I have illustrated a flexible lead constructed in accordance with my invention in which the terminal members are applied to the ends of the lead in the same manner as jaws 1 are applied. This lead includes a plurality, in this particular instance three of lengths 15 of flat copper braid. These lengths of braid are disposed in superposed relation and the end portions thereof are inserted into suitable lengths of copper tubing which are then flattened in a punch press so as to form the terminal 16 which tightly grips the ends of the braid and forms close electrical connections therewith. The terminal member 16 and the end portions of the braid therein are then drilled to provide openings 17 for reception of suitable securing members.

In Figs. 8 to 11 I have illustrated a second modified form of contact jaw and lead therefor. In this modified form the jaw 18 is formed from a suitable length of copper tubing into one end of which is inserted end portion 19a of a flat braided copper lead 19, the portion 19a being preferably expanded or spread laterally as shown. The tubing is then flattened on the portion 19a

of the lead so as to effectively secure the jaw to the lead. In all other respects, the construction of the jaw is similar to that of jaw 1 illustrated in Figs. 1 to 4, inclusive, with the exception that each of the jaws 18 is formed separately whereas the jaws of Figs. 1 to 4 are both formed simultaneously and then cut apart. The jaws 18 are supported for movement toward and away from each other and to receive between them the switch blade, as will be clear from Fig. 9. The leads 19 are secured together at their ends remote from the jaws by being inserted in a suitable length of copper tubing which is then flattened in a punch press to provide the terminal member 20 which tightly grips the ends of the leads, this terminal member and the leads being then bored to provide suitable openings 21 for reception of securing members. In forming the leads 19 I preferably take a single length or piece of flat copper braid and insert the ends thereof into the lengths of copper tubing which are flattened on the braid to form the jaws 18. This length of braid is then folded transversely at its center and inserted into the tubing from which the terminal member 20 is formed and after this terminal member has been flattened upon the braid the bend thereof, which is left projecting slightly beyond the end of the copper tubing, is ground off flush with the terminal member 20. If desired, two separate pieces of braid may be used for forming the leads 19 though I find that the leads can be produced more quickly and at less cost by using a single length of braid in the manner described.

In Figs. 12 to 15 I have illustrated a pair of leads 22 which are formed in the same manner as the leads 19 and secured together at one end by a terminal member 20. Each lead is provided at its other end with a terminal member 23 formed from a suitable length of copper tubing which is flattened upon the end portion of the lead. The construction of the leads 22 and the manner of securing the terminal members thereon is essentially the same as the method of forming the leads 19 and securing the jaws 18 and terminal member 20 thereon the only difference being that in the form illustrated in Figs. 12 to 15 the jaws 18 of Figs. 8 and 9 are replaced by the terminal members 23.

In applying my invention to electric switches I preferably form the cutting edges on the contact faces of the blocks or jaws since, in the form of switch with which my invention is preferably used, these jaws are held with their inner faces in contact with each other when the switch is open thus preventing, to a great extent, the formation of oxides and the collection of dirt on the contact faces of the jaws. It is preferably feasible, however, to provide the cutting edges on the contact faces of the switch blade instead of on the jaws. This is particularly true in switches where pin contact fingers are used instead of the jaws having flat contact faces of substantial area, such as those illustrated. In such cases, the portions of contact surfaces of the switch blade are provided with intersecting grooves disposed substantially diagonally of the blade and forming substantially square elements, the cutting edges of which are disposed to exert a draw-cutting effect upon the contact faces of the co-operating jaws of the switch.

In compliance with the requirements of the patent statutes I have herein shown and described a few preferred embodiments of my invention. It is, however, to be understood that the invention is not limited to the precise embodiments herein shown, the same being merely illustrative of the invention. What I consider new and desire to secure by Letters Patent is:

1. The method of making a terminal member and securing it to a lead, consisting in inserting a portion of the lead into a suitable length of tubing, then flattening the tubing upon the lead under sufficient pressure to force it into intimate contact with the lead and to cause the tubing to permanently grip and retain said lead, and shaping the terminal member to provide an angularly disposed guide element.

2. The method of making a terminal member and securing it to a lead, consisting in inserting a portion of a braided lead into a suitable length of tubing and then flattening the tubing upon the lead under pressure, and simultaneously shaping it to provide an angularly disposed guide element.

3. The method of making terminal members and securing leads thereto, consisting in inserting a flat braided lead member through a tubular member of a length equal to the combined widths of the terminal members to be produced, flattening the tubular member under pressure upon the central portion of the lead, and then cutting through the flattened tubular member and the lead member transversely of the latter, each of the separated portions of the tubular member forming a terminal member and the attached portion of the lead member forming a lead therefor.

4. The method of making electrical terminal members which comprises, inserting a lead through a short length of tubing so that the ends of the lead extend through the ends of the tubing, compressing the tubing upon the leads and forming a guiding lip along one side of the flattened tube, and then cutting the tube in two at right angles to the guiding lip, whereby two terminals each having a lead extending therefrom are produced.

5. The method of making a terminal member and securing it to a lead which comprises, inserting a lead into a substantially tubular member, compressing the tubular member upon the lead to a point beyond the elastic limit of the member, whereby the lead is securely held in the terminal member, shaping the terminal member to provide a guiding lip, and thereafter forming a hole through the terminal member and the lead for making electrical connections thereto.

ALFRED ALSAKER.