May 10, 1960 J. BERNUTZ 2,936,340

MULTI-CONTACT ARRANGEMENT FOR MULTI-SWITCHES

Filed April 3, 1956 2 Sheets-Sheet 1

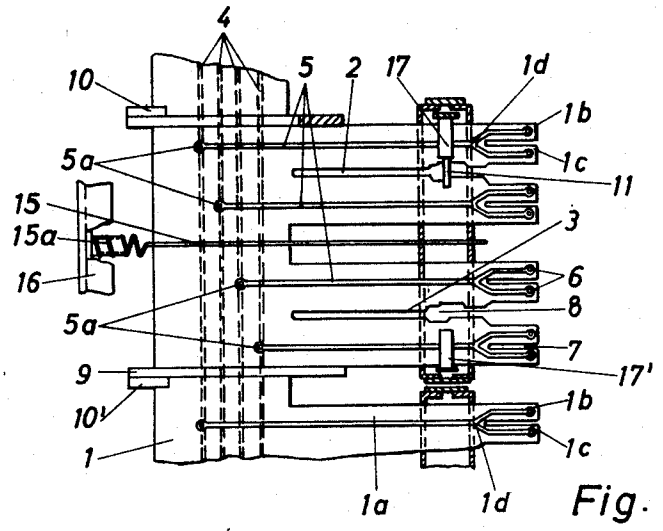

Fig. 1

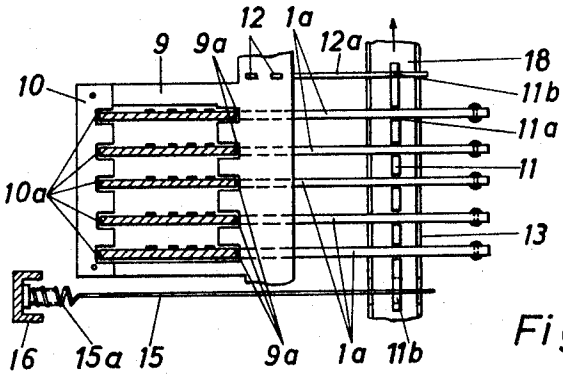

Fig. 2

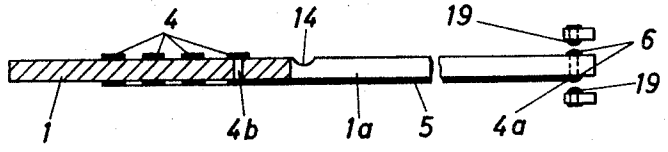

Fig. 3

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MULTI-CONTACT ARRANGEMENT FOR MULTI-SWITCHES

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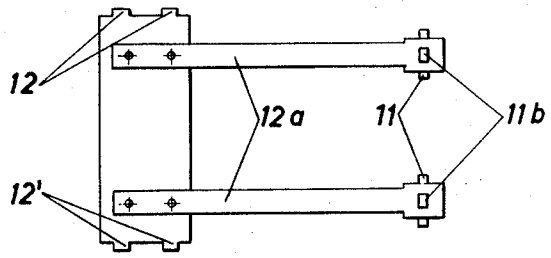

Fig. 4

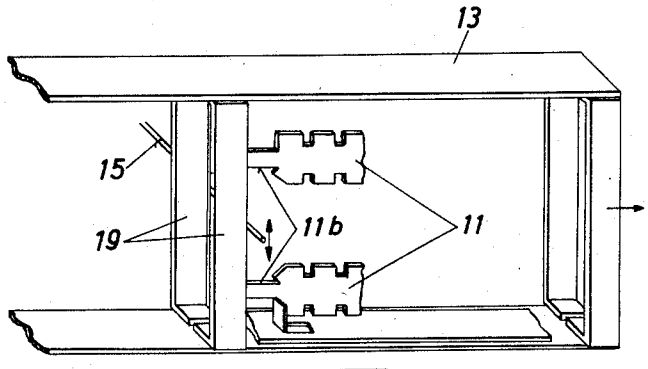

Fig. 5

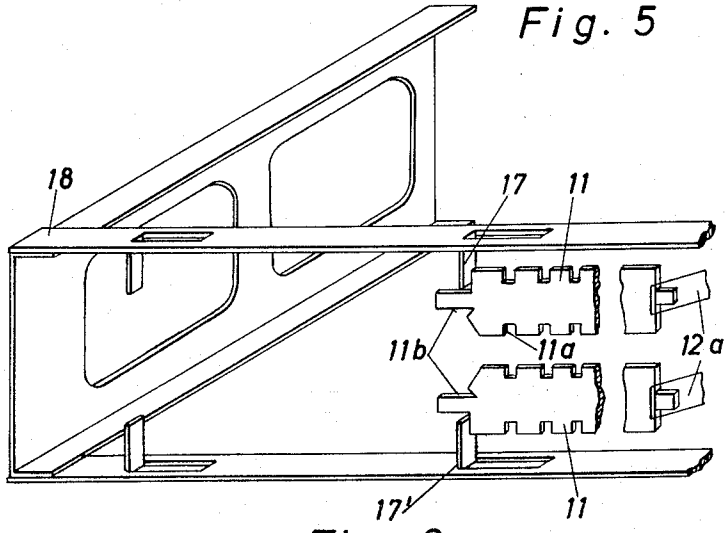

Fig. 6

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United States Patent Office 2,936,340 Patented May 10, 1960

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MULTI-CONTACT ARRANGEMENT FOR MULTI-SWITCHES

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Application April 3, 1956, Serial No. 575,823

Claims priority, application Germany April 6, 1955

9 Claims. (Cl. 179—27.54)

This invention relates to improvements in electric switches and more particularly to a multi-switch of the cross-bar type.

Cross-bar switches comprise a number of vertically disposed contacts which are adapted to be selectively moved into contact in a horizontal direction with fixed contacts by means of select and hold bars. Each movable contact with its cooperating fixed contacts are in reality individual switch units and are connected by a multiple connection to corresponding contacts by an external multiple connection. These corresponding contacts are connected to a single conductor and there thus arises the problem of connecting individual contacts with the multiple connection. In the prior art such connections with the multiple were made by soldering or welding. The use of solder in the past has led to faults due to the inevitable dropping of pieces of solder by the installer and which drops of solder acted to short-circuit other multiple connections. In order to avoid the difficulties encountered in the prior art as aforestated, the invention was made and it utilizes non-soldered connections in a crossbar switch pile-up.

It is accordingly an object of the invention to provide a contact structure for a cross-bar switch which has a contact carrying portion connected to a multiple carrying portion made of insulating material and provided with connecting conductors which are not required to be soldered or otherwise welded.

It is a further object of the invention to provide a multiple carrying portion having a plurality of contact carrying portions extending therefrom and made integrally therewith, of insulating material and having a metallic conductor connecting the contact portion with the multiple conductor carrying portion, the contact carrying portion having sufficient resilience to be urged into contact with a cooperating fixed contact.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood, by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a view partly in section of a single multiple carrying element with its lateral extending contact carrying portions;

Fig. 2 is a top view partly in section of a plurality of multiple carrying elements showing the method used for maintaining separation thereof;

Fig. 3 is an enlarged view partly in section of a single multiple carrying element and one of its contact portions showing the connection of the contacts with the multiple;

Fig. 4 is an enlarged view of the holding springs to support the combs carrying the contact extension arms.

Fig. 5 is an enlarged view of a part of the actuating bar in connection with the combs and the selecting finger.

Fig. 6 is an enlarged view of part of the bridge frame, in which the actuating bar slides.

Referring now to Fig. 1 there is shown a side elevation of a single multiple carrying element **1** having extending laterally therefrom a plurality of spaced contact carrying extension arms **1***a*. The element **1** and its arms **1***a* are made of insulating material and the arms **1***a* are adapted to be resilient in a plane normal to the longitudinal axis of the element **1**. The several portions **1***a* are separated by spaces **2** and **3** respectively to give independence to each contact carrying portion. Each element **1** carries on one surface thereof a plurality of spaced electrical conductors **4** applied thereto by any suitable means including printing, metallization or by any suitable adhesive. Branching from respective of said conductors **4**, there are shown conductors **5** which are applied to the contact carrying portions **1***a* by the same means utilized for the application of the conductors **4**. The conductors **5** are joined to conductors **4** at points **5***a* by any suitable means including printing, riveting, etc.

The free ends of the several contact carrying portions **1***a* are split to provide a pair of utilization portions **1***b* and **1***c* by reason of the bifurcation **1***d*. Each portion **1***b* and **1***c* carries a contact **6**, each contact being connected to the conductor **5** by the forked arrangement clearly shown in Fig. 1. The contacts **6** may extend on one side of the contact carrying portions **1***a* or on both sides thereof depending upon the switching function required.

The elasticity of the portions **1***a* should be such that the portions **1***a* are able to be deflected without causing undue fatigue or stress to the material of which they are made.

Fig. 2 is a top view of a group of multiple carrying elements supported in spaced condition by means of a supporting frame **9** having a plurality of spaced recesses **9***a* each recess adapted to grip an element **1** therein. The supports **9** are provided with a plurality of spaced parallel connecting arms extending normal to the main body of the support, each of the arms being attached to a cooperating rear holding support **10** which support is provided with a plurality of spaced slots **10***a* which are in register with the slots **9***a* of the support **9**. The slots **9***a* and **10***a* serve to grip the main portions of the multiple carrying elements **1** in a spaced relation to each other as clearly shown in Fig. 2. The spacing between the several elements **1** enables the conductors **4** to be carried by the elements **1** insulated from adjacent elements. The support **9** is further provided with a pair of apertures **12** in the main portion thereof and which apertures are adapted to receive a pair of lugs of a spring holding member **12***a* whose function will be later explained. The contact carrying portions **1***a* are carried by a comb **11** (Figs. 2, 5 and 6) which has a plurality of spaced cooperating slots **11***a* cut in one edge thereof which are in register with the slots **9***a* and **10***a*. The comb **11** is supported at either extremity by the springs **12***a* which fit into the cooperating apertures **11***b* (Figs. 2 and 4). On the opposite edge of the comb **11** there is provided a stop **17** (Figs. 1 and 6) and a part **11***b* (Figs. 2, 4 and 6) with which a selecting finger **15** is adapted to cooperate. The selecting finger **15** is mounted by means of the usual damping spring **15***a* to a selecting bar **16** (Fig. 1 and 2). When the selecting bar is operated in the one position, the end of the selecting finger **15** enters the part of the upper comb **11***b* (Fig. 5) but when the selecting bar **16** is operated in opposite direction, the end of the selecting finger **15** enters the lower comb. Cooperating with the selecting finger **15** I provide an actuating bar **13** (Figs. 2 and 5) which bar is provided with driving parts **19** (Fig. 5) and through which the end of selecting finger **15** is adapted to extend. The method of selection and actua-

tion of the selecting bar and the actuating bar is well known to those skilled in the telephone art.

Fig. 3 shows in greater detail the structure of a portion of a carrying element **1** and one of its extension contact carrying portions **1***a*. A pair of contacts **6** are interconnected on opposite sides of the portion **1***a* and are electrically connected to one of the multiples **4** by means of the conductor **5** which extends along the length of the extension **1***a* to the point where a suitable connection to the conductor **5** is made by means of the aperture **4***b* through which a rivet or other electrical conducting means of fastening may be utilized to electrically connect the multiple **4** with the conductor **5**. In Fig. 3 there is schematically shown a pair of fixed contacts **19** which cooperate with the contacts **6** in a manner well known by those skilled in the art.

The extension **1***a* is provided with a hollowed portion **14** as shown in Fig. 3 to reduce the cross-section of the material at that point. This narrow cross-section at point **14** renders the extension **1***a* resilient. If desired another hollowed portion **14** might be applied to the opposite side of element **1***a*, the only criterion being that the material has sufficient cross-section to withstand the stress of continued flexing in either direction during the operation of the contact carrying arm as explained above.

The multiple wires **4** and the conductors **5** may be printed on the elements **1** and **1***a*. The advantage of carrying the conductors **5** on the side of the elements **1** opposite from the multiple conductors **4** lies in the fact that the conductors **5** may be extended to any of the four multiples without having to cross intervening multiples, thus eliminating the necessity for insulating the conductors **5** to electrically isolate same from the intervening conductors.

Fig. 4 shows the holding springs supporting the combs at the points **11***b*. The actuating bar **13** (Fig. 5), when being operated slides on the bridge frame **18** (Fig. 6).

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention as set forth in the objects thereof and in the accompanying claims.

What is claimed is:

1. A contact structure for a cross-bar switch comprising a plurality of individual switch units, each of said units comprising a multiple conductor-carrying element having a plurality of laterally extending contact carrying portions, each portion spaced from the other and having a resilience in a direction normal to the longitudinal axis of said element, first electrical conductive means carried by each of said elements and second electrical conductive means carried by each of said portions, means for connecting said first means with said second means, means for supporting said individual units in a unitary structure, and means for selectively actuating said contact carrying portions.

2. A contact structure for a crossbar switch comprising a plurality of individual switch units, each of said units being of insulating material and carrying thereon multiple conductors in a direction parallel to the longitudinal axis of said units, said units further comprising a plurality of laterally extending contact-carrying portions, each portion spaced from the other and having a resilience in a direction normal to said longitudinal axis, electrical conductive means carried by each of said portions, means for connecting said conductive means with said multiple conductors, means for supporting said individual units in a unitary structure, and means for selectively actuating said contact carrying portions.

3. A contact structure as claimed in claim 2 wherein said contact carrying portions include electrical contacts situated adjacent the free ends of said portions.

4. A contact structure as claimed in claim 3 wherein said multiple conductors comprise a plurality of spaced, parallel electrical conductors extending along one side of said element in parallel relation with its longitudinal axis.

5. A contact structure as claimed in claim 4, wherein said electrical conductive means comprises an electrical conductor extending along the length of a contact-carrying portion on a side thereof opposite the side of said element carrying said multiple conductors, said first mentioned conductor electrically connected with the contact carried by said portion.

6. A contact structure as claimed in claim 5 wherein said means for connecting said multiple conductors with said conductive means comprises an electrically conductive rivet extending through said element at a point coordinate with individual of said multiple conductors and said conductive means, respectively.

7. A contact structure as claimed in claim 6 wherein said multiple conductors and said conductive means are printed on each of said elements and portions.

8. A contact structure as claimed in claim 1, wherein said means for supporting said units comprises a rake-shaped support extending transversely across said elements, said support having a plurality of spaced slots in a side thereof intermediate adjacent teeth of the rake, each slot having a width substantially equal to the thickness of an element, the teeth of the rake extending in a direction opposite said contact-carrying portions and an auxiliary support member extending transversely across said elements, said auxiliary member having a plurality of spaced slots in one side thereof, said support member fastened to the outer portion of the teeth of said rake to form a closed rectangle, with its slots in register with corresponding slots in said rake-shaped support, each of said elements adapted to fit within corresponding slots of said support and said auxiliary support.

9. A contact structure as claimed in claim 1, wherein said means for selectively actuating said contact-carrying portions comprises a card of insulating material extending transversely across said portions, said card having a plurality of spaced slots in a side thereof each of said portions adapted to fit within a different one of said slots, and resilient means for supporting said card from said support means, said card adapted to be actuated in a direction transverse of said portions.

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