June 13, 1961 M. A. TABET 2,988,607

SWITCH WITH REMOVABLE UNITS

Filed May 20, 1958 2 Sheets-Sheet 1

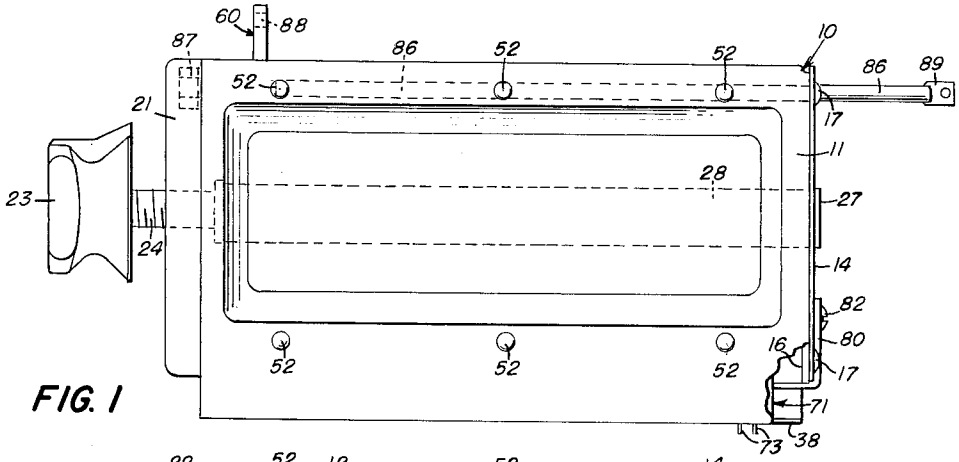


FIG. 1

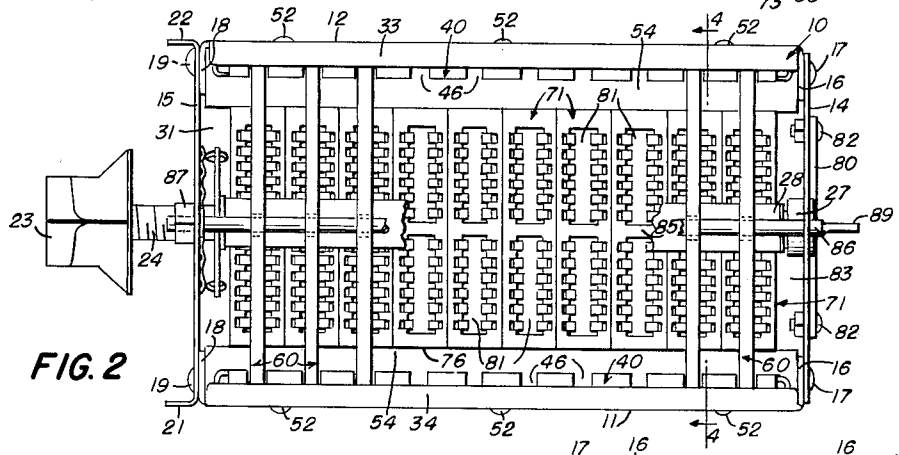


FIG. 2

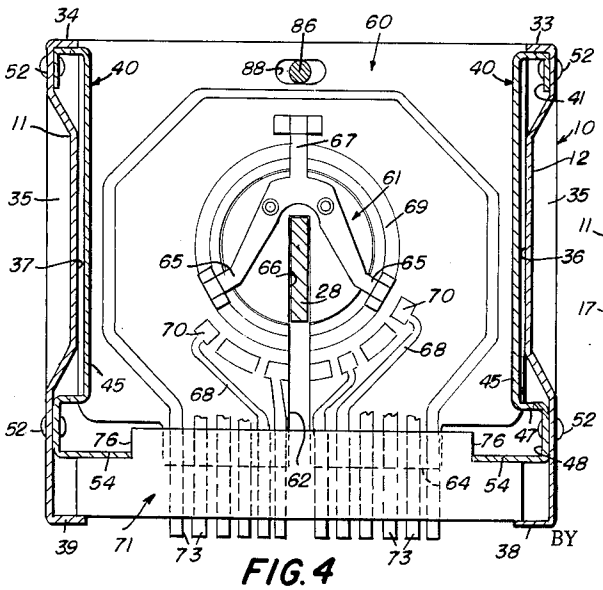


FIG. 4

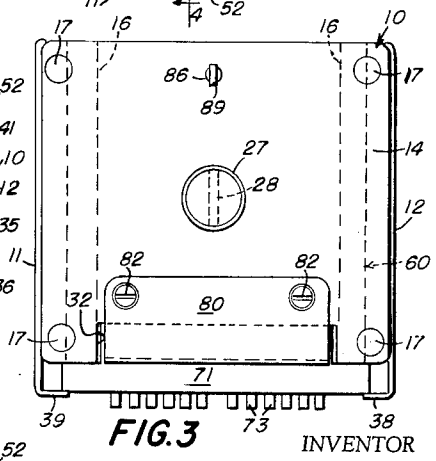


FIG. 3

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SWITCH WITH REMOVABLE UNITS

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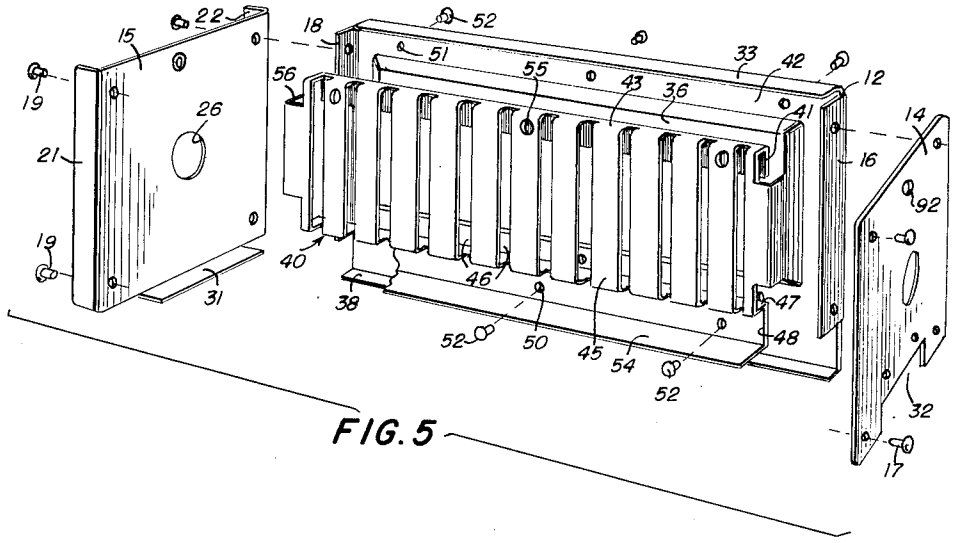


FIG. 5

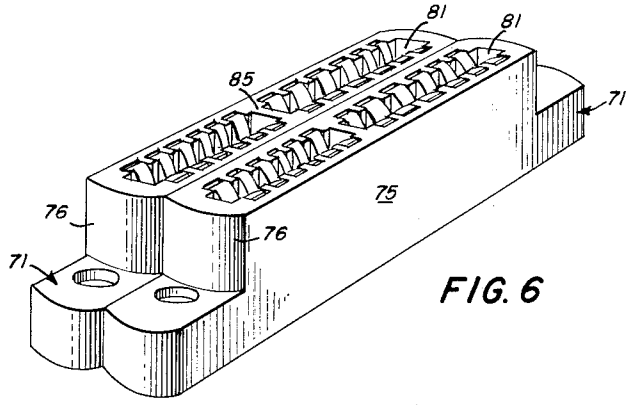


FIG. 6

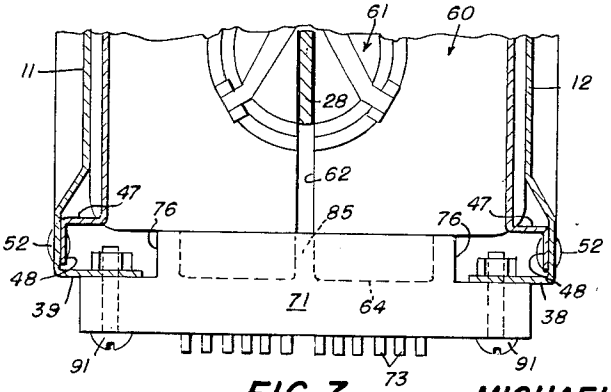


FIG. 7

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SWITCH WITH REMOVABLE UNITS

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Filed May 20, 1958, Ser. No. 736,498
8 Claims. (Cl. 200—11)

The present invention relates to a circuit making and breaking device and more specifically pertains to an assembly which includes a frame and a plurality of wafer units each carrying switch elements thereon with the wafers and frame so constructed that any one of the wafer units may be readily mounted on the frame and removed therefrom for replacement purposes. The invention is directed to improvements in a switch of the type disclosed and claimed in my copending application Serial No. 577,533, filed April 11, 1956, now Patent 2,841,660 and owned by the same assignee as the present application.

An object of the invention is to provide a frame for the switch assembly having guideways therein for receiving a plurality of wafers or plates formed of insulating material for guiding such wafers so that conductors carried thereon may be moved into operative circuit relationship with terminal contacts carried by the frame and with the frame so constructed that any one of the wafers each carrying a switch mechanism thereon may be readily mounted on the frame and removed therefrom and from circuit relationship with its terminal member.

A still further object of the invention is to provide improvements in the mounting of the terminal members on the frame so that these members may be readily mounted on the frame during assembly of the switch structure and which may be readily dismantled to facilitate replacement of any one of the terminal members.

Another object of the invention is to provide improvements in the frame for such a switch assembly formed of sheet material shaped to provided a rigid frame having guideways for the wafer units and to provide means for supporting the terminal members in positions for receiving end portions of the wafer units.

Other objects and features of the invention will be appreciated and become apparent particularly to those skilled in the art to which the invention pertains as the present disclosure proceeds and upon consideration of the accompanying drawings and the following detailed description wherein several embodiments of the invention which has been successful in use are disclosed.

In the drawings:

FIG. 1 is a side elevational view of a switch assembly exhibiting the invention.

FIG. 2 is a plan view of the structure shown in FIG. 1 with some of the wafer units removed.

FIG. 3 is an end view of a switch assembly.

FIG. 4 is a transverse sectional view on a larger scale taken on the line 4—4 of FIG. 2.

FIG. 5 is an exploded perspective view of a portion of frame illustrating structure providing guideways at one side of the frame for the wafers.

FIG. 6 is a perspective view of two terminal members in side-by-side relationship and in positions which they assume when mounted on the frame.

FIG. 7 is a fragmentary sectional view similar to FIG. 4 showing a modified arrangement for mounting the terminal members.

This invention is directed to a switch assembly of the type wherein a plurality of wafers are arranged in spaced face-to-face relation and so mounted on a frame that each may be removed and with each wafer carrying circuit making and breaking means thereon. The present invention pertains to improvements in the structural features of the frame for such a switch assembly and in the structure thereof providing guideways for the wafers and to improvements in mounting of the terminal members which are of the type disclosed and claimed in my copending application Serial No. 678,359, filed August 15, 1957, so that the terminal members may be readily removed from the frame and at the same time supported in operative association with the wafers.

Referring to the drawings there is shown at **10** a frame which may be of an elongated character and formed of sheet material such as sheet metal of any suitable type. The frame includes two side members **11** and **12**. These side members are maintained in spaced relationship by means of end walls or plates **14** and **15**. The end plate **14** is secured to flanges **16** carried by the side members **11** and **12** by means of rivets **17** or the like. The end plate **15** is similarly secured to inturned flanges **18** carried by the side members **11** and **12** by suitable means such as a plurality of rivets **19**. The end plate **15** is provided with outwardly extending flanges **21** and **22** as shown in FIGS. 2 and 5 and these flanges are for the purpose of abutting an inner or rear face of a switch box or switchboard so that an actuating knob **23** for the switch assembly carried by a shaft **24** will be accessible for actuation at the front face of a switchboard or outside a switch box. The flanges **21** and **22** serve the further purpose of reinforcing the switch frame in the vicinity of the end plate **15**. The shaft **24** is journalled for rotation on the frame and by means of a bearing mounted in an opening **26** (FIG. 5) in the end plate **15** and a bearing **27** is mounted in an opening in the end plate **14** as shown in FIG. 3. The portion of the shaft **24** between the end plates **14** and **15** is of elongated rectangular shape in cross section as indicated at **28** in FIGS. 2 and 4.

The end plate **15** carries an inturned flange **31** at a lower portion thereof as best shown in FIG. 5 and the free edge of the flange **31** forms an abutment for a side face of one of the terminal members **71** as hereinafter described. The lower portion of the end plate **14** is provided with a recess **32** therein as shown in FIGS. 3 and 5. This recess is for the purpose of permitting an intermediate portion **75** of each terminal member **71** to move therethrough during the mounting of the terminal members **71** on the frame and during the dismounting of the terminal members. The utility of the recess **32** and the abutment flange **31** will be more evident as the disclosure proceeds.

The side member **12** is provided with an inturned lip **33** along the upper edge thereof which serves to reinforce this side member and a similar inturned lip **34** is provided along the upper longitudinal edge of the side member **11** which serves to reinforce the sheet material of which this member is formed. Each side member has the central area thereof deformed inwardly as best shown in FIG. 4 to provide recesses **35** in the outer faces of the respective side members. The deformed areas of the side member provide an inner face **36** on the side member **12** and an inner face **37** on the side member **11** each displaced inwardly from the plane of other portions of the associated side member. The recesses **35** in each side member extends over major portions of the respective side members. The inward deformed sheet material strengthens the side members and also provides structure wherein the inner faces **36** and **37** serve as abutments for edges of the removable wafer units **60** as hereinafter described. An inturned flange **38** (FIGS. 4 and 5) is carried by the side member **12** and this inturned flange provides a ledge along the length of the side member **12**. A similar inturned flange **39** is formed integral with the side member **11** and extends along the

length thereof. The inturned lips 33 and 34 and the inturned flanges 38 and 39 together with the inwardly deformed sheet material throughout the central areas of the side member serve to strengthen the frame.

A structure 40 as best shown in FIG. 5 and formed of sheet material is mounted inwardly of each side member 11 and 12 providing means for guiding the wafer type switch units into proper position with terminal members for the switch and to maintain the wafer units in position on the frame and in operative association with the respective terminal members and to guide the wafer units during the withdrawal of any one wafer from the frame and from detachment with its terminal member. The sheet material structure 40 at each side of the frame are of identical construction and the shape and form will be more readily appreciated by reference to FIG. 5. This structural element is shaped to include a flange 41 which is adapted to lie as a strip along the inner face of the side member 12 in a flat elongated area between the inturned lip 33 and the inwardly deformed area formed in the central portion of the side member. The sheet material forming the structural element 40 has a strip 43 which is substantially at right angles to the plane of the flange 41. The central portion 45 of the structural element 40 lies in a plane at right angles to the strip 43 but is spaced from the plane of the flange 41. This central portion is provided with a plurality of equally spaced parallel slots 46 and in the embodiment illustrated in FIG. 2 ten of such slots are provided. While the spacing of the slots 46 from each other is determined by the width of the terminal members 71 it will be appreciated that the length of the frame structure may be increased to provide more slots 46 such as twelve shown in FIG. 5 and the spacing of the slots 46 may be varied in accordance with the transverse dimensions of the terminal members.

The sheet material forming the structural element 40 is provided with a strip 47 which is arranged at right angles to the plane of the central portion 45 which comprises principally spaced bars defining the slots 46. It will be observed from a consideration of FIG. 5 that the slots 46 include removal of some of the sheet material of the strips 43 and 47. A flange 48 is provided at right angles to the plane of the strip 47 and the elongated flange 48 lies in the plane of the flange 41. The flange 48 engages the inner face of the side member 12 as shown in FIG. 4. The flange 41 and the flange 48 are each provided with openings 50 and side member 12 is provided with openings 51 for receiving rivets 52 for attachment of the structural element 40 to the side member 12. Large apertures 55 are provided in bars making up the central portion 45 for facilitating the riveting of the element 40 to the side member. The flanges 41 and 48 both lie in flat engagement with the undeformed portions of the side member 12. The central portion 45 of the structural element 40 is spaced inwardly from the inner face 36 of the side member 12 as shown in FIG. 4.

An inwardly directed flange 54 is formed integral with the structural member 40 and its free edge provides an abutment for shoulders 76 of the terminal members 71 as hereinafter described. A similar structural element 40 is provided along the inner face of the side member 11 and is secured thereto by means of rivets 52 or the like. Each structural element 40 is provided with a lip 56 at each end thereof and of such dimensions that the free edges of the lips 56 lie in abutting relationship with the inner face of the undeformed portions of the associated side member.

The switch assembly includes a plurality of wafer units 60 which are each generally in the form of a plate. Each wafer is formed of insulating material and is provided with a circular disc 61 (FIG. 4) at the center thereof which may be rotated in the plane of the wafer 60. Each wafer 60 is provided with a slot 62 which extends from a free edge 64 thereof to the periphery of the rotatable disc 61. The disc 61 is provided with a slot 66 for receiving the flat sided portion 28 of the shaft 24. Each disc 61 carries a contact arm 67 for engaging circumferentially spaced contacts 70 a few of which are shown in FIG. 4 and contact arms 65 which are in engagement with a conductor ring 69 carried by one or both faces of the wafer 60. The contacts and the like carried by each wafer 60 may be of the printed circuit type with conductors 68 extending to the edge 64 of the wafer. The conductors along the free edge are spaced from each other and are adapted to engage contacts carried by the terminal members 71.

The structural elements 40 carried by the side members of the frame are so designed that the slots 46 are aligned with each other transversely of the frame and are adapted to receive side edge portions of each wafer 60 and to guide these wafers during introduction of each wafer unit into the frame and to maintain the wafers in spaced face-to-face relationship as shown in FIG. 2. One of the wafers is shown in a partly removed position in FIG. 1.

The frame in the embodiment illustrated is designed to receive a plurality of terminal members 71 of the type disclosed and claimed in my copending application Serial No. 678,359 and the overall shape of the terminal members is best illustrated in FIG. 6. The terminal members are of identical construction. Each is provided with aligned slots 81 for receiving the end portion 64 of one wafer unit 60. Contacts on the terminal member within the slots 81 are in conductive relationship with terminals 73 and make circuit connections with the conductors 68 on each wafer. A rib 85 as shown in FIGS. 2 and 6 join the sides of each terminal member 71 and this rib is accommodated in the slot 62 of the wafer 60. Each terminal member 71 has an overall length so that this dimension is greater than the space of the free edges of the flange 38 and 39 as shown in FIG. 4. Shoulders 76 define ends of the intermediate portion 75 of each terminal member 71 and these shoulders are so spaced from each other as to be accommodated between the free edges of the inturned flanges 54 carried by the structural elements 40. The transverse dimension of each terminal member 71 is such that when side faces thereof lie in engagement with each other the slots 81 provided in each terminal member are in the plane of the transversely aligned slots 46 of the structures at the sides of the frame. The terminal member 71 adjacent the end plate 15 has its exposed side face in engagement with the free edge of the abutment flange 31 as shown in FIG. 2 which is so dimensioned as to hold this terminal member in proper relationship with the first set of guide slots in the vicinity of the end plate 15.

The terminal members 71 are mounted by inserting the extreme end portions thereof between the flanges 54 and the flanges 38 and 39. The intermediate portion 75 of each terminal member between the shoulder 76 clears the end plate 14 and passes through the recess 32. The terminal members are mounted in position one after another and prior to the mounting of the wafer units in the frame. The aligned slots 81 in each terminal member are then aligned with a pair of slots 46. A detachable bracket 80 which is L-shaped in cross section as shown in FIG. 1 is then attached to the end plate 14 by means of screws or the like 82. The bracket 80 has an inturned abutment flange 83 (FIG. 2) which engages the exposed side face of the terminal member 71 adjacent the end plate 14. In this manner all of the terminal members are retained in operative association with the frame and in proper position for receiving the removable wafer units 60.

Thereafter the wafer units may be mounted on the frame by inserting opposite edges of one plate in one pair of slots 460. The disc 61 of each wafer unit with its slot 66 in alignment with the slot 62 is then in position to receive the flat sided portion 28 of the shaft 24. The

slots 46 guide each wafer unit in the plane thereof into the frame. The ends of the conductors 68 adjacent the edge 64 of the wafer are thus moved into the slots 81 of the associated terminal member 71 and into engagement with the contacts carried by the terminal member. All of the wafer units 60 are detachably held in a position shown in FIG. 4 by means of a rod 86 which extends through an opening 92 (FIG. 5) in the end member 14 and is threaded in a nut 87 or the like carried by the end plate 15. The rod 86 passes through an aperture 83 formed in each wafer element. The flat portions 89 on the free end of the rods facilitate threading of the rod into the nut 87. This rod and the flattened portions may be employed as a lever to assist in removal of the wafer units. The wafers may be readily removed from the frame and from electric circuit relationship with its terminal member after the retaining member in the form of the rod 86 is removed.

A modification of the mounting of the terminal members 71 on the frame is shown in FIG. 7. In this embodiment the flange 54 carried by each structural element 40 is omitted so that the flanges 48 have free lower edges as shown in FIG. 7. The side members 11 and 12 carry inturned flanges 38 and 39 as in the previous embodiment but these flanges are of greater length and lie in a plane substantially in alignment with the edge 64 of the wafer unit 60. The terminal members 71 as shown in FIG. 6 are each provided with an opening adjacent each end thereof. A bolt 91 extends through each of these openings and through threaded nuts carried by the flanges 38 and 39. The openings in the flanges 38 and 39 are transversely aligned so that each terminal member is in a position to receive the free edge portion 64 of a wafer unit 60.

While the invention has been described with reference to specific structural features and with regard to a number of details it will be appreciated that changes may be made in the overall organization and in the materials and the structural characteristics. Such modifications and others may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What I claim and desire to secure by Letters Patent is:

1. A switch assembly comprising, an elongated frame including side members formed of sheet material joined by end plates maintaining said side members in spaced relationship, a central area of sach side member deformed inwardly providing an inner face on each side member spaced inwardly of other portions of the associated side member, an elongated structure formed of sheet material secured to each side member, each of said structures having a central portion formed of cars defining slots therebetween aligned transversely of the frame, said bars being spaced inwardly of the inner face of the associated side member, inturned flanges carried by edge portions of the side members extending therealong and having confronting edges spaced transversely of the frame, elongated terminal members arranged transversely of the frame with opposite end portions abutting a face of said flanges, each terminal member having a slot therein aligned with a pair of slots defined by said bars, contacts on each terminal member along the slot therein and terminals extending from the contacts accessible at the exterior of the frame, means maintaining the terminal members in abutting relationship with said flanges, wafers each having conductors thereon extending to an end edge thereof, switch means on each wafer including a rotatable disc, each wafer having a slot therein extending from said end edge to the periphery of said disc, each disc having a slot therein adapted to be aligned with the slot in the associated wafer, each wafer having opposite side edge portions within a pair of the first mentioned slots with the side edges in abutting relationship with the inner faces of said side members, the end edge portion of each wafer extending into the slot in the associated terminal member with the conductors thereof engaging the contacts thereon, and a shaft journalled for rotation on said end plates extending through the slots in said discs for actuating the switch means.

2. A switch assembly comprising, a frame including opposite side members joined by end plates maintaining said side members in spaced relationship, means carried by the side members providing slots at inner faces of the side members aligned transversely of the frame, inturned flanges carried by edge portions of the side members extending therealong and having confronting edges spaced transversely of the frame, elongated terminal members arranged transversely of the frame with opposite end portions abutting a face of said flanges, each terminal member having a slot therein aligned with a pair of said slots, contacts on each terminal member along the slot therein and terminals extending from the contacts accessible at the exterior of the frame, means maintaining the terminal members in abutting relationship with said flanges, wafers each having conductors thereon extending to an end edge thereof, switch means on each wafer including a rotatable disc, each wafer having a slot therein extending from said end edge to the periphery of said disc, each disc having a slot therein adapted to be aligned with the slot in the associated wafer, each wafer having opposite side edge portions within a pair of the first mentioned slots with side edges in abutting relationship with said side members, the end edge portion of each wafer extending into the slot in the associated terminal member with the conductors thereof engaging the contacts thereon, and a shaft journalled for rotation on said end plates extending through the slots in said discs for actuating the switch means.

3. A switch assembly comprising, an elongated frame including opposite side members and means maintaining said side members in spaced relationship, means carried by each side member providing slots adjacent the inner face of each side member with the slots aligned transversely of the frame, elongated terminal members arranged transversely of the frame, means carried by edge portions of the side members supporting said terminal members, each terminal member having a slot therein aligned with a pair of said slots, contacts on each terminal member along the slot therein and terminals extending from the contacts accessible at the exterior of the frame, wafers each having conductors thereon extending to an end edge thereof, switch means on each wafer including a rotatable disc, each wafer having a slot therein extending from said end edge to the periphery of said disc, each disc having a slot therein adapted to be aligned with the slot in the associated wafer, each wafer having opposite side edge portions within a pair of the first mentioned slots, the end edge portion of each wafer extending into the slot in the associated terminal member with the conductors thereof engaging the contacts thereon, a shaft journalled for rotation on said frame extending through the slots in said discs for actuating the switch means, and means detachably mounted on said frame in abutting relationship with all of said wafers preventing dislodgment of the end edge portions from the slots in the respective terminal members.

4. A switch assembly comprising, an elongated frame including opposite side members joined by end plates maintaining said side members in spaced relationship, means carried by each side member providing slots adjacent the inner face of each side member with the slots aligned transversely of said frame, elongated terminal members arranged transversely of the frame, means supporting said terminal members on said frame, each terminal member having a slot therein aligned with a pair of said slots, contacts on each terminal member along the slot therein and terminals extending from the contacts accessible at the exterior of the frame, wafers each having conductors thereon extending to an end edge

thereof, switch means on each wafer including a rotatable disc, each wafer having a slot therein extending from said end edge to the periphery of said disc, each disc having a slot therein adapted to be aligned with the slot in the associated wafer, each wafer having opposite side edge portions within a pair of the first mentioned slots, the end edge portion of each wafer extending into the slot in the associated terminal member with the conductors thereof engaging the contacts thereon, a shaft journalled for rotation on said end plates extending through the slots in said discs for actuating the switch means, each wafer having an aperture therethrough, and a rod extending through said apertures and through the end plates.

5. In a switch assembly, a frame including elongated side members joined by end plates maintaining the side members in spaced relationship, a structural element carried by each side member disposed over the inner face thereof, said structural elements each having slots therein aligned transversely of the frame, an inturned flange carried by an edge portion of each side member extending therealong and having confronting edges spaced transversely of the frame, an inwardly directed flange carried by each structural element extending therealong and having confronting edges spaced transversely of the frame with the faces of the second flanges respectively spaced from faces of the first flanges, elongated terminal members in side by side relationship arranged transversely of the frame with opposite end portions extending between said flanges, shoulders on each terminal member in abutting relationship with the confronting edges of the second flanges each terminal member having a slot therein aligned with a pair of the first mentioned slots, abutment means carried by one of said end plates engaging the exposed side face of the terminal member adjacent the associated end plate, abutment means detachably mounted on the other of said end plates engaging the exposed side face of the terminal member adjacent the associated end plate, wafers having conductors on the face thereof with the conductors extending to an end edge of the wafer, each wafer having its side edges within a pair of the first mentioned slots with end portions of the conductors and an end of each wafer extending into the slot of the associated terminal member.

6. In a switch assembly, a frame including elongated side members joined by end plates maintaining the side members in spaced relationship, means carried by each side member disposed over the inner face thereof, said means each having slots therein aligned transversely of the frame, an inturned flange carried by an edge portion of each side member extending therealong and having confronting edges spaced transversely of the frame, an inwardly directed flange supported on each side member extending therealong and having confronting edges spaced transversely of the frame with the faces of the second flanges respectively spaced from faces of the first flanges, one of said end plates having a recess therein intermediate the confronting edges of the second flanges, elongated terminal members in side by said relationship arranged transversely of the frame with opposite end portions extending between said flanges, each terminal member having a slot therein aligned with a pair of the first mentioned slots, abutment means carried by one of said end plates engaging the exposed side face of the terminal member adjacent the associated end plate, abutment means detachably mounted on the other of said end plates closing said recess and engaging the exposed side face of the terminal member adjacent the associated plate, wafers having conductors on the face thereof with the conductors extending to an end edge of the wafer, and each wafer having its side edges within a pair of the first mentioned slots with end portions of the conductors and an end of each wafer extending into the slot of the associated terminal member.

7. A switch assembly comprising, a frame including opposite side members joined by end members maintaining said side members in spaced relationship, means carried by the side members providing slots at inner faces of the side members aligned transversely of the frame, an inturned flange carried by an edge portion of each side member extending therealong and having confronting edges spaced transversely of the frame, elongated terminal members arranged transversely of the frame with opposite end portions abutting said flanges, each terminal member having a slot therein aligned with a pair of said slots, contacts on each terminal member along the slot therein and terminals extending from the contacts accessible at the exterior of the frame, means maintaining the terminal members in abutting relationship with said flanges, wafers each having conductors thereon extending to an end edge thereof, switch means on each wafer including a rotatable member, each wafer having a slot therein extending from said end edge to the periphery of said rotatable member, each rotatable member having a slot therein adapted to be aligned with the slot in the associated wafer, each wafer having opposite side edge portions within a pair of the first mentioned slots, the end edge portion of each wafer extending into the slot in the associated terminal member with the conductors thereof engaging the contacts thereon, and a shaft journalled for rotation on said end members extending through the slots in said rotatable members for actuating the switch means.

8. In a switch assembly, a frame including side members joined by end members maintaining the side members in spaced relationship, means carried by each side member disposed over the inner face thereof, said means each having slots therein aligned transversely of the frame, an inturned flange carried by an edge portion of each side member extending therealong and having confronting edges spaced transversely of the frame, each of said means having a shoulder facing the face of the associated flange and spaced therefrom, elongated terminal members in side by side relationship arranged transversely of the frame with opposite end portions extending into the space between the shoulder and the associated flange, each terminal member having a slot therein aligned with a pair of the first mentioned slots, abutment means carried by one of said end members engaging the exposed side face of the terminal member adjacent the associated end member, abutment means detachably mounted on the other of said end members engaging the exposed side face of the terminal member adjacent the associated end member, wafers having conductors on the face thereof with the conductors extending to an end edge of the wafer, and each wafer having its side edges within a pair of the first mentioned slots with end portions of the conductors extending into the slot of the associated terminal member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,401,430	Lake	June 4, 1946
2,644,063	Zickmund	June 30, 1953
2,649,513	Luhn	Aug. 18, 1953
2,765,450	Richardson	Oct. 2, 1956
2,794,081	Luhn	May 28, 1957
2,817,723	Allison	Dec. 24, 1957
2,832,013	Pedersen	Apr. 22, 1958

FOREIGN PATENTS

203,624	Australia	Oct. 10, 1956