Sept. 3, 1940. E. J. MASTNEY ET AL 2,213,845

SWITCH

Filed Dec. 20, 1937 2 Sheets-Sheet 1

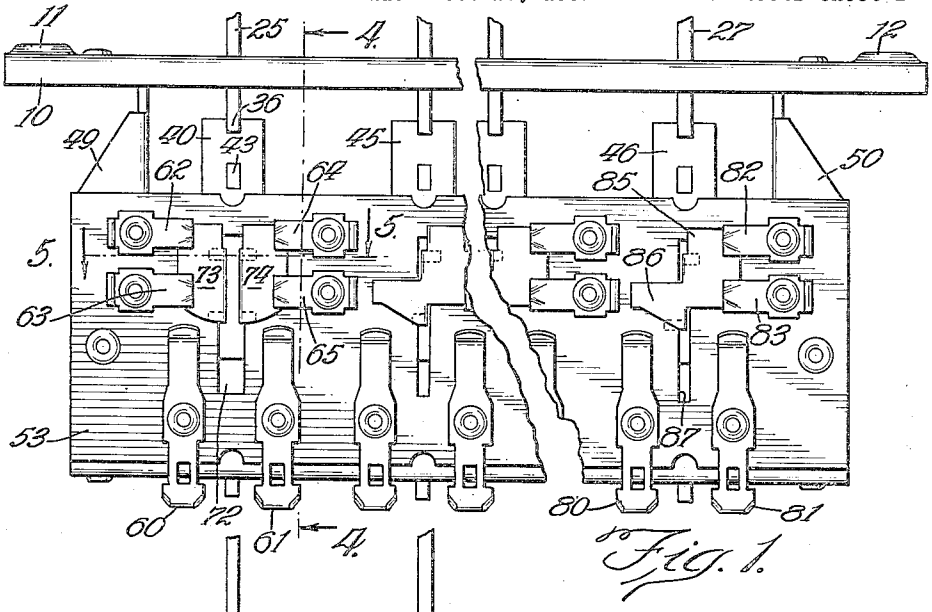

Fig. 1.

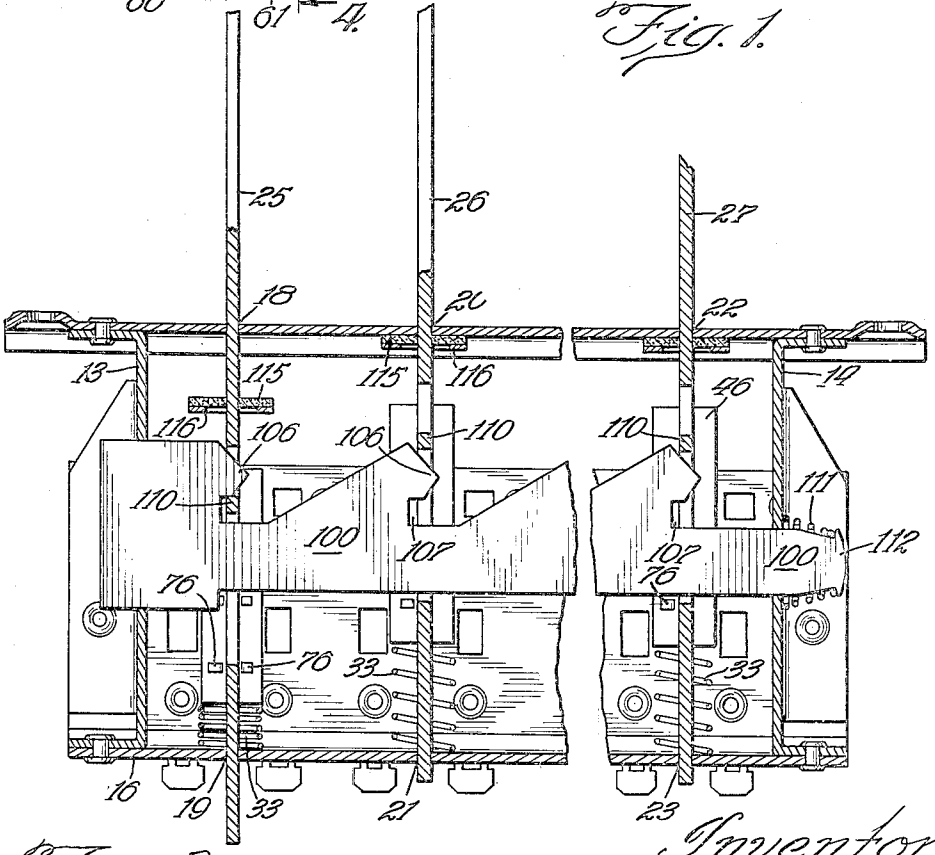

Fig. 2.

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SWITCH

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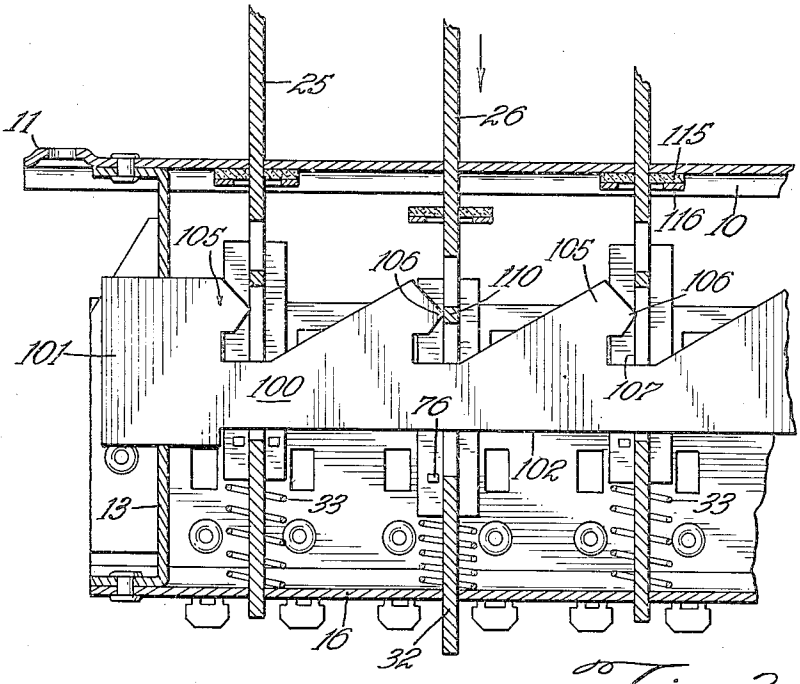

Fig. 3.

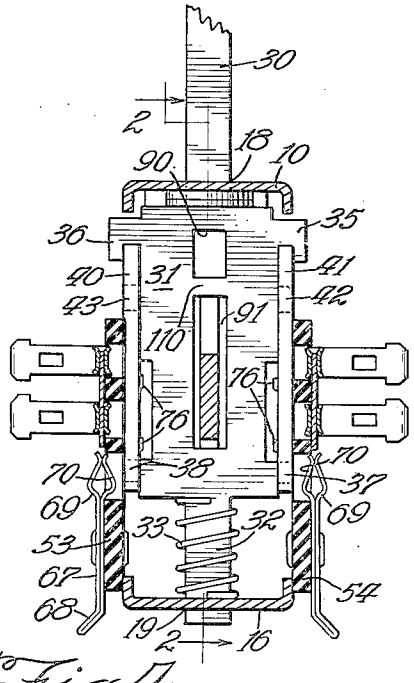

Fig. 4.

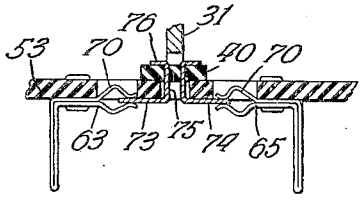

Fig. 5.

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Patented Sept. 3, 1940

2,213,845

UNITED STATES PATENT OFFICE

2,213,845

SWITCH

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Application December 20, 1937, Serial No. 180,742

11 Claims. (Cl. 200—5)

This invention relates to switches, particularly of the self-locking type wherein a plurality of groups of switches are supported to form a unitary structure. Each switch is adapted to be manually operated to go from one position to another, and during this operation, is adapted to automatically release any of the other switches. The general switch is particularly useful in radio receivers wherein each switch group is adapted to control the setting of the receiver for a particular station. Thus, when one switch is operated the other switches are released to permit the receiver to be tuned to the particular station corresponding to the last switch. This general switch structure is useful in other fields besides radio, such as telephone work, for annunciators, and the like.

The switch in general is characterized by simplicity and ruggedness of structure which makes for low cost and freedom from operating difficulties.

The switch units themselves are so constructed that the movable parts thereof are floating so that the movable contacts may adapt themselves to the stationary contacts without any strain imposed by the mechanism proper.

Referring to the drawings:

Figure 1 is an elevation of a switch.

Figure 2 is a section of the switch along line 2—2 of Figure 4 and showing the switch mechanism in one position.

Figure 3 is a view similar to Figure 2 showing the switch mechanism in another position.

Figure 4 is a section along 4—4 of Figure 1.

Figure 5 is a sectional detail along 5—5 of Figure 1.

Referring to the drawings, the switch comprises a sheet metal base 10 of a generally elongated form having a pair of apertured ends 11 and 12 for mounting the entire construction. Base 10 carries at each end supporting side plates 13 and 14 suitably riveted thereto and extending downwardly for a substantial distance. Side plates 13 and 14 at their bottom ends carry a bottom plate 16 extending in a generally parallel plane to base plate 10. As is clearly evident from the various figures, base plate 10 and bottom plate 16 are of a generally elongated rectangular shape. Base plate 10 and bottom plate 16 have a plurality of pairs of registering slots 18 to 23 inclusive which extend transversely to the plates. Operating in each pair of registering slots are push rods 25 to 27 inclusive. Inasmuch as these push rods are all of the same shape, only one of them will be described in detail.

Referring to Figure 4, the push rod has an upper portion 30 which may be designated as the handle portion since the end of it is adapted to be engaged by an operator and pressed downwardly. Handle portion 30 extends down through slot 18 in base plate 10 and flares out to form a locking portion 31. As is evident from the drawing, this portion 31 is substantially wider than handle portion 30. Locking portion 31 extends for a substantial portion of the distance between plates 10 and 16, which may be termed as the depth of the structure, and thereafter this locking portion narrows to form an end portion 32 of substantially the same dimension as handle portion 30. End portion 32 extends through bottom slot 19 in plane 16 and is surrounded by a coil spring 33 extending between bottom plate 16 and locking portion 31. The tendency of the coil spring is to bias the entire member upwardly.

Referring to the body portion 31, the top of the body portion is extended on each side to form ears 35 and 36. The bottom of body portion 31 is similarly extended at the sides to form ears 37 and 38. It should be noted that ears 35 and 36 extend somewhat beyond the lower ears 37 and 38. Each push rod carries a pair of insulating rotor blocks 40 and 41 on opposite sides thereof. These blocks are supported between the opposed pairs of ears. Additional ears 42 and 43 may be provided below top ears 35 and 36 to more adequately support each insulating block. These additional ears, like the lower ears 37 and 38, do not extend outwardly as far as top ears 35 and 36. As is clearly evident in Figures 1 and 4, the insulating blocks are of a generally rectangular shape and are disposed transversely of the general plane of the push rod. Top ear 36 extends into a corresponding slot in the top edge of insulating block 40, while intermediate ear 43 extends into a suitable slot in the block and is preferably flush with the insulating block. The same is true of bottom ear 38. Additional insulating blocks 45 and 46 may be mounted in a similar manner on the remaining push rods.

Side plates 13 and 14 are provided with flanges 49 and 50 upon which are riveted and supported on opposite sides, long stator insulating blocks 53 and 54. As is evident from the drawing, these blocks extend the full length of the switch and have as their width a substantial portion of the entire depth of the switch construction. Each block, as for example 53, is adapted to support a plurality of groups of switch contacts corresponding to a push rod. Thus, for push rod 25, block 53 supports a pair of contacts 60 and 61 in spaced

relation above which may be disposed additional contacts 62 to 65 inclusive. These additional contacts are disposed in groups of two, although, of course, any other arrangement may be utilized. Every one of the stator contacts carried by the insulating blocks 53 and 54 are preferably of the shape shown in Figure 4 and comprise a mounting portion 67 of double metal having a connecting portion 68 on one side of the mounting portion and a contacting portion on the other side of the mounting portion. The contacting portion is divided to form a pair of oppositely bent jaws 69 and 70 of the shape shown with the tips slightly open.

Symmetrically disposed with respect to the entire group of contacts 60 to 65 inclusive is a slot 72 in the insulating block 53 extending entirely through and transverse to the block. This slot exposes insulating movable block 40 adapted to slide immediately below block 53. Block 40 carries in this parallel group a pair of movable contacts 73 and 74 lying along the surface of block 53 and adapted to enter between opposed stator contact jaws. Contacts 73 and 74 are both similar and have intermediate portions 75 extending down through slot 72 in block 53 and terminating in fingers 76 extending through suitable small slots in block 40 and being bent or staked on the reverse or inside surface of block 40 to hold them in position. It should be noted that insulating block 53 is cut away to clear the inside contact jaw 70 so that when movable contact 73 or 74 opens up the jaws, the inside jaw 70 will be free to move.

As is clearly evident from Figure 1, when push rod 25 is in its upper position as shown in the figure, contact 73 will engage stationary contacts 62 and 63, while when moved downwardly, movable contact 73 will engage stationary contacts 60 and 63. Obviously, any other contact arrangement is possible. The same general arrangement of switching will occur with reference to movable contact 74.

Referring to push rod 27 which shows another group of contacts, a different contact grouping is disclosed. Here bottom contacts 80 and 81 are similar to contacts 60 and 61 of the first group. Contacts 82 and 83 are also similar to contacts 65 and 65. As is evident from the drawings, the various stationary contacts are mounted upon insulating block 53 by eyelets, although any other means may be used. Cooperating with these contacts is a movable contact 85 having a portion 86 extending opposite portion 85 and beyond slot 87 in insulating block 53. Contact portion 85 cooperates with contacts 82 and 83 in one position and with 83 and 81 in the bottom position. Contact portion 86 which is part of contact 85 cooperates with fixed contact 80. The mounting of movable contact 85 is precisely the same as with movable contacts 73 and 74 held by means of fingers extending through insulating block 46 and being bent on the reverse side as shown. It is clear that any other arrangement of contacts is possible so that any desired switch action may be obtained in the two positions of the movable contact.

As is clearly evident, the various push rods are arranged in spaced parallel planes transversely of the switch proper. Each locking portion 31 of the push rod has an upper slot 90 and a lower slot 91. These two slots are in line with each other with slot 91 having a substantially greater length than slot 90 although the width may be the same. Threaded through the registering lower slots 91 of the various push rods is a locking bar 100 having a rectangular end 101 passing through a suitable slot in side plate 13. The bottom of locking bar 100 is formed as a straight edge 102. The upper portion of locking bar 100 is cut in a generally saw-tooth fashion to provide a head 105 with a projecting tip 106 extending outwardly from the head and cut away to form a recess 107. The various heads 105 cooperate with a corresponding push rod. The other end of locking bar 100 is reduced to form an end portion 110 extending through a suitable slot in side plate 14. A coil spring 111 is disposed around the protruding end 110 and is locked on the bar by widening the tip 112 of the bar. Coil spring 111 will tend to move locking bar 100 to the right as seen in Figure 2, thus tending to push each projecting tip 106 through lower slot 91 in the event that the push rod is in its upper position. In the event that the push rod is in its lower position as is true of push rod 25 in Figure 2, tip 106 will tend to enter upper slot 90. In the position shown in Figure 2 of push rod 25, tip 106 has entered upper slot 90 so that portion 110 between slots 90 and 91 is disposed in recess 107. Due to the shape of the opposing metal parts, it is evident that the tendency of the locking bar to keep tip 106 in upper slot 90 will lock push rod 25 in the lower position in spite of the tendency of coil spring 33 of the push rod to return the push rod to its upper position. As shown in Figure 3, when push rod 26, for example, is pressed down, the sloping edges forming tip 106 on the locking bar force the locking bar to move left to compress coil spring 111. As shown in Figure 3, push rod 26 is at an intermediate portion of its travel with tip 106 just sliding past intervening metal 110 separating the two slots. The entire locking bar and the various push rods are so arranged that all of the tips have precisely the same relation to the cooperating push rods, so that push rod 25 which has previously been locked in its lower position as shown in Figure 2 will now be released and permitted to spring up to its top position. At the same time push rod 26 will be locked into place when tip 106 will be forced into upper slot 90 and lock the push rod into position.

In the event that all the push rods are simultaneously depressed to their locked position, it will be necessary to push any push rod further down to its extreme limit of travel to unlock the remaining rods. Thus, as is evident from the shape of projection 106, if rod 25 in Figure 2 is pushed down still further—it being in its locked position—the top edge of slot 90 will engage the top sloping face of projection 106 and cause the entire bar 100 to move to an unlocking position. Hence the extreme bottom position will unlock any one or more previously locked rods.

By virtue of the mounting of the movable insulating blocks 40, 45 and 46, it is clear that these blocks tend to float and may align themselves with reference to the stationary insulating blocks and the cooperating contact surfaces. The various push rods and the body portions merely move the insulating blocks up and down and have no tendency to force the insulating blocks to assume any artificial position within wide limits. In this way the spring stator contacts are not strained since the movable contacts tend to assume whatever position the spring contacts demand.

In order to silence the push rods during their return movement up, there is preferably disposed a felt washer 115 with a supporting metal

washer 116 below it around finger portion 30 immediately below upper plate 10.

What is claimed is:

1. A self-locking switch comprising a pair of spaced base members having slots, a slot of each member forming a pair, a push rod slidably disposed in said base members and passing through each pair of slots and normally resting in one of two positions, each push rod having an active portion between the base members, each active portion having a large slot and a smaller slot with ears projecting from the sides of the portions, all of said slots being adapted to register in line with each other when said rods are in the one position, a single locking bar threaded through said large slots and spring biased in one end position, said locking bar having a tooth for each push rod adapted to project into the large slot when said push rod is in the one position and said small slot when said push rod is in the other position, spring means for biasing each push rod to the one position, said teeth being so shaped that upon the downward movement of any one push rod said locking bar is moved to an unlocking position and when the said push rod has reached its other position and thereafter said locking bar locks said push rod in its other position, a large insulating block carried by said bases in proximity to the body portions of said push rods and lying in a plane parallel to the rod travel, a pluraliy of spring contacts carried by said insulating block adjacent each push rod on the outside surface thereof, a small insulating block apertured so that the ears on said body portion project therethrough in order to move said small block with said push rod, said small block being disposed in face to face relation with said large insulating block, said large block being slotted in proximity to said small block, a contact carried by said small block and projecting through said slot and engaging said stationary contacts.

2. An electric switch comprising a flat stationary insulating block having flat faces on opposite sides thereof and having an elongated straight slot therethrough and a plurality of contact apertures, a stationary contact mounted adjacent each aperture, each contact having a pair of opposed spring jaws adapted to be spread by a movable contact, said jaws being normally movable perpendicular to said block faces with one jaw set in a contact aperture and the other jaw beyond said block so that said jaws normally engage each other substantially in the plane of one block face, a flat movable insulating strip normally having one face in contact with the other block face and disposed beneath said slot, an actuating member movable parallel to said slot, means for mounting said strip on said actuating member to permit said strip to float in normal position but to move said strip along said slot, and a movable contact carried by said strip and extending up through said slot and bent down to lie along said one block face and movable into and out of engagement with said stationary contacts.

3. A locking mechanism for switches comprising a pair of spaced slotted base members, a slot of each member forming a cooperating pair, a plurality of push rods slidably mounted in parallel planes in said base and movable lengthwise between two end positions, each push rod operating in each pair of slots and having a locking portion with a large and small slot, all of the respective slots being adapted to register when all the rods are in the same corresponding position to form a series of registering large and small slots with each small slot and the corresponding large slot aligned lengthwise of the push rod, means for biasing said push rods to one end position, a pair of end base members, a single locking bar threaded through the registering large slots and extending through beyond said base end members and movable lengthwise therein between two positions, a tooth on said locking bar for each push rod adapted to project into the large slot during the registering position of the push rod and adapted to project into the small slot when the push rod has been moved lengthwise, a coil spring around one of the projecting ends of said locking bar cooperating with the adjacent end base member for biasing said locking bar in the position where the teeth project into the push rod slots, said teeth being so shaped that upon movement of said push rod from its registering position, said locking bar is moved against its spring bias lengthwise to a non-locking position and upon the registration of the small slot of the moved rod with the corresponding tooth, said locking bar is returned by its spring bias to locking position to prevent the return movement of said push rod back to its registering position.

4. The structure of claim 3 wherein each push rod has a wide body portion between the base members and narrow portions beyond the body portions adapted to operate in the slots and wherein the means for biasing each push rod consists of a coil spring disposed around one of the reduced portions of the push rod and extending between the wide body portion and the adjacent base member.

5. A locking mechanism for switches comprising a pair of spaced elongated channel members, an end member at each end of the mechanism for maintaining said channel members in position, said channel members having a plurality of narrow slots with a slot of each member forming a cooperating pair, a push rod for each pair of slots, said push rod comprising a wide body portion and reduced end portions with the end portions disposed in such slots and one end portion forming a finger piece, a coil spring around the other end portion between the body portion of said push rod and the channel member for biasing said push rod in one position, each push rod having a large and small slot in the body portion thereof with the slots being aligned longitudinally of the push rod and adapted to register when all the rods are in the same corresponding position to form a series of registering large and small slots, a locking bar mounted in the end base members and movable lengthwise between two end positions and threaded through the registering large slots, a tooth on said locking bar for each push rod adapted to project into the large slot during the registering position of the push rod and adapted to project into the small slot when the push rod has been moved lengthwise, spring means for biasing said locking bar in the position where the teeth project into the push rod slots, said teeth being so shaped that upon movement of said push rod from its registering position, said locking bar is moved against its spring bias lengthwise to a non-locking position and upon the registration of the small slot of the moved rod with the corresponding tooth, said locking bar is returned by its spring to locking position to prevent the return movement of said push rod

back to its registering position, at least one insulating sheet supported by said base members, said insulating sheet having a substantially flat smooth face in a plane parallel to the line of motion of said push rods, each push rod having ears formed on at least one side of said body portion, a small insulating block having slots into which said push rod ears extend, said small block having a flat face and being disposed in face to face relation to said large sheet, and cooperating contacts carried by said small block and large insulating sheet and adapted to be switched during movements of said push rod.

6. An electric switch comprising a flat stationary insulating block having flat faces on opposite sides thereof and at least one elongated slot having smooth long sides forming the bounderies thereof, a plurality of stationary spring contacts mounted on said block and having the active contacting portions thereof on one block face only and being alined parallel to said slot, a movable insulating member having a flat face normally pressing against the other block face and extending transversely across the slot, means for moving said member back and forth along said slot for switching purposes, and at least one movable rigid contact rigidly mounted on said member and extending therefrom through said slot, said rigid contact having a length and width great in comparison to the thickness thereof, the thickness thereof being small in comparison to the slot width, the length of the contact being disposed along the slot length with the contact material being disposed against one slot side, the contact width extending from said member through the slot to the one block face and then along the adjacent block portion of the face transversely away from the slot to form a member retaining fold portion on said face, said rigid contact having an active contacting portion extending beyond said folded portion.

7. The structure of claim 6 wherein said stationary contacts are disposed on opposite sides of the slot and wherein said rigid contact has a retaining fold portion crossing the slot and overlying the block face there and having an active contacting portion therebeyond.

8. The structure of claim 6 wherein said block has stationary contacts on both sides of said slot and wherein said member has an additional rigid contact disposed along the other slot side.

9. The structure of claim 6 wherein said active contacting portion of the rigid contact is merely an extension of said folded over portion in the same plane along the block face and wherein each stationary contact has as the active contacting part a pair of oppositely bent spring jaws movable perpendicular to the block face with the block having a clearance opening to accommodate the jaw nearest to the block.

10. An electric switch comprising a flat stationary insulating block having flat faces on opposite sides thereof and a plurality of elongated straight slots, each slot having smooth long sides forming the boundaries thereof, stationary spring contacts mounted on said block and having the active contacting portions thereof on one block face only and being alined parallel to said slots, each slot having a series of stationary contacts, a movable insulating member for each slot and extending transversely across the slot, means for moving each member back and forth along its slot for switching purposes, each member having at least one movable rigid contact rigidly mounted on said member and extending therefrom through said slot, said rigid contact having a length and width great in comparison to the thickness thereof, the thickness thereof being small in comparison to the slot width, the length of the contact being disposed along the slot length with the contact material being disposed against one slot side, the contact width extending from said member through the slot to the one block face and then along the adjacent portion of the block face transversely away from the slot to form a member retaining fold portion on said face, said rigid contact having an active contacting portion extending beyond said folded portion.

11. The structure of claim 10 wherein each slot has stationary contacts on opposite sides thereof and wherein each member has an additional rigid contact disposed along the other slot side.

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