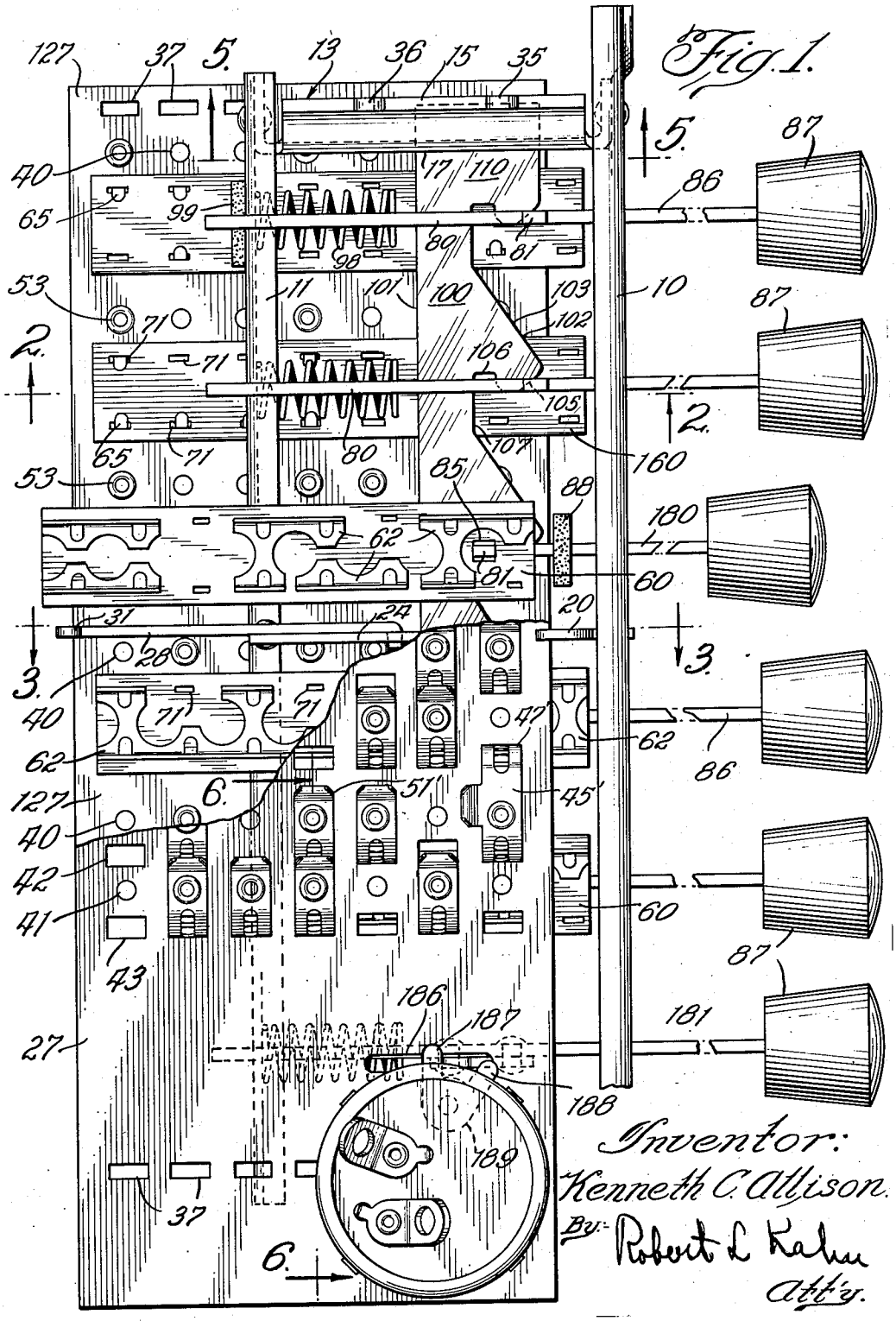
April 9, 1940. K. C. ALLISON 2,196,433

ELECTRIC SWITCH

Filed Sept. 23, 1938 3 Sheets-Sheet 1



Inventor:
Kenneth C. Allison.
By: Robert L. Kahn
Atty.

April 9, 1940. K. C. ALLISON 2,196,433

ELECTRIC SWITCH

Filed Sept. 23, 1938 3 Sheets-Sheet 2

Fig. 2.

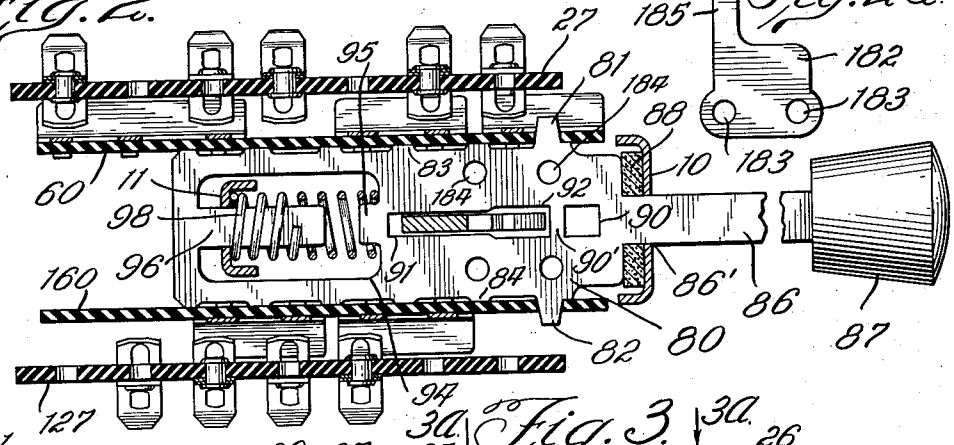


Fig. 2a.

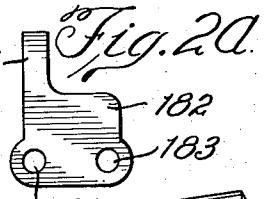


Fig. 3.

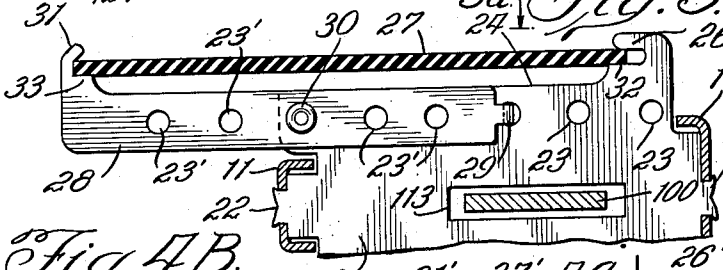


Fig. 3a.

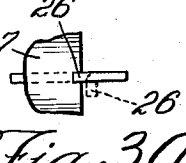


Fig. 4B.

Fig. 4.

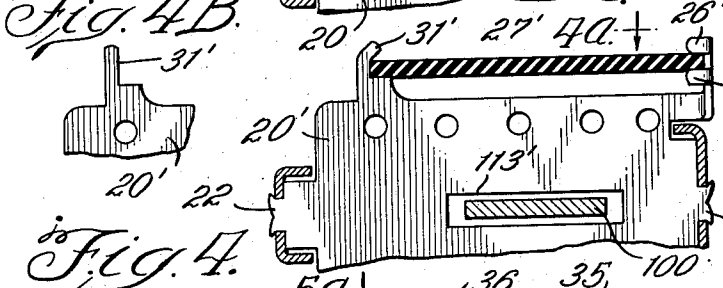


Fig. 4a.

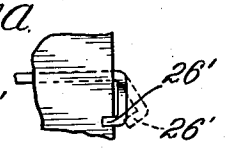


Fig. 5.

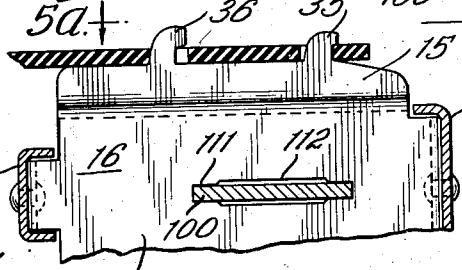
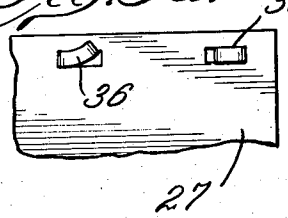


Fig. 5a.



Inventor:
Kenneth C. Allison
By: Robert L. Kahn
Atty.

April 9, 1940. K. C. ALLISON 2,196,433

ELECTRIC SWITCH

Filed Sept. 23, 1938 3 Sheets-Sheet 3

Fig. 6.

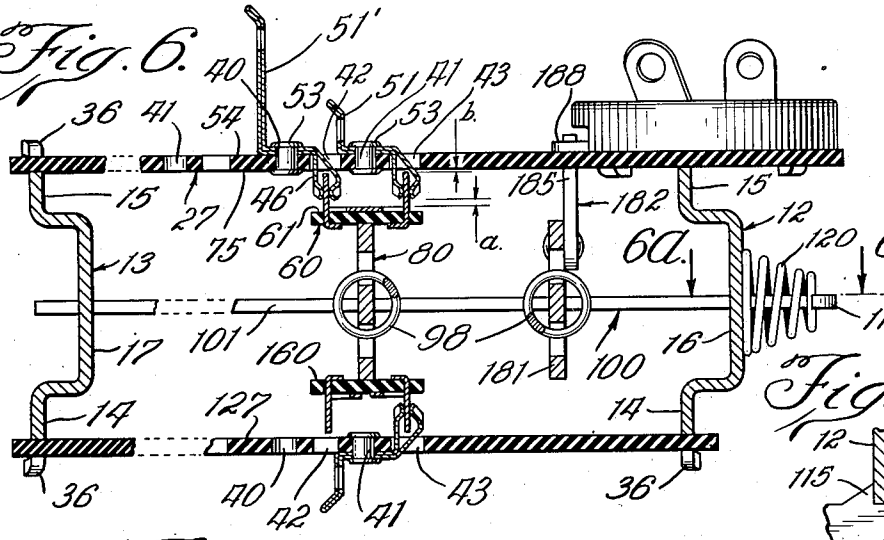


Fig. 6a.

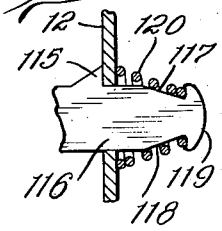


Fig. 7.

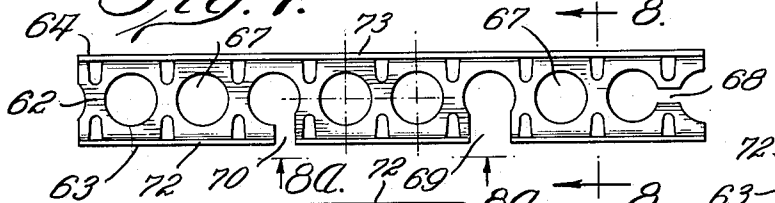
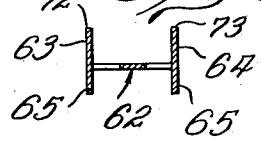


Fig. 8.



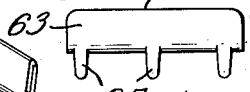


Fig. 9.

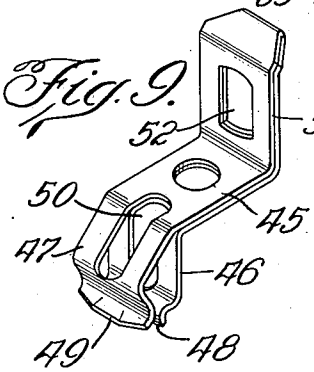


Fig. 8a.

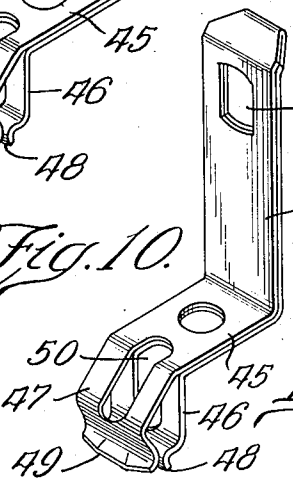


Fig. 11.

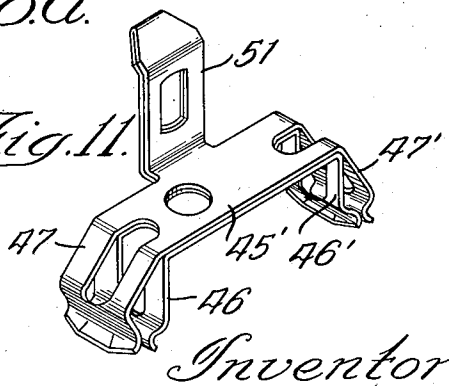


Fig. 10.

Inventor:
Kenneth C. Allison
By:- Robert L. Kahn Att'y.

Patented Apr. 9, 1940 2,196,433

UNITED STATES PATENT OFFICE

2,196,433

ELECTRIC SWITCH

Kenneth C. Allison, Arlington Heights, Ill., assignor to Oak Manufacturing Company, Chicago, Ill., a corporation of Illinois

Application September 23, 1938, Serial No. 231,399

13 Claims. (Cl. 200—5)

This invention relates to electric switches and particularly to switches wherein the movable portions may freely adjust themselves with reference to the contact requirements and thus eliminate or reduce strains upon the contacts themselves. In particular, the construction hereinafter disclosed has resulted because of a demand for an electric switch having greater flexibility and adaptability both in the number of circuits to be controlled and in the mechanical action of the various parts. Thus, in radio receivers it is particularly desirable to provide a multiple switch operated by push buttons to change a large number of circuits with a view to selecting various wave lengths and wave bands. Because of the requirements for space, such a switch must have a large number of contacts compactly disposed.

In a switch as described above, it is desirable to have considerable play in the various parts in order to permit ready adaptation of the various parts to each other. However, the very existence of such play creates a problem in connection with the contacts. Inasmuch as each set of cooperating contacts includes a spring member, it is desirable to protect such spring member against distortion and abuse during the play of the various mechanical parts. This is attained in a simple and effective manner as will appear later.

In its more general aspect, the invention contemplates a pair of supporting members having opposed faces, normally in spaced parallel planes. From each face extend one or more contacts toward the opposing face or surface and between the free edge of each contact and its opposing surface there is normally a clearance. The two supporting members are movable relatively to each other and are adapted to have a permissible play except in the direction of switch motion. By adjusting the relative clearances, it is possible to have rigid contacts act as stop members during the play action and thus protect the delicate spring contacts against injury. The mechanical structure embodying this invention may assume various forms.

The entire switch mechanism as hereinafter described is composed of a plurality of electrically separate switch sections. By virtue of the disposition of the stationary contacts on the supporting member, a large number of contacts may be disposed in compact array without endangering the insulating qualities of the switch. A convenient simple and effective manner of retaining the stationary insulating supporting member on the frame is also disclosed.

The entire switch is provided with an interlocking means whereby a new switch setting releases previous switch settings. This interlocking means is more fully described and claimed in the copending application of Mastney and Sussin, Serial No. 180,742, filed December 20, 1937. However, in this particular construction, certain improvements have been made with regard to mechanical sturdiness.

An important feature of this invention resides in the construction of the rigid contact. By virtue of such construction, a large number of switch combinations is possible since the rigid contact is adapted to be separated into small sections which may be insulated or not as desired from the rest of the blank. Thus by using the same prefabricated parts, and by merely controlling the arrangement of the spring contacts and arranging the separation of the rigid contact along any desired line, it is possible to obtain a large number of possible switch combinations. This is of great importance particularly for use in the manufacture of radios since each manufacturer of a radio has different circuits which are to be controlled. With the construction hereinafter described, it is possible to fill orders for either a large or small number of switches. In either case the tooling is the same.

Referring to the drawings, Fig. 1 shows a plan view of a switch with parts broken away. Fig. 2 is a section on line 2—2 of Fig. 1. Fig. 2*a* is a detail of a catch adapted to be attached to any one or more of the push rods shown in Fig. 2. Fig. 3 is a section on line 3—3 of Fig. 1. Fig. 3*a* is a detail on line 3*a*—3*a* of Fig. 3. Fig. 4 is a modified construction to be used and represents the portion of the switch corresponding to the section line 3—3 of Fig. 1. Fig. 4*a* is a detail on 4*a*—4*a* of Fig. 4. Fig. 4*b* is a detail showing how the insulating panel is to be fastened in position. Fig. 5 is a section on line 5—5 of Fig. 1. Fig. 5*a* is a detail on line 5*a*—5*a* of Fig. 5. Fig. 6 is a section on line 6—6 of Fig. 1. Fig. 6*a* is a sectional detail on line 6*a*—6*a* of Fig. 6. Fig. 7 is a detail of a rigid contact member. Fig. 8 is a section on line 8—8 of Fig. 7. Fig. 8*a* is a detail on line 8*a*—8*a* of Fig. 7. And Figs. 9 to 11 inclusive are details of various forms of spring contacts.

Referring to Fig. 1, a metal or other suitable frame is shown comprising a top channel member 10 and a bottom channel member 11 in spaced parallel relation. As shown in Fig. 2, channel members 10 and 11 have the side edges in turned toward each other to form a generally U-shaped

section. As shown in this figure, channel member 10 is substantially wider than 11, although this is not essential. Channel members 10 and 11 are maintained in spaced relationship by side members 12 and 13 shown in Fig. 6, having generally similar cross sections. To impart strength to these members, they are shaped as shown in Fig. 6 to form a general U section with sides 14 and 15 bent outwardly parallel to the base portion 16 and 17 of each member. The side members 12 and 13 may be joined to channels 10 and 11 in any suitable manner, such as, for example, by bolts or rivets as shown at one end of Fig. 1, these passing through suitably shaped ends of the side members bent flat against the channels 10 and 11.

Midway between side members 12 and 13 there may be disposed an intermediate supporting plate 20 of suitable material as metal shown in Fig. 3. This plate 20 is provided with a pair of projections 21 and 22 adapted to pass through suitable registering slots in channel members 10 and 11 respectively and then to be staked to maintain the same in position. It is understood, of course, that as many intermediate plates 20 may be provided as may be deemed necessary or may be omitted entirely. As shown in detail in Fig. 3, intermediate plate 20 is provided with a series of apertures 23 placed at regular intervals along side edge 24 thereof. It is understood, of course, that plate 20 is symmetrical in having a companion edge to edge 24 since both sides of the switch are similar. One portion of plate 20 here shown as a portion adjacent channel 10 is provided with a claw 26 which is adapted to engage one edge of a stationary supporting member 27 to be described in greater detail later.

As shown in Fig. 3, supporting plate 27 is substantially wider than intermediate plate 20 and in order to provide adequate support for the member an extension member 28 is provided. This extension member 28 is a flat strip of metal having a finger 29 which is adapted to engage any one of apertures 23 in plate 20. This extension strip 28 has a series of apertures 23' which register with certain of apertures 23 in plate 20 when finger 29 engages an aperture 23. Extension 28 is provided with a second point of support to plate 20 at any one of the registering apertures by means of an eyelet 30. Extension 28 has its free end provided with a claw 31 as clearly shown in Fig. 3. Claws 26 and 31 are adapted to engage the opposite edges of supporting member 27.

Prior to assembly, claw 26 is bent sideways as shown in Fig. 3*a* to permit supporting member 27 to rest upon a supporting ledge 32 on plate 20. Likewise, claw 31 is straight as, for example, shown in Fig. 4*b* to permit supporting member 27 to rest on ledge 33. After the supporting member 27 is disposed in position as shown in Fig. 3, claw 26 is straightened over supporting member 27 and claw 31 is bent down over supporting member 27 to lock the same in place.

In Fig. 4, a modified intermediate plate 20' is shown which is generally similar to plate 20 of Fig. 3. Here the supporting member 27' is narrow enough to obviate the necessity for an extension member such as shown in Fig. 3. In Fig. 4, the claw 31' engages one edge of supporting member 27'. The other edge of insulating member 27' is supported in a modified form by the claws 26' and 32' shown in Fig. 4*a*. This permits member 27' to be higher up on the switch and makes possible the disposition of extra contacts. As clearly indicated in Fig. 4 and 4*a*, the plate 20' has its tip bent around to parallel the edge of member 27'. Claw 32' functions as a supporting ledge and claw 26', which is ordinarily in the position shown in Fig. 4*a* is thereafter bent over to lock supporting member 27' in position.

Supporting member 27, preferably of rigid insulation, extends throughout the extent of the frame and is adapted to be supported itself at the end members 12 and 13. This is accomplished by the provision of lugs 35 and 36 extending through suitable apertures in supporting member 27. As shown in Fig. 1, supporting member 27 is provided with a series of rectangular apertures 37 uniformly spaced and any successive two of which are adapted to be engaged by lugs 35 and 36. Apertures 37 are so spaced with reference to lugs 35 and 36 as to provide some play of member 27 in the direction of the length of these apertures, namely transverse to the entire supporting member 27 as shown in Fig. 1, but are adapted to fit lugs 35 and 36 rather snugly as regards movement transversely to the lugs. As shown in Fig. 5*a*, supporting member 27 is disposed so that lug 35 projects up through an aperture 37. The lugs 35 and 36 are so shaped that when member 27 is forced down first over lug 35 and then over lug 36, the curved rear edges of the lugs tend to move the member to engage as shown in Fig. 5. There a clearance in front of lug 36 and a clearance in the rear of lug 35 is shown. Lug 36, which is initially straight, is then twisted as shown in Fig. 5*a* to dispose it in locking position.

Supporting member 27 is provided with a plurality of series of apertures. Inasmuch as the entire mechanism is merely a duplication of certain switch sections, it is only necessary to consider a portion of the entire mechanism in detail. Thus, for example, referring to the section or portion of the mechanism shown in Figs. 1 and 6, it will be seen that supporting member 27 and its companion member 127 is provided with a series of round apertures 40 and 41 spaced from each other and disposed transversely across the supporting member. Corresponding to each aperture 40 and 41 of the series is a companion series 42 and 43, respectively, of rectangular apertures.

The circular apertures, 40 or 41 or both, may have applied thereto a spring contact such as shown in Fig. 9 or 10. Thus, referring in detail to these contacts shown in Figs. 9 and 10, a mounting portion 45 is shown of a doubled thickness of metal having a pair of oppositely bent spring jaws 46 and 47. These spring jaws have their extreme edges 48 and 49 flared outwardly. Cutouts 50 may be provided in the metal to improve the resiliency thereof. A connecting portion 51 extends upwardly from mounting portion 45 at right angles thereto and is provided with an aperture 52 into which a suitable wire may be threaded and soldered. As clearly shown in Fig. 9, the contact making portion of the clip comprises the two jaws 46 and 47 and this is bent down from mounting portion 45. The only difference between the clip shown in Figs. 9 and 10 is in the connecting portion. In Fig. 10 the connecting portion 51' is extended to provide a greater length.

As clearly shown in Fig. 6, a spring contact slip may be disposed at any one or more of the round apertures 40 or 41 by having the mounting portion 45 thereof retained against supporting member 27 by means of an eyelet 53. The mounting portion 45 is disposed in the outer surface 54 of supporting member 27 and has the contacting portion thereof extend down through the corre-

sponding slot 42 or 43. Jaw 46 is preferably bent down at right angles to mounting portion 45 and with companion jaw 47 extends down through slot 42 and has sufficient room so that the jaws may open for contact making.

As shown in Fig. 6 the two rows of circular apertures 40 and 41 for mounting the spring contacts are spaced closely together in comparison to the physical dimensions of the contact members themselves. The fact that the spring jaws extend down through the corresponding rectangular slots 43 permits the spring jaws of one contact to clear the connecting part of a neighboring spring contact. In that way the series of mounting apertures 40 and 41 may be disposed rather closely. It is understood, of course, that the precise arrangement of spring contacts depends upon the number of circuits to be controlled and the manner in which the control is to be exercised.

In Fig. 11 a modified form of spring contact is shown wherein the mounting portion 45' is provided with two separate contacting portions, each having jaws 46, 46' and 47, 47'. This type of contact may be used in place where interconnected spring contacts are desired from one series of rectangular apertures such as 42 to a neighboring series which may be either 43 or into another section of the entire switch mechanism. It is understood, of course, that two separate spring contacts such as shown in Fig. 9 or 10 may be mounted in a common aperture in back-to-back relationship, but the modified contact shown in Fig. 11 is preferred where electrically necessary, since a neater and more compact construction results. It is understood, of course, that the connecting portion 51 of the contact shown in Fig. 11 may be short or long as desired.

Thus, through the series of rectangular apertures 42 or 43 an aligned row of spring contact jaws extends transversely of supporting member 27.

Disposed within the switch structure shown in Fig. 1 are suitable movable members having movable contacts. Thus cooperating with supporting member 27 is a movable supporting member 60. As clearly understood, each section of the entire switch has duplicate members 60 and 160. This member 60, which is preferably of rigid insulating material has a face 61 and may preferably assume the form of a flat elongated strip.

Carried by a movable member 60 is a rigid contact blank which may be divided into as many unit sections as desired and which is shown in Fig. 7. This rigid contact comprises a flat body portion 62 with upstanding side portions 63 and 64, the latter two of which form the rigid contacts proper. At spaced intervals, tabs 65 extend downwardly from the edge of body 62 away from contact parts 63 and 64. As shown in Fig. 8, the blank itself at the tabs has an H section whereas elsewhere the blank has a U section.

The entire blank may be considered as made up of a large number of unit portions with a longitudinal axis as shown in dotted lines and transverse axes as shown. These axes form the boundaries of adjacent unit sections. In order to remove excess metal from the blank and enable the blank to be cut up easily into unit or other sections as well as reduce electrical capacitance, the body portion 62 is provided with a number of apertures 67 whose centers are disposed at the intersections of the transverse and longitudinal axes. Thereafter various portions of the metal may be cut out to isolate any one or more unit sections. Thus, as shown in Fig. 7, a longitudinal strip may be cut out at 68 to separate the contacts in relation to the longitudinal axis of the blank. It is also possible to cut out metal at 69 or 70 to isolate unit sections with regard to the transverse axes. It will be noted that the cut outs at 69 and 70 differ with respect to their extent and this is due to the spacing and proximity of the spring contacts and the desired action.

The rigid contact blanks are maintained on supporting member 60 by tapered tabs 65 threaded through suitable apertures 71 (Fig. 1) which may be provided at uniformly spaced intervals. These tabs are bent along the lower surface of member 60 and retain the contact section rigidly in position. It is understood, of course, that in comparison to the spring contacts shown in Figs. 9 and 10 the contact portions 63 and 64 are heavy and relatively unyielding.

As is clearly evident in Fig. 6, the spring contact jaws of the clips extend downwardly through the rectangular apertures 42 or 43 toward the opposing face 61 of movable member 60. Likewise, rigid contacts 63 and 64 have their free edges 72 and 73 extend toward the opposing surface 75 of supporting member 27. Movable member 60 is supported, as will be later described, in a manner to provide play except with respect to the length thereof. It is clear, therefore, that if movable member 60 were rocked or moved nearer to supporting member 27, that there would be danger of the spring jaws of the contact clips being injured. Inasmuch as it is important to prevent these jaws from being bent beyond their elastic limits, their protection is of great importance. This protection is accomplished by providing a clearance, shown as *b* in Fig. 6 between the inside surface 75 of member 27 and the free edges 72 and 73 of the rigid contacts, small in comparison to the clearance *a* shown between the free edges 48 and 49 of the spring jaws and the body of the rigid contact blank 62. Naturally, where the rigid contact material is removed, as might be the case under certain conditions, the clearance *a* is greater by the thickness of the metal so that in general, the clearance between the extreme edges of the spring contact jaws and the face 61 which opposes these edges is at all times larger than clearance *b*. Hence in the event of any rocking or movement of member 60, the rigid edges 72 and 73 which should always be longer than rectangular apertures 42 or 43, will strike against the bottom face 75 and limit the play. Thus, while the switch section is provided with normal clearances, nevertheless, considerable play is permissible without endangering the spring contacts. It should be noted that the amount of play *b* not only prevents the spring contact jaws from striking supporting member 60, but also acts to limit the opening of each pair of jaws 46 and 47 due to any movement of each rigid contact 72 or 73 out of its normal plane.

As shown in Fig. 6, the general switch structure is provided with supporting members 27 and 127 and each of these supporting members has relatively movable members 60 and 160 respectively. As shown in Fig. 6, movable member 160 has rigid contacts along both sides thereof, although only one series of spring contacts is provided. The idle rigid contact serves as a bearing member to limit play.

The two movable members 60 and 160 are mounted on a plunger 80 which is shown in greater detail in Fig. 2. This plunger may be of any shape, but is here shown as being of flat metal stock provided with a pair of large lugs 81 and 82 on opposite sides thereof and a series of small ears 83 and 84 on opposite sides thereof. Lug 81 projects through a suitable aperture 85 (see Fig. 1) in movable member 60. The ears 83 of the plunger are preferably co-planar and function as points of support for said movable member 60. As shown in Fig. 1, aperture 85 is somewhat greater than lug 81 with regard to the thickness of the metal of lug 81 and thus permits some side movement of member 60 with respect to the plunger. As seen in Fig. 1, this play would be up and down and would be perpendicular to the length of the plunger. By tapering lug 81 as shown in Fig. 2, play in the direction of the length of the plunger 80 is eliminated. By this form of mounting, the entire movable member 60, together with its rigid contacts, is permitted to adjust itself to the requirements of the various spring contacts within wide limits and the only coupling with substantially no play at all is along the length of the plunger which is the direction of motion of the movable member during switching operation.

Similarly, movable member 160 is supported by ears 84 and lug 82.

Plunger 80 is provided with a handle or actuating portion 86 which projects through a suitable slot 86' in channel member 10. Portion 86 may have its free end provided with a push button 87. In order to quiet the operation of the plunger rod, a rubber or felt washer 88 may be disposed on the inside surface of channel member 10 and separate this channel member from the shoulders of plunger 80. The central portion of plunger 80 is provided with a rectangular aperture 90, which is preferably disposed midway between the opposite sides of the rod although this is not essential. In line with aperture 90 along the longitudinal axis of the plunger is an elongated cut out 91 whose portion 92, adjacent to cut out 90, is widened to approximate the dimension of cut out 90.

Further down the plunger a large cut out region 94 is provided, with such a shape as to provide projections 95 and 96 opposing each other along the longitudinal axis of the rod. As is evident in Fig. 2, projection 96 is substantially longer than 95 and this projection 96 is adapted to extend through a suitable slot in channel member 11. Disposed around opposite projections 95 and 96 is a coil spring 98 which obviously tends to maintain the plunger so that the button 87 is at its highest position away from channel 10. If desired, a rubber or felt washer 99 (see Fig. 1) may be disposed around projection 96 and against the outside of channel 11.

The various plungers 80 of each portion of the switch are all parallel to each other and normally tend to assume positions where the various cut outs register with each other. In order to provide an interlocking action a ladder bar 100 is provided. This bar as shown in Fig. 1 has a straight bottom edge 101 and a generally serrated top edge 102. For each switch action one serration is provided and this in general assumes the form of a long sloping edge 103, terminating in a tip 104 and then rounded off to form a nose 105 which finally ends in a recessed part 106. The recessed part 106 goes into a flat portion 107 and this flat portion 107 then is extended to form another inclined portion 103 of a new serration.

One end 110 of ladder bar 100 has the full width of the bar and is adapted to play in end member 13. This member 13 is provided at a suitable interior portion thereof with a slot 111 whose intermediate portion 112 is widened out beyond the normal requirements of ladder bar 100. In this way, merely the ends of slot 111 actually operate as bearing portion so that friction is reduced. The intermediate plates such as 20 and 20' are provided with cut outs 113 and 113' respectively, substantially larger than the cross section of ladder bar 100 so that no friction is created.

The other end of ladder bar 100 shown in Fig. 6a is provided with a stop 115 adapted to bear against the inside surface of side plate 12 in its extreme position. The free end of the ladder bar 100 is reduced at 116 to a width substantially less than the first end 110. This reduced end 116 is shaped as shown in Fig. 6a to provide two tapering sides 117 and 118 to terminate in an enlarged head portion 119. Reduced portion 116, as pointed out before, extends beyond plate 12 and around this reduced portion a coil spring 120 is disposed. By virtue of the enlarged head 119, spring 120 may be locked in place and normally tends to keep the ladder bar in the position shown in Fig. 1. In this position, nose 105 of each serration is adapted to extend within the plane of the corresponding plunger 80. Thus, upon any plunger being depressed, the strip of metal 90' acts against nose 105 of the ladder bar and forces said bar lengthwise against its normal biased position. As shown in Fig. 1, this would be a leftward movement of ladder bar 100. Upon the completion of the downward movement of any one plunger, the corresponding nose 105 will be opposite aperture 90 of the plunger and permit the latter plunger to attain its normal position. In that position, nose 105 of the ladder bar is disposed in aperture 90 and locks the corresponding plunger 80 in its down position and against the spring 98. At the same time, any other plungers which have previously been in their down position are released during the off normal position of the ladder bar and permitted to assume their normal up position. As pointed out in the copending application previously referred to, the nose 105 for each serration is so shaped that upon extreme downward movement of any plunger such as, for example, 180 in Fig. 1, the ladder bar is also released.

It is understood, of course, that the movable portions 60 and 160 and the cooperating stationary portions 27 and 127 may be made as wide as desired so that any number of contacts for each switch section may be disposed. The length, of course, may be adjusted so that any number of switch sections may be provided.

As shown in the switch of Fig. 1, one of the plungers 181 is adapted to control a snap switch which, in the case of a radio, may be the main switch for turning the set on or off. In this case, the plunger which is the same as shown in Fig. 2 and may be referred to as 80, has a catch 182 shown in Fig. 2a. This is merely a piece of metal having apertures 183 adapted to register with apertures 184 normally provided in the plunger blank. Suitable rivets may be disposed in the registering apertures to support catch 182 on whichever side of the plunger desired. Thus, catch 182 having a finger 185 as shown in Fig. 6

extends upwardly through a suitable slot 186 in member 27. This slot 186 is long enough to accommodate the travel of finger 185 throughout the length of movement of plunger 181. Finger 185 is adapted to operate between the two portions 187 and 188 of a pivoted member 189. Member 189 may be used to operate any suitable snap switch mechanism.

What is claimed is:

1. An electric switch comprising a base, a pair of rigid contact supporting members having spaced opposing surfaces adapted to be normally in fixed parallel planes, means for supporting said members on said base to maintain said surfaces and to be movable with respect to each other in a certain direction for switching purposes, said supporting means including means for retaining such members rigidly along the line of switching motion but providing relative play in other directions between said members thus tending to disturb the normal parallel relationship between said opposing surfaces, at least one rigid contact carried by one of said members and extending toward the opposing member surface and having active sides for contacting purposes and terminating in a free bearing edge lying in the line of switching motion and being sufficiently long to have at least a portion thereof free to engage the opposing member surface in all switch positions and having a normal clearance between said bearing edge and opposed member surface serving to define a limit to said play, and at least one cooperating spring contact carried by the other member and having its active portion extending toward the opposing member surface with a clearance therebetween substantially greater than said first clearance, said spring contact normally engaging at least one side of said rigid contact whereby distortion of said spring contact due to play is kept within safe limits.

2. An electric switch comprising a base, a pair of rigid contact carrying members having flat faces, means for mounting said members with the flat faces in opposed relation on said base to provide relative movement between said members along a straight line for switching purposes, at least one spring contact, at least one rigid contact having a straight blade-like portion extending along the line of switching motion and having active contacting portions at the sides thereof and having a straight bearing edge in the direction of switching motion, means for mounting said spring and rigid contacts on each of said members respectively to extend toward the opposing member, said rigid contact having a normal clearance between its bearing edge and the opposed member face, the spring contact having a normal clearance between it and the opposed member face which is substantially larger than the first clearance, one of said mounting means providing play between cooperating contacts in directions other than the line of switching motion, said rigid contacts being long enough along the line of switching motion so that in all switching positions said rigid contact bearing edge together with the opposed member face serve to limit play and protect the spring contact against damage.

3. The switch of claim 2 wherein the mounting means for one of said contact carrying members provides the play, said mounting means supporting said member along the line of switching motion.

4. The switch of claim 2 wherein the mounting means for that member carrying the rigid contact provides play, said mounting means providing support for said contact carrying member along the line of switching motion.

5. An electric switch having a base, a pair of rigid contact carrying members having flat faces, means for mounting said members with said faces in opposed relation on said base to provide relative movement between said members along a straight line for switching purposes, one of said mounting means providing play between said members in directions other than the line of switching motion, at least two rigid contacts each having a straight blade-like portion adapted to extend along the line of switching motion and having active contacting portions at the sides thereof and having straight bearing edges, said rigid contacts being mounted in parallel planes, at least one spring contact for each of said rigid contacts, means for mounting said spring contact and rigid contact on each of said members respectively to extend toward the opposing member, all spring contacts being mounted on one member and all rigid contacts being mounted on another member, said rigid contacts having a normal clearance between their bearing edges and the opposed member face, the spring contacts having a clearance between them and the opposed member face which is substantially larger than the first-named clearance, each of said rigid contacts being long enough along the line of switching motion so that in all switch positions said rigid contact bearing edge together with the opposed member face function to limit play and protect the spring contacts against damage.

6. The switch of claim 5 wherein the mounting means for the rigid contact carrying member provides the play.

7. The switch of claim 2 wherein the spring contact carrying member is apertured with the spring contacts mounted on a side of the member remote from the opposing member with the contact bearing portion of the spring contact extending through said aperture toward the opposing member.

8. The switch of claim 5 wherein the rigid contact carrying member face has a generally U-shaped blank disposed thereon, the sides of the U forming the rigid blade-like contacts with each rigid contact divided into unit sections each section having a fastening means for retaining said rigid contact on said contact carrying member and wherein the connecting portion between opposed rigid contacts is adapted to be cut up along various lines so that each unit rigid contact section may be connected to or disconnected from opposite or adjacent contact sections.

9. The switch of claim 2 wherein the spring contact includes a pair of spring jaws adapted to enclose the rigid contact on opposite sides with the spring contact mounted on its carrying member on a side remote from the rigid contact and extends through an aperture in said carrying member toward the opposing member face.

10. The switch of claim 5 wherein the contact carrying members are flat strips each having a series of apertures extending along the line of switching motion, wherein the spring contact is mounted on the side of the carrying member remote from the other carrying member and extends through an aperture with each spring contact having a pair of spring jaws adapted to enclose the rigid contact on opposite sides thereof and wherein the rigid contact is divided into unit

sections having a fastening means engaging an aperture in its carrying member.

11. An electric switch comprising a base, a plunger mounted on said base and movable back and forth along a straight line, a movable contact carrying member, means for mounting said member on said plunger along a line in the direction of movement with said member tiltable around said mounting line, a stationary contact carrying member rigidly mounted on said base opposite said movable member, said two contact carrying members having opposed flat faces, a rigid contact carried by said movable contact carrying member, said rigid contact having a generally blade-like shape extending in the line of switching motion and extending toward the opposing member face and terminating in a straight bearing edge having a predetermined normal clearance therefrom, said rigid contact extending from said member along a line offset from the mounting line of said movable member, spring contacts carried by said stationary member and extending toward said movable member and having active portions adapted to engage the side of said rigid contact and having a clearance from said movable carrying member substantially greater than the first clearance whereby when said movable member tilts on its mounting the bearing edge of said rigid contact will engage the opposing member surface first to limit the play and to protect the spring contact against damage.

12. The switch of claim 11 wherein the movable member has a pair of rigid contacts mounted thereon on opposite sides of the line of support of said member each of said contacts extending toward the opposing member surface along parallel planes with spring contacts for each of the rigid contacts.

13. In an electric switch, a front and rear elongated channel member disposed in parallel relationship and having transverse registering slots therethrough forming a series of pairs of slots, a straight flat plunger for each pair of slots, said plunger having a handle portion extending through the front member slot, said plunger having an enlarged body portion extending from the front member to the rear member with a cut out near the end thereof through which the rear member is threaded, said plunger having an inwardly extending tongue in the rear slot extending from the outside of the member to the space between said members, and a spring coiled around said tongue for biasing said plunger.

KENNETH C. ALLISON.