Jan. 16, 1940. K. C. ALLISON ET AL 2,186,949

ELECTRIC SWITCH

Filed Dec. 9, 1935 2 Sheets-Sheet 1

Fig. 1.

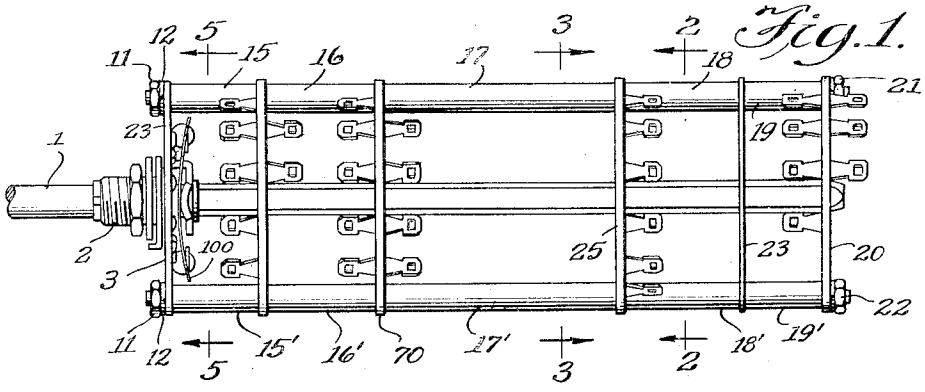


Fig. 2.

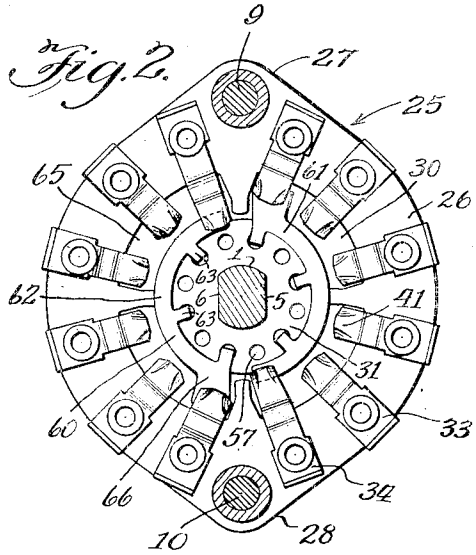
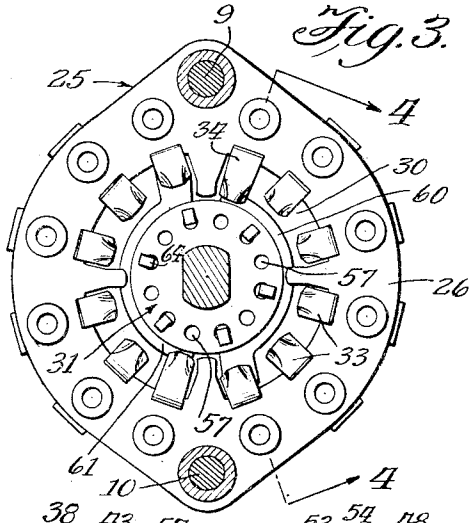


Fig. 3.



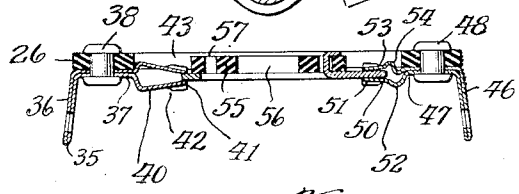


Fig. 4.

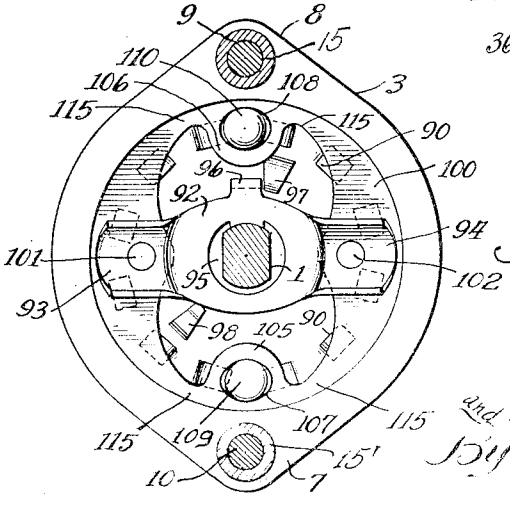


Fig. 5.

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Filed Dec. 9, 1935 2 Sheets-Sheet 2

Fig. 6.

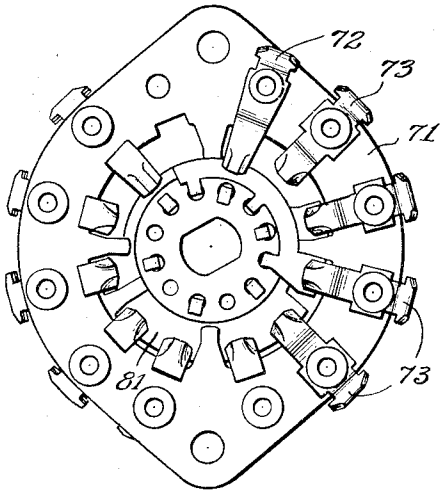


Fig. 7.

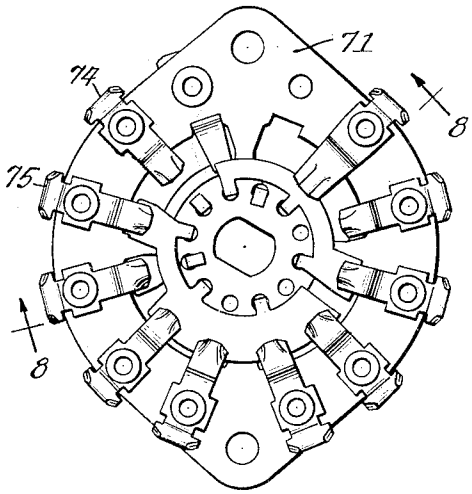


Fig. 8.

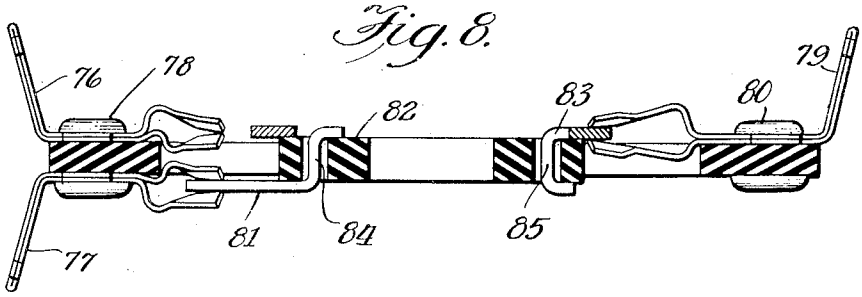
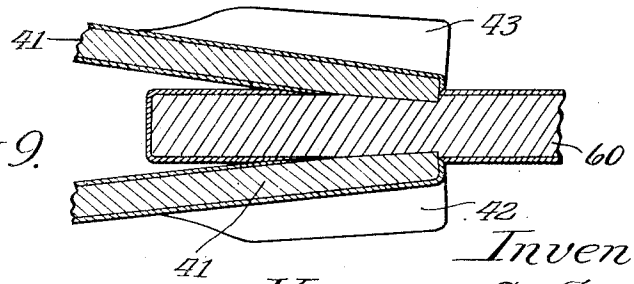


Fig. 9.



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UNITED STATES PATENT OFFICE

2,186,949

ELECTRIC SWITCH

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Application December 9, 1935, Serial No. 53,486

18 Claims. (Cl. 200—15)

This invention relates to electric switches and more particularly to switches useful in radio receivers for changing from one wave band to another. Switches for this type of service must be cheap, compact, easily assembled and disassembled, must have definite switching positions and must have uniform operating characteristics.

An object of this invention is to devise a switch of this character which will satisfy the above requirements.

Referring to the drawings, Figure 1 is a side view of the switch. Figure 2 is a section along line 2—2 of Figure 1. Figure 3 is a section along line 3—3 of Figure 1. Figure 4 is a section along line 4—4 of Figure 3. Figure 5 is a section along line 5—5 of Figure 1, and shows the indexing mechanism. Figure 6 is a detail of a modified switch stator and rotor. Figure 7 shows the reverse of Figure 6. Figure 8 is a section on 8—8 of Figure 7. Figure 9 is an enlarged detail of the contact surface.

Referring to the drawings, a circular shaft 1 is mounted for rotation in a bushing 2 carried by a front plate 3. Beyond the indexing assembly, carried by plate 3, to be described later, shaft 1 has opposite portions removed to provide flattened sides 5 and 6. Front plate 3, as shown in Figure 5, is of generally circular shape and provided with diametrically opposed projections 7 and 8, having suitable apertures therethrough. Elongated bolts 9 and 10 pass through each of the apertures in plate 3 and are adapted to be locked in position by nuts 11 and lockwashers 12. Bolts 9 and 10 may be as long as desired and are provided with a plurality of sleeves 15 to 19 and 15′ to 19′ inclusive. The sections having the same numbers but with a prime are preferably of the same length and are adapted to maintain a plurality of switching sections in spaced relationship to each other.

Inasmuch as the switching sections are one of two types, it will only be necessary to describe in detail one type shown in Figures 2 and 3 and the other type shown in Figures 6 and 7. The last switching section in the gang, generally designated by the numeral 20, has a stator with the same shape as plate 3 threaded on to bolts 9 and 10. Nuts 21 and 22, with corresponding lockwashers, are provided to maintain the entire switch assembly intact. If desired, a metal shielding plate 23 may be disposed between adjacent switch sections and maintained in position between adjacent sleeves 18 and 19 and the corresponding sections 18′ and 19′. While only one shielding plate is shown, it is to be understood, of course, that as many may be provided as may be found necessary.

Switching section 25, having a series of stationary contacts on one side of stator and illustrated in detail in Figures 2 and 3, will now be described. This section comprises a stator 26 of rigid insulating material such as a phenolic condensate of a generally circular shape and having diametrically opposed extensions 27 and 28 and similar in shape to front plate 3. Stator 26 has the interior region 30 cut out. Within region 30 a rotor generally designated as 31 is disposed and adapted to be operated by non-circular portion of shaft 1.

Disposed on the circumference of a circle concentric with shaft 1 is a series of stationary contacts. Inasmuch as these contacts are the same except for two different lengths, a detailed description will be given of contacts 33 and 34, the remaining contacts being similar thereto. These contacts, shown in section in Figure 4, comprise a strip of spring material such as silver plated phosphor bronze bent over at 35 and pressed together to form a soldering lug 36. Portion 36 runs into a mounting portion 37 suitably apertured and disposed on the surface of insulating stator 26. The entire contact is rigidly maintained in position by an eyelet 38. Mounting portion 37 runs into a contact portion 40. Contact portion 40 has its longitudinal central portion 41 flat in about the same plane as mounting portion 37. On each side of this central region, however, the contact material is flared outwardly to form lips 42 and 43, which taper down toward each other at the free edge of the contact portion.

The shorter contact 33 is made in generally the same manner and is provided with a soldering lug portion 47 maintained in place by an eyelet 48 and having contact portion 50. The lower jaw 51 of contact portion 50 is provided with a circular hinge portion 52, while the upper contact portion 53 is provided with an S-shaped portion 54, connecting contact portion 53 with mounting portion 47. The outer contacting edges are the same as in the larger contact clip and, therefore, need no further description.

The rotor comprises an insulating disc 55, having a non-circular aperture 56 to permit the non-circular portion of shaft 1 to rotatively engage said rotor but permit transverse movement to compensate for manufacturing inequalities in the switch section spacing means as described and claimed in Patent No. 2,012,492 to Arnold and Dunn. Insulating rotor disc 55 is provided with a plurality of apertures 57 symmetrically dis-

posed with respect to shaft 1. A plurality of rotor contacts 60 and 61 are carried by disc 55. These rotor contacts are of any desired angular extent and may be of any number. Since all the rotor contacts are alike except for their angular extent, a detailed description of contact 50 will suffice. This contact comprises a circular band 62, having a plurality of inwardly disposed tongues 63 at spaced intervals. Tongues 63 pass through apertures 57 and are bent over at 64 against insulating portion 55. Band 62 is provided with two or more tongues 65 and 66 extending outwardly therefrom and of any desired angular extent. It will be noted that certain of the contacts, such as contact 33, does not extend inwardly toward shaft 1 as far as other of the contacts, such as 34. By disposing outwardly extending tongues 65 and 66 in predetermined relationship with respect to the various contact lengths, a selective switching action may be obtained.

Referring to Figure 9, the advantages of the shaping of the contacts 33 and 34 will be evident. Rotor contact 60 is made of soft brass with a thin coating of silver. The stator contacts are preferably of springy material such as spring brass or phosphor bronze, also silver plated. Wearing of the softer rotor contact 60 will permit parts 41 of the stator contact to lie along the rotor contact and keep opposing fresh silver edges together. This contact surface provides a constant contact resistance over a long life.

Referring to Figures 6 and 7, switching section 70 is shown in detail. This switching section has stator and rotor contacts on opposite sides thereof.

Referring to Figures 6 and 7, stator disc 71 is preferably identical with stator 26 of switching section 25. On one side of section 70, as shown in Figure 6, a plurality of contacts 72 and 73 may be mounted as in Figure 2. The other side of this switching section shown in Figure 7 carries additional contacts 74 and 75.

Referring to Figure 8, it will be noted that a pair of contacts 76 and 77 may be carried by one eyelet 78, or one contact 79 only need be maintained by an eyelet 80. Rotor contacts 81, similar to the rotor contacts described in Figures 2 and 3, may be carried on one side of rotor disc 82, while electrically distinct rotor contacts 83 may be carried on the opposite side of the rotor disc 82, it being understood, of course, that the inwardly extending fingers 84 and 85 of the respective contacts extend through different apertures in rotor disc 82.

In order to limit the operation of the switch between predetermined positions and force the switch sections to assume one of a number of definite positions, an indexing mechanism is provided on front plate 3. Front plate 3 is provided with a plurality of struck-up portions 90 disposed on the circumference of a circle with respect to shaft 1. Rigidly carried by shaft 1 immediately behind front plate 3 is a rigid cross member 92, having arms 93 and 94. This cross member 92 is preferably maintained in position by a C washer 95 engaging shaft 1 in a groove thereof, cross member 92 being prevented from rotating relative to shaft 1 by non-circular cross section of shaft 1 and a corresponding aperture through cross arm 92. The central portion of cross arm 92 is provided with a finger 96 which is adapted to play between two indentations 97 and 98 on front plate 3, spaced apart a predetermined angular distance. Finger 96 can only travel between indentations 97 and 98 and functions as a stop mechanism for the entire switch. Between cross arm 92 and front plate 3 a spring member 100 is disposed. This member has its central portion cut out to leave an irregularly shaped rim. The portion of spring 100 immediately below arms 93 and 94 is widened and is provided with apertures 101 and 102 which are engaged by fingers depending from arms 93 and 94 and extending thereinto. These fingers and apertures, it will be noted, clear the series of indentations 90 of plate 3. Spring 100 narrows as the distance from the arms 93 and 94 increases until at right angles to said cross arms this spring flares out to form regions 105 and 106 extending inwardly down toward shaft 1. These regions 105 and 106 are provided with elliptical apertures at 107 and 108, these apertures being directly above the series of struck-up portions 90. Below the spring are two ballbearings 109 and 110 positioned in apertures 107 and 108 of the spring and adapted to ride over and between struck-up portions 90 of front plate 3. It will be noted that the region 115 of spring 100 on each side of regions 105 and 106 is so narrow in comparison with these portions that the center of apertures 107 and 108 is nearer to shaft 1 than region 115 with the result that when the ballbearings 109 and 110 ride on top of struck-up portions 90, the ball retaining regions 105 and 106 remain substantially parallel with respect to front plate 3 and do not tend to tilt outwardly in such a way as to throw out the ballbearings. Furthermore, because of the elliptical shape of apertures 107 and 108, the ballbearings are gripped at only two points, reducing the friction and permitting the balls to roll as the index arm is turned.

We claim:

1. In an electric switch, a switching section removable and replaceable as a unit comprising a flat insulating stator construction having a free central region cut out therefrom, contacts mounted thereon on both sides thereof and having active contact portions extending into said free region, each active contact portion comprising a pair of spring jaws adapted to open in a direction perpendicular to the stator plane, the contact jaws on each side of the stator operating in a plane parallel to the stator plane, an insulating rotor disposed within said free region and provided with a series of apertures therethrough near the edge thereof and with a central aperture for engagement with a shaft, flat contacts disposed on opposite sides of said rotor, the contacts on each side lying in the plane of operation of the stator contacts cooperating therewith, each of said contacts having the general shape of an annular segment with the active portion extending beyond the rotor and freely accessible to the stator jaws, each contact having attaching portions overlying certain of said apertures and having other portions clearing at least one of said apertures, means passing through said certain apertures for retaining said contact on said rotor, the retaining means for opposing contacts being staggered and the contact unsupported by any retaining means being clear thereof.

2. In an electric switch, a switching section removable and replaceable as a unit comprising a flat insulating stator having an interior portion cut out therefrom, a series of contacts mounted thereon around said cut out portion, each contact having a pair of spring jaws adapted to open in a direction perpendicular to said stator plane, a flat circular insulating rotor, dis-

posed within said cut out region, said rotor having a non-circular aperture through the central portion thereof for engagement with a shaft and also a series of apertures therethrough disposed near the outer portion thereof, flat contacts disposed on at least one side of said rotor, said contacts having the general shape of an annular segment lying in a plane parallel to the stator plane between the stator contact jaws, said contacts extending beyond said rotor edge and having portions disposed to clear certain apertures and overlie other apertures and means passing through said other apertures for retaining said extensions on said rotor.

3. In an electric switch, a switching section removable and replaceable as a unit comprising a flat insulating stator construction having a free central region cut out therefrom, contacts mounted thereon on both sides thereof and having active contact portions extending into said free region, each active contact portion comprising a pair of spring jaws adapted to open in a direction perpendicular to the stator plane, the jaws of the contacts on one side of the stator operating in one plane parallel to the stator plane and the jaws of the contacts on the other side operating in a spaced parallel plane, an insulating rotor disposed within said free region and provided with a non-circular aperture for engagement with a rotatable shaft and a series of apertures therethrough near the outer portion thereof, flat contacts disposed on opposite sides of said rotor, the contacts on each side thereof lying in the plane of operation of the cooperating stator contacts, said contacts having the general shape of an annular segment and having the active portions thereof extending beyond said rotor edge and having spaced extensions from the inner edge going through certain rotor apertures for retaining said contact and having portions clearing other apertures, the extensions of one contact being angularly staggered with respect to the extensions of the opposing contact and coinciding with the clearances of the opposing contact.

4. In an electric switch having a stator with a series of contacts carried thereby, a rotor comprising an insulating disk apertured to accommodate a shaft for turning the same, said disk having a series of regularly spaced apertures around said shaft aperture, and at least one contact carried by said rotor, said contact being flat and lying in a plane parallel with the disk and near the disk edge and having the general shape of an annular segment of desired angular extent necessary to cooperate with the stator contacts and having attaching portions overlying at least two of said apertures and having other portions clearing at least one other aperture and means passing through said two apertures for rigidly maintaining said contact on said disk.

5. In an electric switch having a stator with a series of contacts carried thereby, a rotor comprising an insulating disk apertured to accommodate a shaft for turning the same, said disk having a series of regularly spaced apertures around said shaft aperture, and at least one contact carried by said rotor, said contact being flat and lying in a plane parallel with the disk and near the disk edge and having the general shape of an annular segment of desired angular extent necessary for cooperation with the stator contacts, said contact extending beyond the disk edge and having attaching portions overlying at least two of said apertures and having other portions clearing at least one other aperture, and means passing through said two apertures for rigidly maintaining said contact on said disk.

6. In an electric switch having a stator with a series of contacts carried thereby, a rotor comprising an insulating disk apertured to accommodate a shaft for turning the same, said disk having a series of regularly spaced apertures around said shaft aperture, and at least one contact carried by said rotor, said contact being flat and lying in a plane parallel with the disk and near the disk edge and having the general shape of an annular segment of desired angular extent necessary to cooperate with the stator contacts and having its inner edge beyond said apertures and having extensions from said inner edge reaching certain non-adjacent apertures but leaving intervening apertures free and means passing through said certain apertures for rigidly maintaining said contact on said disk.

7. In an electric switch having a stator with a series of contacts carried thereby, a rotor comprising an insulating disk apertured to accommodate a shaft for turning the same, said disk having a series of regularly spaced apertures around said shaft aperture, and at least one contact carried by said rotor disk, said contact being flat and lying in a plane parallel with the disk and near the disk edge and having the general shape of an annular segment of desired angular extent necessary for cooperation with the stator contacts and having the outer edge project beyond the disk edge with the inner edge beyond the apertures and having extensions from said inner edge reaching certain non-adjacent apertures but leaving intervening apertures free, and means passing through said certain apertures for rigidly maintaining said contact on said disk.

8. In an electric switch having a stator carrying a series of contacts, a rotor comprising an insulating disk apertured for a shaft for turning the same, said disk having a series of regularly spaced apertures near the edge thereof, and at least one contact carried by said disk, said contact being flat and lying in a plane parallel with the disk and near the disk edge and having a generally annular shape of desired angular extent necessary for cooperation with the stator contacts, said rotor contact having its outer portion projecting beyond the disk edge and the inner portion having regularly spaced attaching portions overlying certain non-adjacent apertures and clearing intermediate apertures, and means passing through said non-adjacent apertures for maintaining said contact rigidly on said disk.

9. In an electric switch, a switching section comprising a flat insulating stator having an interior portion cut out therefrom, a series of contacts mounted thereon on both sides thereof around said cut out portion, each contact having a pair of spring jaws adapted to open in a direction perpendicular to the stator plane, a flat insulating rotor disk of substantially the same thickness as the stator disposed within the cut out region and being apertured to accommodate a shaft for turning the same, said disk having a series of regularly spaced apertures near the edge thereof, at least one contact on each side of said disk, each contact being flat and lying in a plane parallel with the disk and near the disk edge and having the general shape of an annular segment of desired angular extent for cooperation with the stator contacts on the same side thereof, said rotor contacts projecting beyond the disk

edge and movable between the contact jaws, each contact having portions overlying certain apertures, the overlying portions of opposing contacts being staggered and each contact clearing those apertures which the opposing contact overlies, and means passing through said certain apertures and engaging the overlying parts of each contact for rigidly maintaining the opposing contacts in insulating relation to each other on the disk.

10. In an electric switch having a stator with a series of contacts carried thereby, a rotor comprising an insulating disk apertured to accommodate a shaft for turning the same, said disk having a series of regularly spaced apertures around said shaft aperture, and at least one contact carried by said rotor, said contact being flat and lying on its flat side near the disk edge and having the general shape of an annular segment of desired angular extent necessary to cooperate with the stator contacts and having attaching portions overlying at least two non-adjacent apertures and having other portions clearing at least one intervening aperture and means passing through said two apertures for rigidly maintaining said contact on said disk.

11. In an electric switch having a stator with a series of contacts carried thereby, a rotor comprising an insulating disk apertured to accommodate a shaft for turning the same, said disk having a series of regularly spaced apertures around said shaft aperture, and at least one contact carried by said rotor, said contact being flat and lying on its flat side near the disk edge and having the general shape of an annular segment of desired angular extent necessary for cooperation with the stator contacts, said contact extending beyond the disk edge and having attaching portions overlying at least two non-adjacent apertures and having intervening portions clearing at least one other aperture, and means passing through said two apertures for rigidly maintaining said contact on said disk.

12. In an electric switch having a stator with a series of contacts carried thereby, a rotor comprising an insulating disk apertured to accommodate a shaft for turning the same, said disk having a series of regularly spaced apertures around said shaft aperture, and at least one contact carried by said rotor, said contact being flat and lying on its flat side near the disk edge and having the general shape of an annular segment of desired angular extent necessary to cooperate with the stator contacts and having its inner edge beyond said apertures and having extensions from said inner edge reaching certain non-adjacent apertures but leaving intervening apertures free and means passing through said certain apertures for rigidly maintaining said contact on said disk.

13. In an electric switch having a stator with a series of contacts carried thereby, a rotor comprising an insulating disk apertured to accommodate a shaft for turning the same, said disk having a series of regularly spaced apertures around said shaft aperture, and at least one contact carried by said rotor disk, said contact being flat and lying on its flat side near the disk edge and having the general shape of an annular segment of desired angular extent necessary for cooperation with the stator contacts and having the outer edge project beyond the disk edge with the inner edge beyond the apertures and having extensions from said inner edge reaching certain non-adjacent apertures but leaving intervening apertures free, and means passing through said certain apertures for rigidly maintaining said contact on said disk.

14. In an electric switch having a stator carrying a series of contacts, a rotor comprising an insulating disk apertured for a shaft for turning the same, said disk having a series of regularly spaced apertures near the edge thereof, and at least one contact carried by said disk, said contact being flat and lying on its flat side near the disk edge and having a generally annular shape of desired angular extent necessary for cooperation with the stator contacts, said rotor contact having its outer portion projecting beyond the disk edge and the inner portion having regularly spaced attaching portions overlying certain non-adjacent apertures and clearing intermediate apertures, and means passing through said non-adjacent apertures for maintaining said contact rigidly on said disk.

15. In an electric switch, a stationary insulating member having a series of fixed contacts carried thereby, a flat thin movable insulating member having an edge, means for moving said thin member in its own plane, said member having a series of regularly spaced apertures parallel to said edge along the line of motion, and at least one contact carried by said movable member, said contact being flat and lying in a plane parallel to said thin member and being normally movable in its own plane, said contact having a length suitable for cooperation with the fixed contact and having attaching portions overlying at least two non-adjacent apertures and having other portions clearing at least one intervening aperture and means passing through said two apertures for rigidly maintaining said contacts on said movable member.

16. The structure of claim 15 wherein said movable contact has an active contacting portion extending beyond the edge of said movable member.

17. In an electric switch, a stationary insulating member having a series of fixed spring contacts carried thereby, each contact having a pair of opposed jaws, a thin flat movable insulating member having an edge, means for moving said movable member in its own plane, said member having a series of regularly spaced apertures parallel to said edge along the line of motion, at least one flat rigid contact carried by said movable member, said contact having a length suitable for cooperation with the fixed contacts and lying in a plane parallel to said thin member and being normally movable in its own plane and slidable between the jaws of said fixed contacts, said movable contact having an active contacting portion extending beyond said edge and engageable by said jaws, said movable contact also having attaching portions overlying at least two non-adjacent apertures and having other portions clearing at least one intervening aperture and means passing through said two apertures for rigidly maintaining said movable contact on said movable member.

18. The structure of claim 17 wherein at least two movable contacts are provided, one on each side of said movable member with each movable contact having its fastening means staggered with respect to the fastening means of the other movable contact and wherein said stationary member has two series of fixed contacts cooperating respectively with said two rigid contacts.

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