

Oct. 24, 1939.

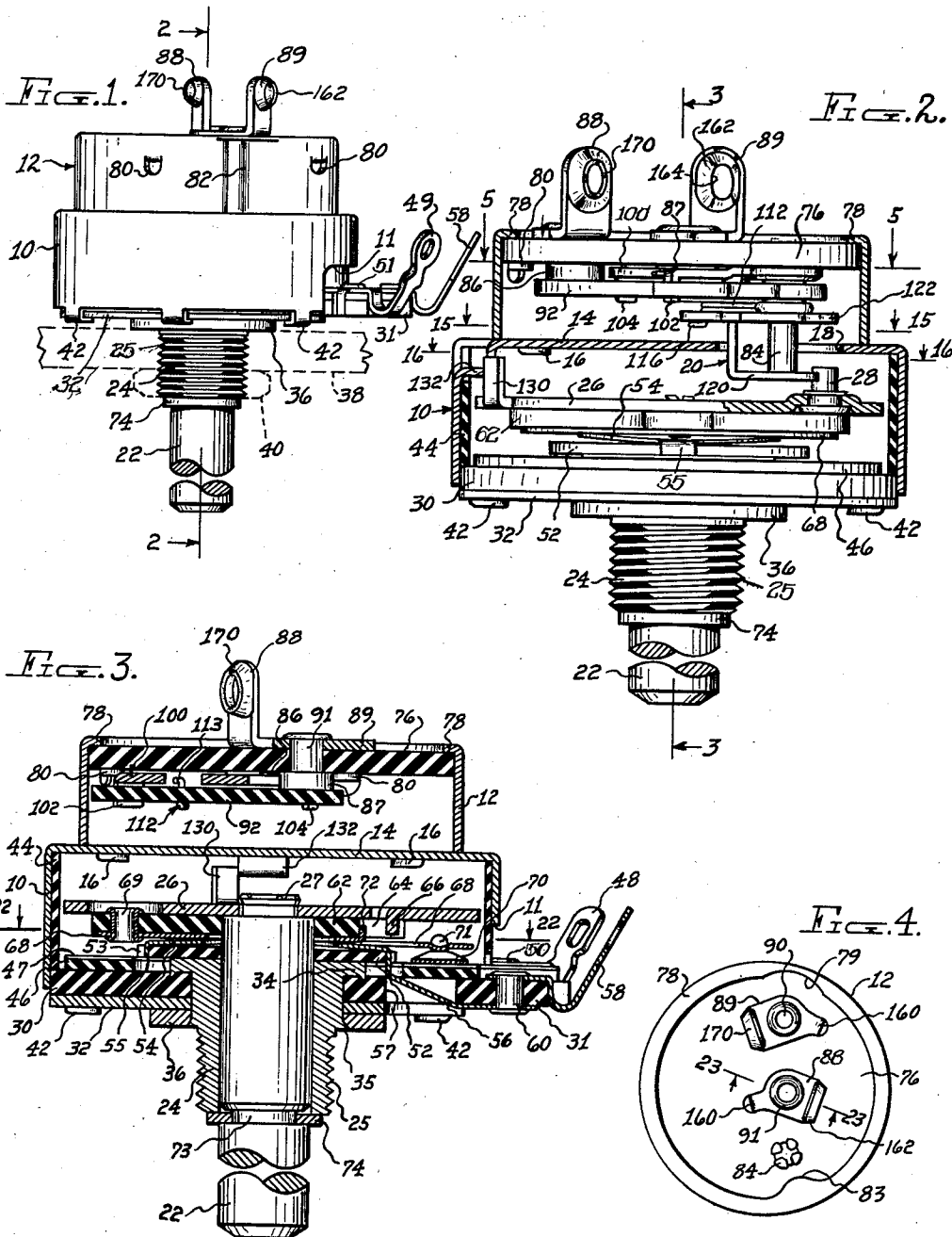
N. C. SCHELLENGER

2,177,284

SWITCH

Filed June 6, 1936

4 Sheets-Sheet 1



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N. C. SCHELLENGER

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SWITCH

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4 Sheets-Sheet 2

FIG. 5.

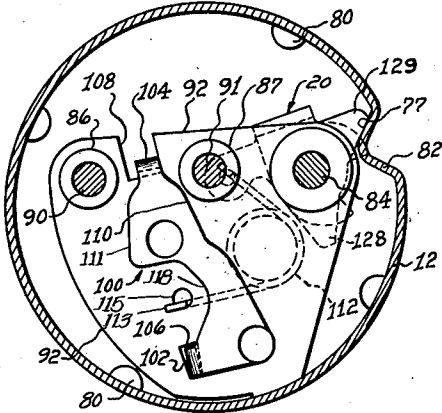


FIG. 6.

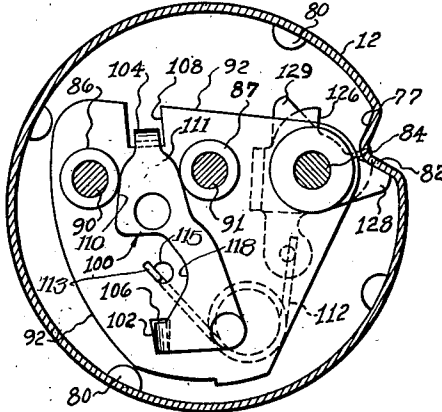


FIG. 7.

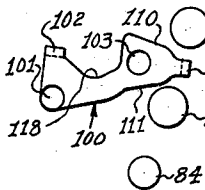


FIG. 8.

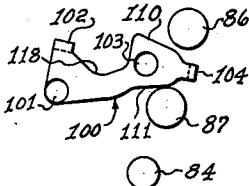


FIG. 9.

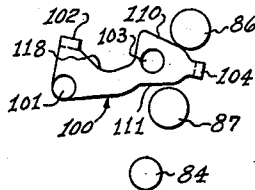


FIG. 10.

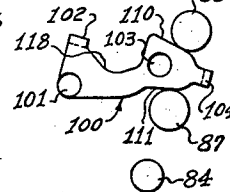


FIG. 11.

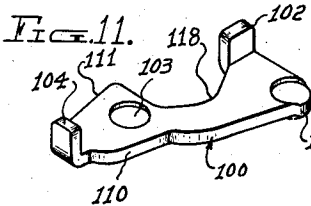


FIG. 12.

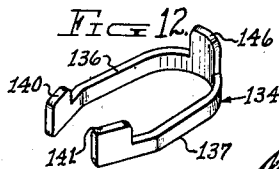


FIG. 13.

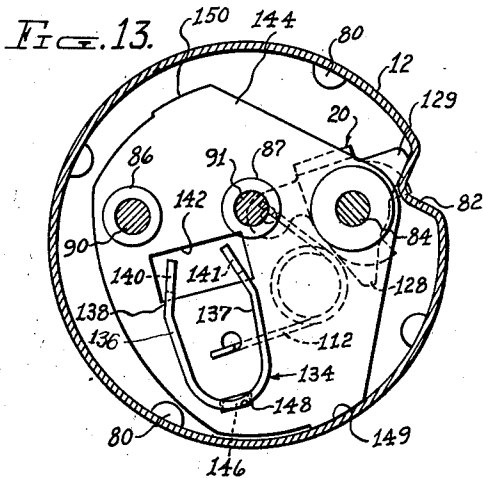
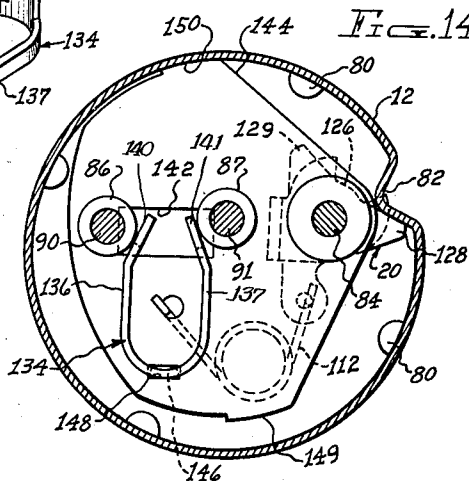


FIG. 14.



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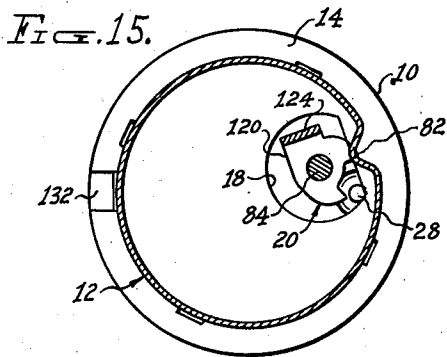
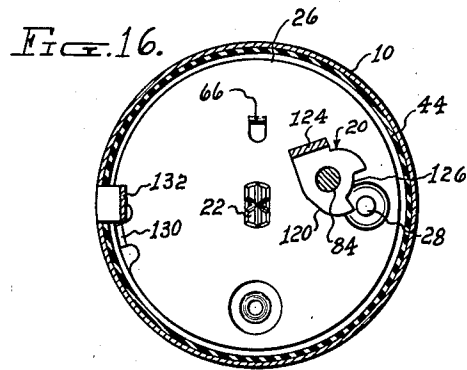
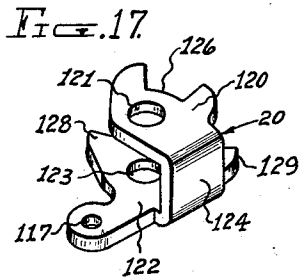
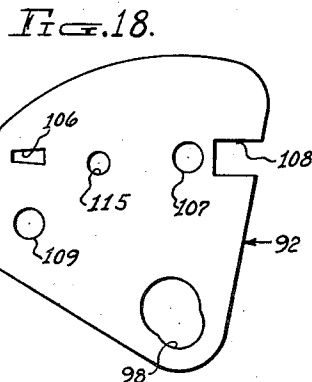
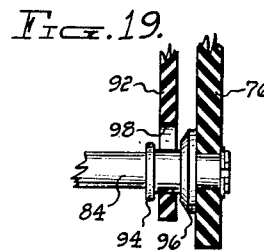
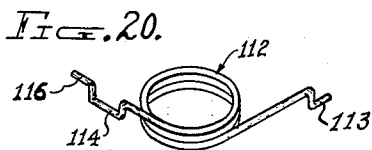
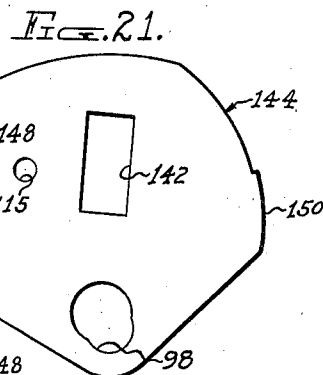
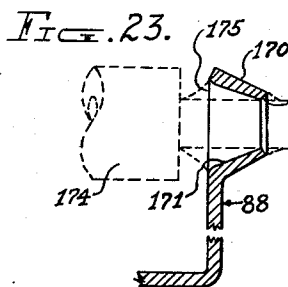
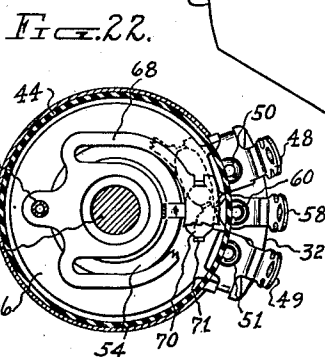
N. C. SCHELLENGER

2,177,284

SWITCH

Filed June 6, 1936

4 Sheets-Sheet 3



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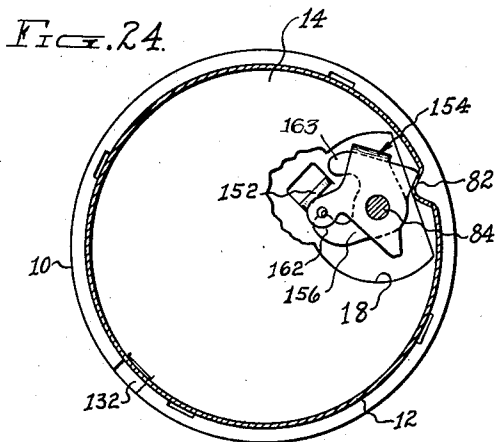
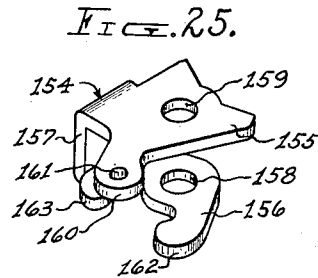
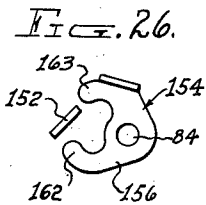
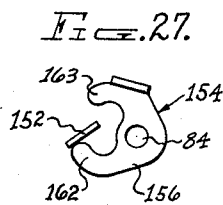
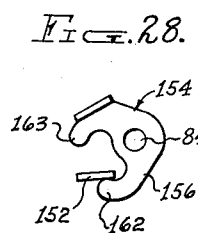
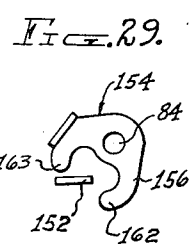
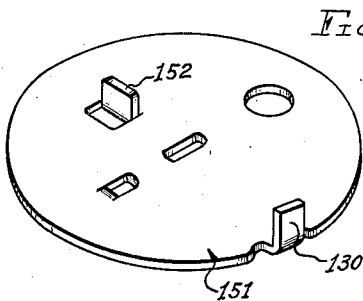
N. C. SCHELLENGER

2,177,284

SWITCH

Filed June 6, 1936

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,177,284

SWITCH

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Application June 6, 1936, Serial No. 83,963

17 Claims. (Cl. 200—67)

This invention relates to a new and improved switch construction and more particularly to a switch especially adapted for use in connection with low voltage currents at relatively high power loads.

While my improved switch may be used for controlling any electrical circuit which does not exceed the power carrying capacity of the switch it is especially adapted for use with automobile radio sets to control the current supplied to the set. The switch may be used and operated independently of other circuit controls, but it is especially adapted for joint operation with the variable high resistance used as a volume control in such sets.

Automobile radio sets are designed and manufactured to have a very high sensitivity which is required by the comparatively small antennas with which they are operated. Recently because of the use of the so-called "turret top" or one-piece metal top on automobiles, the antennas have been placed under the car or under the running board where they are smaller than those formerly used in car tops, and also are less effective due to closer proximity to ground. For these reasons automobile radios are now made with an even higher degree of sensitivity.

Automobile radio receivers are also subjected to much more severe conditions as to temperature, vibration and humidity than usual house receivers. Automobile receivers are subjected to wide temperature variations from extremes of cold to very high temperatures when they are located adjacent or in the engine compartment of the car. They are not only subjected to severe road shocks but to continuous vibration during the operation of the car.

With highly sensitive receivers operating from low voltage current supplies, it is essential that the switch controlling the current be of low resistance character, but that the resistance remain constant not only during the shocks and vibrations during use, but also during the effective life of the set. The contact pressure must be adequate to prevent the slightest variation in contact resistance during use.

The highly sensitive automobile radio must also be shielded from the high frequency disturbances set up by the ignition system of the automobile. Since the ignition system and the radio are operated from the same battery, these disturbances must be prevented from reaching the sensitive set circuits through the power supply lines. An even more important factor in automobile radios and also a factor in certain types of home radios

which are now designed to operate entirely from a six volt battery is the interference created by the vibrator type of high voltage supply for the radio set. This type of high voltage supply includes a vibrator which breaks up the six volt primary of a step-up transformer into a very rough wave form which is also, of course, present in the high voltage secondary circuit. The switch which controls the current supply to the heaters or filaments of the tubes controls the six volt supply to the vibrator and as a result, any resistance in series with these two circuits will cause a voltage drop due to each component. The voltage drop due to the vibrator component will have the same wave form as the current and will be impressed upon the leads going into the heaters or filaments of the tubes and will thus convey interference into the set. This effect can be minimized or substantially eliminated by the use of a low resistance switch. This rough wave form will further cause an electrostatic transfer from the switch to the volume control unless adequate shielding between them is provided.

With many types of combination switches and variable resistances now in use, the switch cam is formed of metal and is insulated both from ground and from the current carrying portions of the switch when the switch is in the closed position. While shielding is interposed between the current carrying portions of the switch and the resistance, there is none interposed between the current carrying portion of the switch and the cam and none between the cam and the variable resistance. This means that the metal cam structure can act as a transfer agent from the switch enclosure to the volume control enclosure by the process of re-radiation, minimizing to a certain extent the effectiveness of the switch shield.

It is an object of the present invention to provide a new and improved switch construction.

It is a further object to provide a construction in which a solid bridge member is firmly wedged between solid fixed contacts.

It is also an object to provide a construction in which the bridging contact and fixed contacts are designed to give angles of engagement such as to maintain a firm and even contact under severe conditions of vibration and shock.

It is an additional object to provide a construction of this character operated with a snap action and with a spring thrust urging the bridging member into wedging engagement between fixed contacts.

It is a further object to provide contacts of

such angularity relative to the spring thrust that the contact pressure is of a high order.

It is also an object to provide a construction in which the movable contact is loosely mounted on a switch arm whereby it is self-aligning and automatically compensates for wear as well as providing a wiping contact.

It is an additional object to provide a construction in which the spring thrust and contact relationship provide a substantially uniform contact between the movable contact and each of two fixed contacts.

It is a further object to provide a shield construction in combination with such a switch.

It is another object to provide a switch construction in which the switch operating cam serves as a portion of the shield between the switch and variable resistance.

It is also an object to provide a switch adapted for support upon a flat base member.

It is an additional object to provide a switch composed of but few and simple parts and adapted for easy assembly.

It is another object to provide a switch which is comparatively inexpensive to manufacture and adapted for commercial production and use.

Other and further objects will appear as the description proceeds.

I have shown certain preferred embodiments of my invention in the accompanying drawings, in which—

Figure 1 is a view in elevation showing the improved switch applied to a variable resistance;

Figure 2 is a view of the combination of Figure 1 on a somewhat larger scale and taken substantially on line 2—2 of Figure 1, with the housing members in section, the variable resistance shield disc partly in section, and the remaining parts shown in elevation;

Figure 3 is a section of the combination device of Figure 2 taken substantially on line 3—3 of Figure 2;

Figure 4 is a plan view of the switch housing assembly shown in Figure 1;

Figure 5 is a section taken on line 5—5 of Figure 2, with the switch in open position;

Figure 6 is a view similar to Figure 5 but showing the switch in closed position;

Figures 7, 8, 9 and 10 are diagrammatic plan views of the fixed and movable switch contacts showing progressively the engagement between the movable and fixed contacts;

Figure 11 is a perspective view of the movable contact member used in the forms of construction shown in Figures 1 to 10 inclusive;

Figure 12 is a perspective view of a modified form of movable contact member;

Figure 13 is a sectional view similar to Figure 5 but showing the movable contact of the form shown in Figure 12, the switch being in open position;

Figure 14 is a view similar to Figure 13, but showing the switch in closed position;

Figure 15 is a section taken on line 15—15 of Figure 2;

Figure 16 is a section taken on line 16—16 of Figure 2;

Figure 17 is a perspective view of the switch actuating member;

Figure 18 is a plan view of the switch arm;

Figure 19 is a fragmentary section showing the mounting of the switch arm on its pivot member;

Figure 20 is a perspective view of the switch spring;

Figure 21 is a view similar to Figure 18 but

showing the switch arm for use with the form of movable contact shown in Figure 12;

Figure 22 is a transverse section on a reduced scale taken on line 22—22 of Figure 3, and showing the contact arm partly broken away;

Figure 23 is a fragmentary section on an enlarged scale showing the soldering end of the connecting lugs;

Figure 24 is a transverse sectional view generally similar to Figure 15 but showing a modified form of switch actuating member;

Figure 25 is a perspective view of the switch actuating member shown in Figure 24;

Figures 26, 27, 28 and 29 are plan views showing progressively the engagement of the operating member with the switch actuating member of the type shown in Figures 24 and 25; and

Figure 30 is a perspective view of the variable resistance movable shield showing the switch operating lug and stop lug.

Referring first to the form of construction shown in Figures 1 to 11 inclusive, the variable resistance unit is provided with the housing 10, which supports the switch housing 12. The housing 10 is a cup-shaped member having a top portion 14 which serves as a fixed metallic shield between the switch and the variable resistance. The switch housing 12 is provided with a plurality of ears 16 which extend through elongated perforations in the top portion 14 of the housing 12, and are turned over against the under face of the portion 14 to firmly secure the switch housing in place upon the variable resistance housing.

This connection between the switch housing 12 and variable resistance housing 10 also serves to electrically connect the two housings. The intermediate shield portion 14 of the housing 10 is provided with the opening 18 through which the switch cam 20 projects.

The variable resistance device is controlled by the shaft 22 which is journaled in the thimble 24 and carries the disc 26 which is retained on the inner end of the shaft 22 by the swaged inner end 27 of the shaft. The rotating disc 26 carries the switch operating pin 28 which coacts with the switch cam 20.

The base 30 of the variable resistance device is formed of sheet insulating material and the metal shield plate 32 is carried upon its outer face. The flange 34 on the inner end of the thimble 24 engages the inner face of the base 30 and the portion 35 of the thimble retains the washer 36 against the outer face of the plate 32, to retain the base elements in assembled relation. The assembled unit may be supported on a panel or chassis flange indicated in broken lines 38 on Figure 1 by means of a nut 40, screwed upon the threaded portion 25 of the thimble 24.

As will be seen in Figures 1 to 3 inclusive, the major portion of the cylindrical flange of the housing 10 extends beyond the edge of the base member 30 and the housing 10 is provided with ears 42 which are bent over against the plate 32 to secure the housing 10 to the base 30. The insulating strip 44 extends around the inner face of the cylindrical wall of housing 10 and serves to space the shield wall 14 at a predetermined distance from the base 30. The base 30 is provided with an extended portion 31 to carry the terminals and the housing 10 is cut away at 11 as shown in Figures 1 and 3 to clear the extended portion 31 and the terminals. The insulating strip 44 substantially closes the cut away portion 11. The lateral edges of this portion 11

engage the edges of the extended portion 31 of the base and thus have the function of definitely and permanently locating the housing 10 and the switch supported thereby, relative to the base.

5 The arcuate strip 46 carries the film or layer of resistance material 47. This strip 46 may be formed of paper, fibre, sheet Bakelite or similar material and is secured to the base 30 by the terminals 48 and 49 and the rivets 50 and 51.
10 The insulating washer 52 fits about the shaft 22 against the inner end of the thimble 24 and carries a collector ring 54 which has a downturned locating lug 55 extending into the notch 53 of washer 52 as shown in Figure 3. The ring 54 is also provided with the connecting extension 56 which passes downwardly through the opening 57 in the base 30. The center terminal 58 is connected to the extension 56 by means of the rivet 60 which passes through the extended portion 31 of the base 30.

20 The insulated contactor drive disc 62 is mounted upon shaft 22 below the metallic disc 26 and is provided with a notch 64 into which extends the downturned lug 66 on the disc 26. The interengagement of this lug 66 and notch 64 causes the disc 62 to rotate with the shaft 22 and disc 26. The contact drive arm member 68 is secured to the under side of the disc 62 by means of rivet 69 and engages the collector ring 54. The contactor 70 is provided with the upstanding ears 71 by means of which it is driven by member 68. The member 68 is provided with an upturned lug 72 which engages in the notch 64 of disc 62 to assist the rivet 69 in properly locating the member 68 relative to disc 62 and shaft 22. The shaft 22 has the groove 73 formed therein to receive the C washer 74 which serves to maintain the parts in assembled relation.

40 The switch base 76 is held in the switch housing 12 by means of the inturned flanged 78 on the outer edge of the housing and by the inturned lugs 80 which engage the inner face of the base. The flange 78 is cut away at 79 to provide ample clearance between the flange and the terminal 89. The base 76 is notched at 77 to engage the inwardly bent portion 82 of the housing 12 as shown in Figures 5 and 6. The flange 78 is extended at 83 to cover this portion 82. The indented portion 82 of the housing serves not only as a stop and grounding contact for the switch cam 20 but also serves to positively locate the base 76 relative to the housing 12.

50 The pivot member 84 is riveted in place in the base 76 and supports the switch cam 20. The fixed contacts 86 and 87 are riveted to the base 76 by means of reduced extended portions 90 and 91 which also serve to rivet in place the connecting lugs 88 and 89 on the outer face of the base member. The fixed contacts 86 and 87 are cylindrical in form and may be silver plated or otherwise treated to reduce contact resistance.

60 As shown in detail in Figure 19, the switch pivot 84 carries the switch arm 92 which fits between the enlarged portion 94 of the pivot and the pivot flange 96 which engages the inner face of the base 76. As shown in Figures 18 and 19 the switch arm 92 has the keyhole type of opening 98 formed therein so that it may be readily assembled over the pivot enlargement 94.

70 The elongated movable contact member 100 is carried between the switch arm 92 and the base 76. This member 100 is of a thickness less than the height of the fixed contacts 86 and 87 and consequently fits somewhat loosely between
75 the switch arm and base since the switch arm is

held away from the base by the fixed contacts. The movable or bridging contact member 100 is provided with the depressed portions 101 and 103 as best shown in Figure 11, these portions serving as reduced sliding contacts in engagement with the base 76. The contact member 100 is further provided with an upturned pivot lug 102 which fits in an opening 106 in the switch arm 92. The member 100 also has the upturned lug 104 which fits in the notch 108 in the arm 92. The opening 106 is sufficiently larger than the pivot lug 102 so as to permit the contact member to swing freely through an arc limited by the relative sizes of the lug 104 and the notch 108. This arcuate movement is designed to be adequate to permit free movement of the contact during seating engagement as shown progressively in Figures 7, 8, 9 and 10. In order to reduce frictional contact between the switch arm 92 and the movable contact 100, the arm is provided with small depressed portions 107 and 109, shown in Figure 18. Thus the bridging contact is free to swing and to adjust itself between the base 76 and the switch arm 92 and to properly engage the two fixed contacts.

25 From a consideration of Figures 5 and 6 it will be seen that the tendency for the contact portion of the member 100 to be thrown outwardly by centrifugal force during the rapid closing movement is opposed by engagement of the bearing portion 101. The contact engaging surfaces 110 and 111 of the member 100 are placed in such angular relation to each other that while the surfaces progressively engage the fixed contacts as shown in Figures 7 to 10 inclusive, there is no tendency for the member to bounce or vibrate when it reaches the closed position, thus causing arcing and also noises in the radio. Further, the angle between these surfaces is not so small that the contactor wedges and sticks. It has been found that to accomplish these results the angle between the surfaces should be between twenty and forty degrees. The bridging contact member 100 is cut away at 118 to provide clearance for the end 113 of the switch spring and to permit this spring to be connected to the arm 92 at a point intermediate the pivot 102 of member 100 and the contact portions 110 and 111 so that the thrust is transmitted without lateral bias to equalize the pressure against the two fixed contacts.

50 The switch actuating spring 112, shown in detail in Figure 20, is provided with a plurality of turns and with a downturned end 113 which is hooked into a perforation 115 in the switch arm 92. The opposite end has an offset portion 114 substantially equal in depth to the thickness of the several turns of the spring. The end 116 of the spring 112 is hooked through the opening 117 in the switch cam 20, extending above this portion of the cam while the adjacent portion fits into the offset portion 114. This construction permits an efficient multi-turn coil spring which takes up but little space. By reason of the offset ends and intermediate portion, the down thrust or bias due to the spring is minimized and the friction of the arm 92 against the top of the fixed contacts 86 and 87 is reduced.

65 The switch cam 20 is formed as a unitary metal member which is U-shaped, with an upper leg 120, a lower leg 122 and a connecting portion 124. The lower leg 122 has an opening 123 which fits on the pivot 84 adjacent the enlargement 94. This portion is also provided with the opening 117 receiving the end of the spring 112. The
75

lower leg 122 has formed thereon the lugs 128 and 129 which alternately engage the portion 82 of the switch housing 12 so that the switch cam is grounded to the housing in both the on and off positions of the switch.

The upper leg 120 is provided with an opening 121 which fits on the pivot 84. The openings 121 and 123 are in alignment and give the cam 20 a double bearing on the pivot so that it operates freely and without binding.

The snap switch is operated by the spring toggle action in the usual manner. Referring to Figures 5 and 6, Figure 5 shows the switch in the off position, while Figure 6 shows it in the on position. When the cam 20 in Figure 5 is rotated in the counterclockwise direction, the coil spring 112 is compressed. As the end of the spring 112, which is connected to the cam 20, passes beyond the line joining the pivot 84 and the point where the end 113 of the spring 112 engages the switch arm 92, the energy stored in the spring snaps the arm 92 in the clockwise direction about the pivot 84, which movement is stopped when the surfaces 110 and 111 on the bridging member 100 engage the fixed contacts 90 and 91. The action of spring 112 carries the parts to the position shown in Figure 6. The action on opening the switch is exactly the reverse of that described. When the spring gets beyond dead center the switch arm is snapped back to the open position in Figure 5.

I have shown a modified form of construction of switch arm and bridging contact member in Figures 12, 13, 14 and 21. The bridging contact member 134 is generally U-shaped in form and is formed of resilient metal which may be silver plated or otherwise treated to afford low resistance contacts. The member 134 is provided with the spaced legs 136 and 137, each terminating in inwardly inclined end, these ends being provided with the upwardly extending lugs 140 and 141 respectively. The intermediate portion of the U is formed with an upwardly projecting lug 146.

Referring now particularly to Figure 21, the switch arm 144 is formed of sheet Bakelite or similar non-conducting material, and is provided with a keyhole opening 98 for engagement with the pivot 84 and with a perforation 115 for engagement with the spring 112 in the same manner as the form of construction shown in Figure 18. The member 144 is provided with an enlarged opening 142 which receives the upwardly extending lugs 140 and 141 of the member 134. In addition, the switch arm 144 is provided with the opening 148 to receive the pivot lug 146 of the member 134. It will be understood that the intermediate portions of the legs 136 and 137 are of less height than the fixed contact members 86 and 87, so that the member 134 fits somewhat loosely between the base 76 and the switch arm 144. The member 134 has comparatively small areas in contact with these members and therefore moves with very slight frictional resistance. The switch arm 144 is provided with two portions 149 and 150 which, as shown in Figures 13 and 14, engage the inner wall of the housing 12 in the switch open and closed positions respectively. The portion 150 by its engagement with the housing 12 limits the extent of the compression of the two legs 136 and 137 of the bridging contact member. With the solid bridging member as shown in the forms of construction of Figures 1 to 11, no stop is provided in the closed position of the switch other than

the engagement of the bridging member with the fixed contacts. With the resilient bridging member of Figures 12, 13, and 14 it may be desirable to provide this stop 150 to limit the extent of the resilient compression of the member.

As shown in Figures 13 and 14, the remainder of the switch construction when using the bridging contact 134 is the same as that used in the first form of construction described. The spring 112 and cam 20 are formed and operate in the same manner to drive the switch arm. The spring connection with the switch arm is intermediate the pivot 146 of the bridge member and the contact portions of the member, and provides a drive which equalizes the thrust upon the two fixed contacts.

In Figures 24 to 29 inclusive, I have shown a modified form of switch operating cam which differs from the form of cam of the earlier figures in that the cam is actuated by a member operating on a smaller circular arc between the pivot and the center of rotation, instead of between the pivot and the outer periphery of the switch assembly.

As shown in Figure 24, the housings 10 and 12 and the perforation 18 in the shield 14 are the same as in the prior form of construction. Also the pivot 84 is provided and the inwardly extended portion 82 of the housing 12 is used as before to serve as a grounding stop for the cam. The disc 151 is mounted on the shaft of the variable resistance in the same manner as the disc 26 of Figures 1 to 3. It is provided with the peripheral upwardly extending lug 130 in the same manner as disc 26. This lug 130 cooperates with the stop 132 which is indented from the housing 10 as best shown in Figure 2. The disc 151 is provided with the switch actuating lug 152 which is struckup from the disc a substantial distance inwardly from the edge thereof. The cam 154 is U-shaped in the same general manner as the cam 20 of the previous form of construction, having an upper leg 155 and a lower leg 156 connected by an integral portion 157. The legs 155 and 156 are provided with the perforations 158 and 159 which serve to mount the cam on the pivot 84. The portion 155 of the cam which is adjacent the switch, is provided with the extended lug 160 having the perforation 161 to receive the end of the operating spring 112. The portion 156 of the cam, which serves to receive the actuating lug 152, is formed with the rounded horns 162 and 163.

The method of operation is shown progressively in Figures 26 to 29. With the parts in the form of Figure 26, the switch is in closed position. In opening the switch the lug 152 moves in the clockwise direction in Figures 26 to 29, which means that the shaft of the variable resistor is moved in the counterclockwise direction when viewed from the knob side, to open the switch, as is customary in such devices. As this movement continues, the lug 152 engages the horn 162, as shown in Figure 27. As the movement continues to the position of Figure 28, the parts reach and pass the dead center so that the switch spring carries on, moving the switch arm and the cam away from the lug 152, as shown in Figure 29. In this position the switch is open. It is noted that the distance between the horns 162 and 163 is adequate so as to permit this final switch movement without interference from the operating lug 152 and entirely independently of the speed of movement of the shaft of the variable resistance.

It will be understood that the operation in the reverse direction is carried out in a similar manner. The rounded contact surfaces on the horns 162 and 163 of the cam 154 materially assist in reducing friction and facilitating smoothness of operation, which is important with the lug 152 moving on the arc of a comparatively small circle as is necessary when these devices are built in small sizes with the actuation between the cam pivot and the center of rotation of the drive.

I have shown a preferred form of connecting lug in detail in Figure 23, this lug also appearing in Figures 1 to 4 inclusive. The lug 88 of Figure 23 has its wire receiving portion 170 depressed or sloped as shown at 171 toward the wire receiving opening 172. This opening is preferably made of a size to fit closely about the wire 173, shown in broken lines in Figure 23. This wire, as is usual in radio construction, is provided with insulation 174 and after insertion in the lug, solder, indicated at 175, flows into the joint to make and maintain a good electrical contact. Due to the formation of the wire receiving portion of the lug 88 and the fact that the hole 172 is substantially the size of the wire, this solder flows in very readily and does not pass on through the lug to waste solder or carry it to undesired points. The sloping surface 171 is also very useful in facilitating the insertion of the wire by the person assembling the device in the radio apparatus.

The switches of both forms of construction are comparatively simple in design and in assembly, and efficient in operation. The housing assembly is important in that it permits the manufacture of a switch of this character without the necessity for the use of any expensive molded housings. The use of the indent 82 in the switch housing 12 permits the formation of a stop without additional material or separate assembly operations, the stop serving both to locate the switch base 76 and to stop and ground the switch cam 20 or 154. In both forms of construction the fixed contacts are solid members which are simpler to assemble and adjust than spring contacts which are often used for this purpose and which require careful adjustment as to position and resilient thrust.

The wedge-shaped solid bridging portion of the form of bridging contact shown in Figures 1 to 10 makes a firm and positive contact and as either the fixed or movable contacts are worn away, the bridging contact merely moves further in between the fixed contacts. The sloping contact surfaces 110 and 111 are sufficiently long to take up any wear which may occur during use.

As shown in Figures 7 to 10, in the closing movement the bridging contact may first engage the fixed contact 87, then move against contact 86 and finally be driven firmly in between the two contacts 86 and 87. This progressive engagement between the contacts has an important advantage in that it aids materially in keeping the contact surfaces clean. Due to the formation and location of the mass of the contact and of the small bearing portions 101 and 103 of the member, the effect of centrifugal force in throwing the movable contact against the outer fixed contact is minimized and the contact operates smoothly and uniformly. Because of the location of the drive connection between the pivot and the contact surfaces, the member may freely swing an adequate amount to adjust itself and the thrust is properly distributed between the two contact surfaces. With this form of con-

struction it is not desirable to have any stop to limit the closing movement of the switch arm since the contact engagement is substantially non-resilient and freedom must be allowed for taking up wear by further movement as the device is continually used.

In the form of construction shown in Figures 12 to 14, a stop is provided to limit opening movement of the bridging contact and to define its extreme closed position. During the final portion of the switch closing movement the two legs of the U-shaped member are urged toward each other, thus increasing the angle between the movable contacts. This serves to exert a progressive braking action on the motion of the arm and contactor and also permits the contactor to be moved from between the studs with less effort than if the angle did not change. Further, this springing action of the U-shaped contactor gives a very substantial wiping effect and keeps the contacts bright and clean. The actual contact pressure is due to the resilience of the member 134 and not to the pressure of the spring 112, although the pressure of the spring 112 must be greater than the resistance of the member 134 in order that the stop 150 may reach and bear against the housing wall 12.

While I have shown certain preferred embodiments of my invention, these are to be understood to be illustrative only, as I contemplate such changes and modifications as come within the spirit and scope of the appended claims.

I claim:

1. A switch comprising a base member, a pair of spaced fixed contacts secured to and projecting above the base member, a pivot secured to the base member, a non-conducting switch arm rotatably mounted on the pivot and spaced from the base member by the fixed contacts, and a bridging contact loosely carried by the switch arm between the switch arm and base, said bridging contact being of less thickness than the height of the fixed contacts.

2. A switch comprising a base member, a pair of spaced fixed contacts secured to and projecting above the base member, a pivot secured to the base member, a non-conducting switch arm rotatably mounted on the pivot and spaced from the base member by the fixed contacts, and a bridging contact pivoted to the switch arm and located between the switch arm and base, said bridging contact being of less thickness than the height of the fixed contacts and having a wedge-shaped end adapted to fit between the fixed contacts.

3. A switch comprising a base member, a pair of fixed contacts secured to and projecting above the base member, a pivot secured to the base member, a switch arm rotatably mounted on the pivot, and a movable contact member moved into and out of bridging contact with the fixed contacts by the switch arm, said member being U-shaped and comprising spaced resilient arms inclined inwardly toward each other and adapted to engage the fixed contacts adjacent the free ends of the arms on the inclined surfaces whereby the ends of the resilient arms are urged toward each other and the angle between the inclined surfaces of the arms increased.

4. In an electric snap switch, an insulating base, a switch arm overlying the base, a pivotal connection between the arm and base constraining the arm to oscillatory motion between switch open and switch closed positions, spaced stationary contacts mounted on the base, a 75

bridging contactor, a pivotal connection between the contactor and the switch arm whereby the switch arm carries the contactor to and from contact engaging position, snap spring actuating means for the switch arm, and a connection between the snap spring actuating means and the switch arm located between the pivotal connection of the contactor to the switch arm and the contact engaging portions of the contactor so that the closing force is transmitted to the contactor in a line extending substantially from the contactor pivot to a point medially of the stationary contacts.

5. In an electric snap switch, an insulating base, a pair of spaced stationary contacts mounted on the base, a bridging contactor engageable with the contacts, a switch arm, means for mounting the switch arm on the base and constraining it to oscillatory motion, a connection between the contactor and the switch arm spaced appreciably and substantially equal distances from the contacts when the switch is closed so that a line connecting the contacts and a line extended from said connection between the switch arm and contactor and bisecting the first named line form substantially a T, snap spring actuating means, and a connection between the snap spring actuating means and the switch arm substantially on the stem of the T and between the connection of the contactor to the switch arm and the contact engaging portions of the contactor so that the closing force is transmitted to the contactor in a line extending substantially from the contactor pivot to a point medially of the stationary contacts.

6. In an electric snap switch, an insulating base having a substantially flat surface, a pair of spaced stationary contacts carried by the base and projecting up from its flat surface, a bridging contactor movable across the flat surface of the base to and from a switch closed position bearing against the sides of the stationary contacts, a switch arm overlying the contactor, a pivotal connection between the switch arm and the base constraining the arm to oscillatory motion in a plane substantially parallel with the flat surface of the base, a pivotal connection between the switch arm and the contactor spaced appreciably and substantially equal distances from the contacts when the switch is closed, a snap spring actuating means, and a connection between said snap spring actuating means, and the switch arm located between the pivotal connection of the arm to the contactor and the contact engaging portions of the contactor substantially on a line extended from the connection of the contactor to the arm and bisecting a line connecting the stationary contacts when the switch is closed so that the closing force is transmitted to the contactor in a line extending substantially from the contactor pivot to a point medially of the stationary contacts.

7. In an electric snap switch, an insulating base, a pair of spaced stationary contacts mounted on the base, a bridging contactor having a substantially wedge-shaped contact engaging portion to move between and into engagement with the contacts during switch closure, a switch arm having a portion overlying the bridging contactor, a pivotal connection between the switch arm and base constraining the switch arm to an oscillatory motion, snap spring means connected with the switch arm for snapping the same from one position to another, and a pivotal connection

between the contactor and the switch arm spaced appreciably to the rear of the contact engaging portion thereof with reference to the direction of switch closing motion of the contactor so that in closing the contactor is pushed by the switch arm to contact bridging position, whereby the contactor tends to wobble from one contact to the other during switch closure, and thereby keep the contact surfaces clean.

8. In an electric snap switch, an insulating base, a pair of spaced stationary contacts mounted on the base, a bridging contactor having a substantially wedge-shaped contact engaging portion to move between and into engagement with the contacts during switch closure, a switch arm having a portion overlying the bridging contactor, a pivotal connection between the switch arm and base constraining the switch arm to an oscillatory motion, snap spring means connected with the switch arm for snapping the same from one position to another, a pivotal connection between the contactor and the switch arm spaced appreciably to the rear of the contact engaging portion thereof with reference to the direction of switch closing motion of the contactor so that in closing the contactor is pushed by the switch arm to contact bridging position, whereby the contactor tends to wobble from one contact to the other during switch closure, and thereby keep the contact surfaces clean; and a connection between the contactor and the switch arm for limiting the pivotal motion of the contactor with respect to the switch arm.

9. In an electric snap switch, an insulating base, a pair of spaced stationary contacts mounted on the base, a bridging contactor having a part movable between said contacts for engagement therewith, a switch arm having a portion overlying the contactor, means pivotally mounting the switch arm on the base and constraining the arm to an oscillatory motion across the base, said switch arm having spaced apart apertures, one of which is adjacent to the stationary contacts and another of which is spaced a substantial distance therefrom, tangs struck from the contactor and engaging in said apertures, said tangs and their apertures being of such relative sizes that the contactor has a pivotal connection with the switch arm at the latter of the two apertures and has its pivotal motion with relation to the switch arm guided and limited at the former of the two apertures.

10. In a snap switch of the character described, an insulating base having a substantially flat surface, spaced stationary contacts carried by the base and projecting up from said surface, a contactor movable across said surface of the base to and from bridging engagement with the contacts, said contactor having a portion adapted to be pushed between and into electrical engagement with the contacts and having a portion extending a substantial distance rearwardly of its contact engaging portion, a switch arm overlying the contacts and contactor, a pivotal connection between the switch arm and base constraining the switch arm to oscillatory motion, snap spring means connected with the switch arm for moving the same with a snap action between switch open and switch closed positions, a pivotal connection between the rearwardly extending portion of the contactor and the switch arm by which motion of the switch arm pushes the contactor between and into engagement with the stationary contacts, and a connection between the contactor

and the switch arm for limiting the pivotal movement of the contactor with respect to the switch arm and thereby guide the contactor between the contacts.

11. In an electric snap switch, a flat insulating base, spaced stationary contacts mounted on the base and projecting upwardly therefrom, a bridging contactor slidable across the base and having contact engaging means movable between and into engagement with the contacts, and having an attaching portion disposed a substantial distance from the contact engaging means, a switch arm overlying the contactor, a pivotal connection between the switch arm and the base, a pivotal driving connection between the switch arm and the attaching portion of the contactor whereby switch closing motion of the arm pushes the contactor into engagement with the contacts, said contactor being so shaped as to leave an unobstructed space between its pivotal driving connection with the arm and its contact engaging means, snap spring actuating means, and a connection between said snap spring actuating means and the switch arm substantially on a line extended from the pivotal connection of the contactor to the switch arm and bisecting a line connecting the stationary contacts when the switch is closed and into said space defined by the shape of the contactor so as to be adequately electrically spaced from the contactor, and whereby switch closing motion is imparted to the contactor in a line extending substantially from the contactor pivot to a point medially of the stationary contacts.

12. In an electric snap switch, a pair of spaced stationary contacts, a bridging contactor having a substantially V-shaped contact engaging portion movable between the stationary contacts and into engagement therewith, a carrier for the contactor for moving the same to and from switch closing position, and a pivotal driving connection between the contactor and its carrier spaced substantially equal distances from the contacts when the switch is closed and an appreciable distance to the rear of the contact engaging portion with relation to the direction of switch closing motion, by which the contactor is pushed to its bridging position to thereby increase its tendency to wobble between and successively wipe against the stationary contacts as it goes home and thus keep the contact surfaces clean.

13. In an electric snap switch, a substantially flat insulating base, a pair of spaced substantially cylindrical stationary contacts rising up from said base, a bridging contactor slidable across the base, said contactor having a substantially wedge-shaped contact engaging portion movable between and into engagement with the stationary contacts, a movable switch arm, means for imparting a snap action motion to the switch arm between switch closed and switch open positions, and a pivotal connection between the contactor and the switch arm, said pivotal connection being substantially on a line bisecting and substantially normal to a line connecting the stationary contacts when the switch is closed and spaced rearwardly a substantial distance from the stationary contacts with respect to the direction of closing motion so that the contactor is pushed into bridging engagement with the contacts to thereby increase its tendency to wobble and successively wipe against the stationary contacts as the contactor goes home.

14. As an article of manufacture, a contactor for electric snap switches comprising, a sheet

metal stamping, said stamping being shaped to provide a substantially wedge-shaped contact engaging portion adapted to move between and into engagement with suitably spaced stationary contacts to electrically bridge the same and having a rearwardly projecting portion formed with a recess in one side to provide electrical clearance for a metal actuating part connected with a suitable carrier for the contactor, a tang struck up from one face of the stamping at the point of the wedge-shaped contact engaging portion, and another tang struck up from the same face of the stamping substantially at the tail end portion of its rearward extension, said tangs being adapted to engage in suitably spaced apertures in a carrier for the contactor.

15. As an article of manufacture, a contactor for electric snap switches comprising, a sheet metal stamping, said stamping being shaped to provide a substantially wedge-shaped contact engaging portion adapted to move between and into engagement with suitably spaced stationary contacts to electrically bridge the same and having a rearwardly projecting portion formed with a recess in one side to provide electrical clearance for a metal actuating part connected with a suitable carrier for the contactor, a tang struck up from one face of the stamping at the point of the wedge-shaped contact engaging portion, another tang struck up from the same face of the stamping substantially at the tail end portion of its rearward extension, said tangs being adapted to engage in suitably spaced apertures in a carrier for the contactor, and raised portions punched up from one surface of the stamping to reduce the area of frictional contact between the contactor and an adjacent surface over which the contactor may slide.

16. As an article of manufacture, a contactor for electrical snap switches comprising, a U-shaped resilient metal band having its ends directed inwardly toward each other to form the sides of a wedge but spaced apart to enable compression of the arms of the U-shaped member toward each other, lugs projecting from one side of the general plane of said contactor adjacent to the ends of its arms for guiding engagement in an aperture formed in a suitable contactor carrier, and another lug projecting from the closed end of the U-shaped contactor and in the same direction as said first named lugs for pivotal engagement in another aperture in the contactor carrier.

17. In a snap switch of the character described, an insulating base, stationary contact means carried thereby, a movable contactor engageable with the stationary contact means, a switch arm connected with the movable contactor, a pivotal connection between the switch arm and the base constraining the arm to oscillatory motion, an actuating cam pivotally supported from the base and having an arm overlying the switch arm, and a spring connecting said arm of the cam and the switch arm, said spring having an intermediate spiral loop portion and diverging end portions extending therefrom, one of said end portions directly overlying the adjacent surface of the switch arm and having its extremity connected thereto, and the other end portion extending toward the arm of the cam and having a reversely bent portion offset an amount substantially equal to the depth of the loop portion to extend under the arm of the cam and project up into an aperture therein.