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A. A. LUTSKY ET AL

2,570,960

ELECTRICAL SWITCH

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FIG. 1

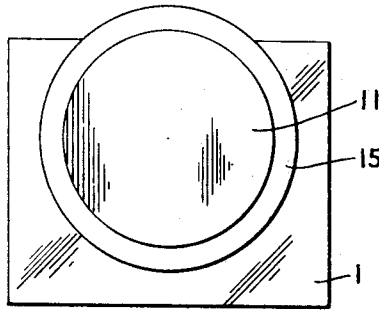


FIG. 2

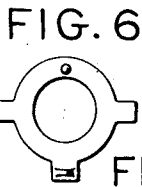
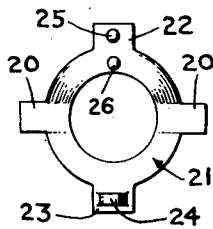
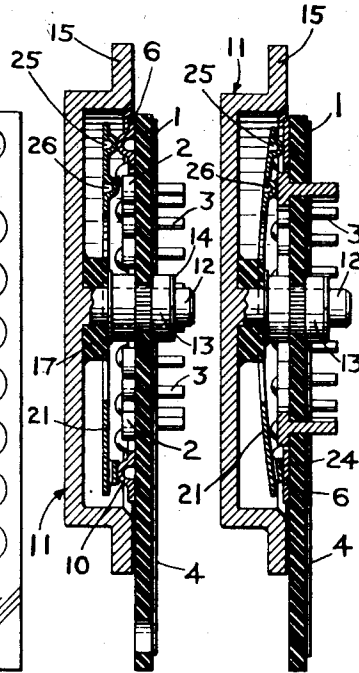
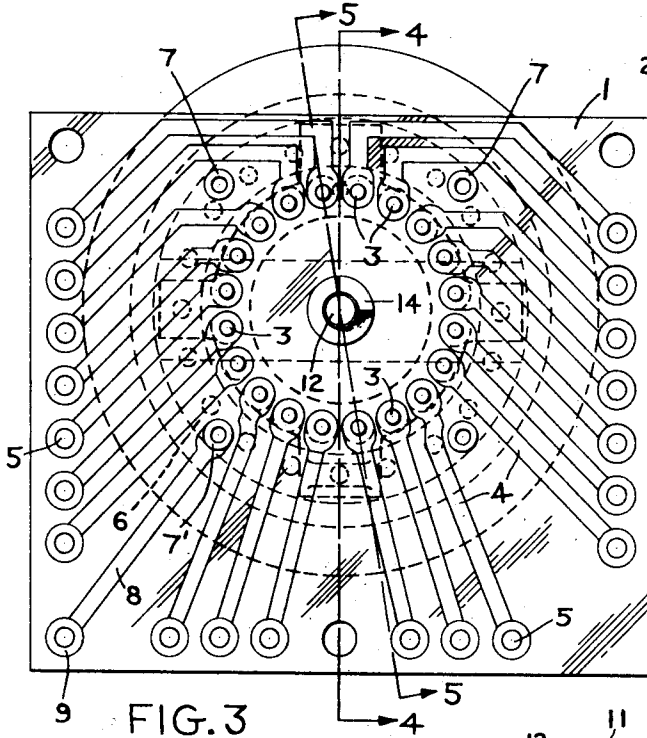
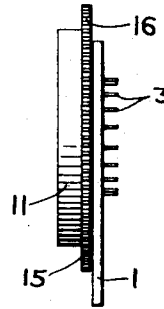


FIG. 7

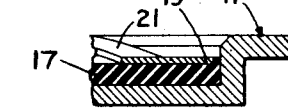


FIG. 8

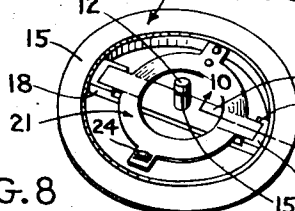


FIG. 4 FIG. 5

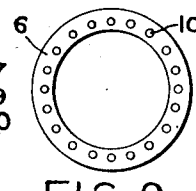


FIG. 9

ARTHUR A. LUTSKY
ALBERT A. WALKER
INVENTORS

BY *Robert D. ...*
Attorney

UNITED STATES PATENT OFFICE

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ELECTRICAL SWITCH

Arthur A. Lutsky, Newark, and Albert A. Walker,
Succasunna, N. J., assignors to The Daven
Company, Newark, N. J., a corporation of New
Jersey

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16 Claims. (Cl. 200—11)

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This invention relates to electrical switches such as are employed in electrical communications field, and an object of the present invention is to provide a thin, neat appearing practical switch employing a minimum number of parts and requiring a relatively small amount of manual labor to assemble it and connect it in a circuit.

An object of the present invention is to provide an electrical switch of the type employed in transducers, such as attenuators, potentiometers, etc., in which the circuit-carrying leads are in the form of flat metal strips bonded to the insulating plate and may be formed either by electrochemical or electrolytical deposit of the metal on the insulating carrying plate or by the bonding of a sheet of metal to the insulating plate which is then etched to remove the metal except in those areas where the leads are required, thereby eliminating much hand wiring and the consequent multiple wires usually employed in such switches.

Another object of the present invention is the provision of a simplified electrical switch as specified wherein the contact-making arm or switch arm and the ring contact also act as a detent gear and pawl, thereby eliminating the employment of a separate detent gear and pawl such as normally employed in switches of this character.

A further object of the invention is to provide a simplified switch structure wherein the switch arm is carried by the dialing knobs of the switch, being connected thereto for rotation with the knob in a simple, novel manner, and wherein the knob is rotatably supported upon the insulating contact-carrying plate by a simple relationship of stub shaft, bearing sleeve and snap ring.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing an electrical switch of a preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is a front elevation of the improved electrical switch.

Figure 2 is an edge elevation of the switch.

Figure 3 is a plan view of the back of the switch structure.

Figure 4 is a section on the line 4—4 of Figure 3 of the drawings showing the switch in a circuit-breaking position.

Figure 5 is a cross section through the switch

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taken on the line 5—5 of Figure 3 and showing the switch in a circuit making position.

Figure 6 is a plan view of the circuit-making and breaking switch arm.

Figure 7 is an edge elevation of the switch arm.

Figure 8 is a perspective view showing the manner of attaching the switch arm to the dialing knob.

Figure 9 is a detailed view of the contact ring.

Figure 10 is a detailed section taken on the line 10—10 of Figure 8.

Figure 11 is a detailed view of a slight modification of the switch structure.

Referring more particularly to the drawings, the improved electrical switch includes the contact carrying plate 1 which is made of any suitable insulating material of sufficient rigidity to form a supporting plate. The contact carrying plate 1 has a plurality of spaced contacts 2 carried thereby and arranged in the usual ring concentric of an axis point through the plate. The contacts 2 of posts 3 formed thereon are attached thereto which extend through the plate 1 and through the inner ends of the thin flat electric current conducting leads or lines 4 carried by the back of the plate 1. The electric current conducting leads 4 consist of thin flat metal strips on the back of the plate 1 and they extend outwardly to terminals 5 spaced around the plate 1 near its edges thus providing permanent rigid electric current conducting leads from each of the independent or spaced contacts 2 to a terminal point near the edge of the plate 1 to facilitate the connection of the contacts in an electrical circuit and eliminate not only the multitude of wires leading from the relatively small space encompassed by the posts 3, but also eliminating the manual labor required for connecting such wires (not shown) to the posts 3. Furthermore, the employment of the thin flat metal leads 4 very materially reduces the thickness of the switch structure which, together with other features hereinafter described, permits the provision of a thin switch which will require much less space than analogous switches as they are now manufactured.

A ring contact 6 is attached to the outer face of the plate 1 concentric of the ring of spaced contacts 2 by suitable means such as the eyelet rivets 7 shown in Figure 3. An electric current conducting lead 8 which is also a thin flat metal strip upon the back of the plate 1 is conductively connected to the contact ring 6 by the eyelet rivet 7'. The lead 8 extends out to near

the edge of the plate 1 and is connected to a terminal 9 to which a wire (not shown) may be connected.

The ring contact 9 has a plurality of circumferentially spaced bosses 10 struck thereon which are substantially semi-spherical in shape.

The dialing knob 11 of the switch structure has a stub shaft 12 formed thereon which extends through a bearing collar 13 carried by the plate 1. A snap ring 14 engages the stub shaft and holds the stub shaft 12 against axial movement relative to the bearing sleeve 13 and the contact carrying plate 1. The stub shaft 12 is rotatably supported by the bearing 13 so as to permit rotation of the dialing knob 11. The dialing knob 11 has an annular flange 15 formed thereon, the outer surface of which is knurled, as shown at 16. If it is so desired, the annular flange 15 may project above or beyond one edge of the contact carrying plate 1 as shown in Figures 1 and 2 of the drawings so as to facilitate rotation of the dialing knob by engagement with its knurled flange 15.

A bar 17 extends diametrically across the inner hollow portion of the dialing knob 11 and it has its outer ends thickened as shown at 18. The thickened ends 18 have recesses 19 formed therein in which the ears 20 formed on the switch arm 21 engage for connecting the switch arm 21 to the dialing knob 11 for rotation therewith. In Figures 6 and 8 of the drawings the switch arm 21 is shown as comprising a ring of electrical current conducting metal which has the diametrically opposed projecting ears 20 formed thereon at right angles to the diametrically opposed projecting ears 22 and 23. The ear 23 has a contact strap 24 struck outwardly from its inner face and the ear 22 has a boss 25 which is substantially semi-spherical in shape struck inwardly from its inner surface. A second boss 26 is struck inwardly from the inner face of the switch arm 21 inwardly towards the axis of the arm from the boss 25 and spaced so that while the boss 25 will ride over and engage the bosses 10 on the contact ring 6 the boss 26 will engage any one of the spaced contacts 2. The strap 24 is of such length that it will engage between two of the bosses 10 on the contact ring 6. As clearly shown in Figures 5 and 7 of the drawings, the switch arm 21 is bowed so as to provide spring action thereto and in such manner that its concave side faces the contact carrying plate 1. The bowed switch arm together with the strap or boss 24 and boss 25 serve a dual function during the operation of the switch, they, riding over the bosses 10, provide a detent action for the switch, holding it in adjusted positions and thus eliminate the need of a detent gear and pawl such as normally employed in switches of this general type. Also the strap or boss 24 and boss 25 provide means for breaking an electrical circuit through the switch. When the dialing knob 11 is adjusted, as shown in Figure 4 of the drawings, with the strap or boss 24 and the boss 25 engaging on a pair of diametrically opposed bosses 10, the boss 26 is held out of engagement with any one of the contacts 2 and thus the electrical circuit is broken. When the dial 11 is adjusted so that the bowed strap or boss 24 engages between two adjacent bosses 10 the spring action of the switch arm 21 causes it to assume its bowed position as shown in Figure 5 thus moving the boss 26 into engagement with one of the contacts 2 and closing an electrical circuit through the switch structure.

As shown in Figures 2, 4 and 5 of the drawings,

the provision of the novel type of switch arm carried by the dialing knob 11 together with the novel type of ring contact not only eliminate the need of a detent gear and pawl in the switch structure but materially simplifies the construction of the switch and permits the construction of a switch which is very much thinner and consequently occupies much less space than corresponding or analogous switches of approved construction now in use. The bowing of the switch arm 21 provides sufficient spring action to permit positive non-slipping adjusted movements of the switch arm and dialing knob and also provides quick snap make-and-break action of the switch.

The current carrying leads 4 and 8 may be formed on the insulating contact carrying plate 1 by various well known methods such as by electrochemical or electrolytical depositing of the metal on the insulating plate or by means of bonding a sheet of metal to the plate of insulation and then etched to remove all of the metal except in those areas where the leads are required.

As shown in Figure 11 of the drawings, the lug 22 or ear and, consequently, the boss or extrusion 25 on the switch arm 21 may be eliminated which will permit use of the switch as a circuit shorting type switch.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In an electrical switch, an insulation contact carrying plate, a plurality of spaced contacts carried by said contact carrying plate, a ring contact carried by said plate, a plurality of thin flat electrical current conducting leads on one side of said contact carrying plate and connected one to each of said spaced contacts, an electric current conducting lead on said contact carrying plate and connected to said ring contact, a dialing knob rotatably carried by said contact carrying plate, a circuit-closing switch arm detachably connected to said dialing knob for rotation therewith, and contact bosses formed on said ring contact, means formed on said switch arm cooperating with said bosses to provide detent action for the knob and switch arm.

2. In an electrical switch, an insulation contact carrying plate, a plurality of spaced contacts carried by said contact carrying plate, a ring contact carried by said plate, a plurality of thin flat electrical current conducting leads on one side of said contact carrying plate and connected one to each of said spaced contacts, an electric current conducting lead on said contact carrying plate and connected to said ring contact, a dialing knob rotatably carried by said contact carrying plate, and a circuit closing switch arm detachably connected to said dialing knob for rotation therewith, said ring contact having a plurality of bosses formed thereon, and said switch arm having a pair of bosses formed thereon cooperating with said ring contact bosses to provide detent action.

3. In an electrical switch, an insulation contact carrying plate, a plurality of spaced contacts carried by said contact carrying plate, a ring contact carried by said plate, a plurality of thin flat electrical current conducting leads on one side of said contact carrying plate and connected one to each of said spaced contacts, an electric current conducting lead on said contact carry-

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ing plate and connected to said ring contact, a dialing knob rotatably carried by said contact carrying plate, and a circuit closing switch arm detachably connected to said dialing knob for rotation therewith, said ring contact having a plurality of bosses thereon, a pair of bosses formed on said switch arm and cooperating with said ring contact bosses to provide detent action, said switch arm having a contact boss thereon for engagement with any one of said spaced contacts, said switch arm being bowed to provide spring action to hold the bosses thereon in contact with a ring contact at all times and to hold the contact boss on the switch arm out of contact with any of said spaced contacts when the bosses on the switch arm are in engagement with bosses on the ring contact.

4. An electrical switch as claimed in claim 2 wherein said dialing knob has a pair of spaced recesses in its inner surface, said switch arm having ears thereon fitting in said recesses to connect the switch arm to the dialing knob for rotation therewith.

5. An electrical switch as claimed in claim 3 wherein said dialing knob has a stub shaft thereon, a bearing collar carried by said contact carrying plate, said stub shaft extending rotatably through said bearing collar, means for preventing longitudinal displacement of said shaft in said bearing collar, said dialing knob having a pair of spaced recesses in its inner surface, said switch arm having ears thereon fitting in said recesses to connect the switch arm to the dialing knob for rotation therewith.

6. In an electrical switch, an insulation contact carrying plate, a plurality of spaced contacts carried by said plate, a ring contact carried by said plate, said ring contact having a plurality of circumferentially spaced bosses thereon, a switch arm, means for rotatably supporting said switch arm, said switch arm provided with a pair of bosses spaced one on each side of the axis of rotation of the arm and adapted to coact with the bosses on the ring contact to provide detent action.

7. An electrical switch as claimed in claim 6 including a contact boss formed on said switch arm for contact with any one of said plurality of contacts.

8. An electrical switch as claimed in claim 6 including, a contact boss formed on said switch arm for contact with any one of said spaced contacts, said switch arm being bowed to provide spring action in the switch arm to maintain said pair of bosses always in contact with the ring contact and to move the contact boss on the switch arm out of engagement with a spaced contact when the pair of bosses on the switch arm are in engagement with bosses on the ring contact.

9. In an electrical switch an insulation contact carrying plate, a plurality of spaced contacts carried by said plate, a ring contact carried by said plate, said ring contact having a plurality of circumferentially spaced bosses thereon, a dialing knob rotatably carried by said contact carrying plate, a switch arm connected to said dialing knob for rotation therewith, said switch arm provided with a pair of bosses spaced one on each side of the axis of rotation of the switch arm and adapted to coact with the bosses on the ring contact to provide detent action.

10. An electrical switch as claimed in claim 9 including, a contact boss formed on said switch arm for contact with any one of said plurality of spaced contacts, said switch arm being bowed to provide spring action in the switch arm to main-

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tain said pair of bosses always in contact with the ring contact and to move the contact boss out of engagement with the spaced contacts when the pair of bosses on the switch arm are in engagement with bosses on the ring contact.

11. An electrical switch as claimed in claim 9 including, a contact boss formed on said switch arm for contact with any one of said plurality of spaced contacts, said switch arm being bowed to provide spring action in the switch arm to maintain said pair of bosses always in contact with the ring contact and to move the contact boss out of engagement with the spaced contacts when the pair of bosses on the switch arm are in engagement with bosses on the ring contact, said dialing knob having spaced recesses in its inner surface, ears formed on said switch arm and engaging in said recesses to detachably connect the switch arm to the dialing knob for rotation therewith.

12. In an electrical switch, an insulation contact carrying plate, a plurality of spaced contacts carried by said contact carrying plate, a ring contact carried by said plate, a plurality of thin flat electrical current conducting leads on one side of said contact carrying plate and connected one to each of said spaced contacts, an electric current conducting lead on said contact carrying plate and connected to said ring contact, a dialing knob rotatably carried by said contact carrying plate, and a circuit closing switch arm detachably connected to said dialing knob for rotation therewith, said ring contact having a plurality of bosses thereon, a pair of bosses formed on said switch arm cooperating with the ring contact bosses to provide detent action, said dialing knob having a pair of spaced recesses in its inner surface, and ears formed on said switch arm and fitting in said recesses to detachably connect the switch arm to the dialing knob for rotation therewith.

13. In an electrical switch, an insulation contact carrying plate, a plurality of spaced contacts carried by said contact carrying plate, a ring contact carried by said plate, a plurality of thin flat electrical current conducting leads on one side of said contact carrying plate and connected one to each of said spaced contacts, an electric current conducting lead on said contact carrying plate and connected to said ring contact, a dialing knob rotatably carried by said contact carrying plate, and a circuit closing switch arm detachably connected to said dialing knob for rotation therewith, a plurality of bosses formed on said ring contact, a pair of bosses formed on said switch arm and cooperating with said ring contact bosses to provide detent action, said switch arm having a contact boss thereon for engagement with any one of said spaced contacts, said switch arm being bowed to provide spring action to hold the bosses thereon in contact with the ring contact at all times and to hold the contact boss on the switch arm out of contact with any of said spaced contacts when the bosses on the switch arm are in engagement with bosses on the ring contact, said dialing knob having a pair of spaced recesses in its inner surface, said switch arm having ears thereon fitting in said recess to connect the switch arm to the dialing knob for rotation therewith, a stub shaft on said dialing knob, a bearing collar carried by said contact carrying plate, said stub shaft rotatably mounted in said bearing collar, and means for preventing longitudinal displacement of said stub shaft relative to said bearing collar.

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14. In an electrical switch, an insulation contact carrying plate, a plurality of spaced contacts carried by said contact carrying plate, a ring contact carried by said plate, a plurality of thin flat electrical current conducting leads on one side of said contact carrying plate and connected one to each of said spaced contacts, an electric current conducting lead on said contact carrying plate and connected to said ring contact, a dialing knob rotatably carried by said contact carrying plate, and a circuit closing switch arm detachably connected to said dialing knob for rotation therewith, said dialing knob having a recess in its inner side, said ring contact and said spaced contacts extending into said recess and said circuit closing switch arm located wholly within the recess in said knob.

15. An electrical switch as claimed in claim 2 wherein said dialing knob has its inner portion cut away to form a recess in its inner side, said ring contact and said spaced contacts extending into said recess, and said circuit closing switch arm located wholly within the recess in said knob, said dialing knob having a pair of diametrically

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opposed recesses in inner wall of the recess therein, said switch arm having a pair of ears formed thereon engaging in said diametrically opposed recesses to hold the switch arm in place within the knob.

16. An electrical switch as claimed in claim 13 wherein said dialing knob has a recess in its side facing said installation contact carrying plate, said ring contact and said spaced contacts extending into said recess, and said circuit closing switch arm located wholly within the recess in said knob.

ARTHUR A. LUTSKY.
ALBERT A. WALKER.

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