Nov. 26, 1957 G. L. McFARLAND 2,814,678

SELF-PIVOTED BLADE SWITCH

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Fig. 1.

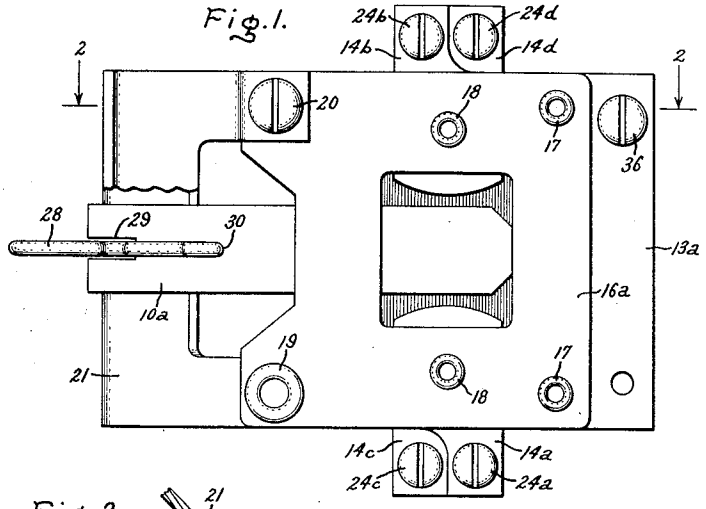


Fig. 2.

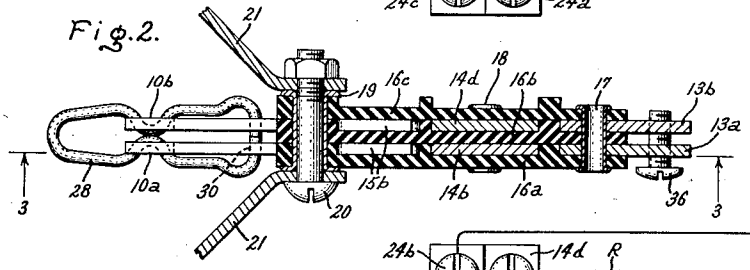


Fig. 3.

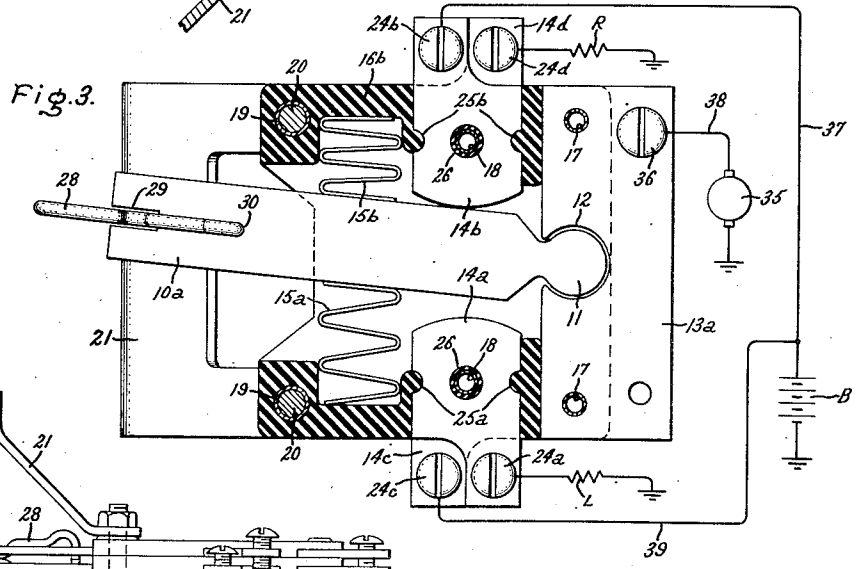
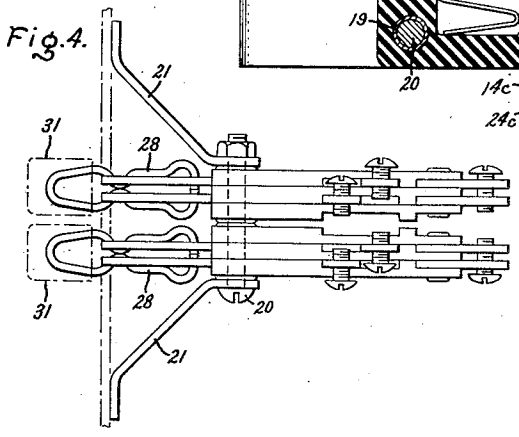


Fig. 4.



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Fig. 5.

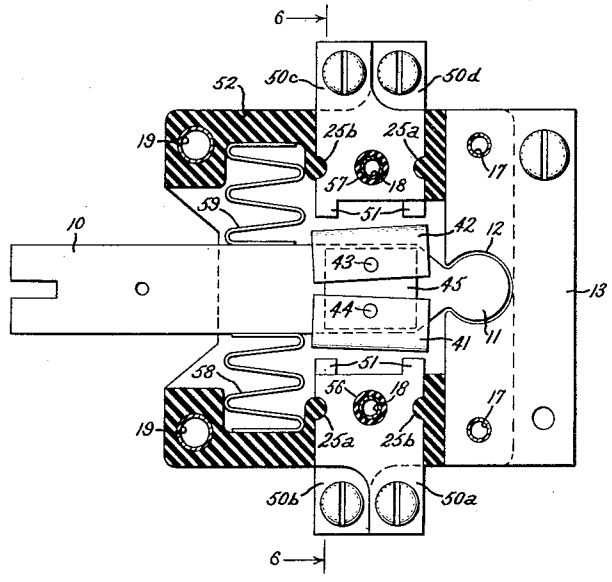


Fig. 6.

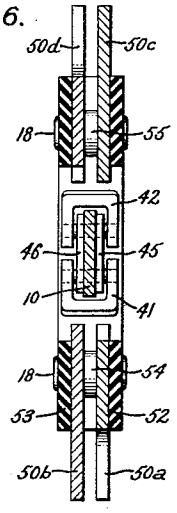
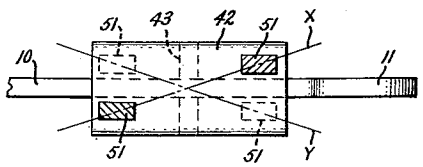


Fig. 7.



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SELF-PIVOTED BLADE SWITCH

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Application June 24, 1955, Serial No. 517,696

7 Claims. (Cl. 200—6)

The invention relates to electric switches and more particularly to selective circuit controlling switches of the current conducting pivoted blade type.

The principal object is to provide an improved stratiform self-pivoted blade switch structure utilizing a minimum number of relatively flat interlocking parts.

A further object is to enable the relatively flat current conducting switch parts to be readily assembled and clamped between molded insulating plates, preferably by means of hollow eyelets, to form a flattened or waferlike switch unit.

The improved self-pivoted blade switch unit provided by the present invention is suitable for various control applications. In the double-pole, double-throw form the switch unit may be readily mounted for selectively and directly controlling the reversing circuits of small electric motors used on automobiles. For example, it may be conveniently mounted under the seat for the finger-tip selective reversing control of the seat adjusting and convertible top raising and lowering electric motors of automobiles.

In carrying out the invention in its preferred form a current conducting flat switch blade is provided with a round headed flat end that can be readily assembled in current conducting and self-pivoting coplanar nesting relation with a complementary curved opening formed in one of the cooperating flat fixed contacts and then confined between parallel insulating plates so as to rotatably support the blade in circuit controlling relation with one or more cooperating flat fixed contacts fixedly mounted between the plates.

Such improved coplanar nesting round headed end self-pivoting flat blade switch structure of the present invention enables the blade and contact parts to be punched directly from metal sheets of uniform thickness and eliminates all need for the usual pivot pins and bearings. Thus the improved switch structure is particularly adapted for low-cost, large-scale production and ready assembly, as well as for long, trouble-free circuit controlling service.

The invention is further carried out by interleaving parallel flat insulating plates and flat current conducting switch parts provided with mutual interlocking elements to facilitate the ready assembly thereof into a flattened or waferlike switch unit with the movable flat switch blade guided between the plates and the cooperating flat contacts projecting laterally from the unit to constitute terminals for ready interconnection with a plurality of circuits that are to be selectively controlled by the switch unit.

Further objects and advantages of the present invention will become apparent from the following description of the accompanying drawings in which Fig. 1 is a side view of a manually operable double-pole, double-throw electric switch embodying the self-pivoted round headed end blade structural improvements of the present invention. Fig. 2 is a sectional view of the switch structure shown in Fig. 1 taken on the line 2—2. Fig. 3 is a side view of

the switch structure shown in Fig. 1 taken on the line 3—3 with certain parts broken away in order more clearly to reveal the inner structural details. Fig. 3 also includes a schematic circuit diagram illustrating the manner in which the double-pole, double-throw switch may be connected for the reversing control of the seat adjusting or top raising motor of an automobile. Fig. 4 shows how a pair of the double-throw, double-pole switches, such as shown in Figs. 1, 2 and 3, may be conveniently mounted in juxtaposition for finger-tip control of the up and down, and forward and back, seat adjusting motors. Fig. 5 shows a modified form of self-pivoted blade switch embodying the improvements of the present invention. Fig. 6 is a sectional view of the modified switch shown in Fig. 5 on the lines 6—6. Fig. 7 is a schematic diagram used in explaining the crisscross contact alignment principle of the modified switch shown in Figs. 5 and 6.

As shown in Figs. 1, 2 and 3, the improved form of self-pivoted blade switch comprises a switch blade **10***a* in the form of a flat rectangular strip provided with a round headed end **11**. This rounded head **11** is nested within a complementary curved opening **12** formed in the fixed switch contact **13***a* in coplanar relation. In this way the blade **10***a* is rotatably supported in circuit controlling relation between the pair of flat fixed contacts **14***a* and **14***b* spaced apart adjacent to the edges of the switch blade **10***a*. The flat accordionlike springs **15***a* and **15***b* engage the opposite edges of the switch blade **10***a*, to bias the blade to a central position between the fixed contacts **14***a* and **14***b*. It will be observed that contacts **14***a* and **14***b* are duplicates. This is also true of the biasing springs **15***a* and **15***b*.

The switch parts just described are mounted in edgewise operating alignment between a pair of insulating and clamping plates **16***a* and **16***b*. These plates are provided with suitable interlocking projections for holding the switch parts in proper operating alignment when the insulating and clamping plates **16***a* and **16***b* are secured together by means of the cooperating pairs of hollow eyelets **17**, **18** and **19**. The hollow eyelets **19** preferably are of sufficient diameter to enable the mounting bolts **20** to be inserted therethrough for mounting switch units on the brackets **21**, either as a single unit as shown in Figs. 1, 2 and 3, or as a double unit as shown in Fig. 4.

It will be evident that the double-pole, double-throw switch unit shown in Figs. 1, 2 and 3 can be readily assembled simply by interleaving layers of the flat copper punchings constituting the duplicate switch blades **10***a*, **10***b*, the duplicate fixed contacts **13***a*, **13***b* and the duplicate fixed contacts **14***a–b–c–d* along with the biasing springs **15***a* and **15***b* in the space between the three duplicate insulating and clamping plates **16***a*, **16***b* and **16***c* as shown in the sectional view of Fig. 2. In such assembly the juxtaposed pairs of fixed contacts **14***a*, **14***b*, and **14***c* and **14***d* are assembled in reversed relationship so that the terminal binding screws **24***a*, **24***b*, **24***c*, and **24***d* are aligned in offset relation to be readily accessible from the same side of the switch unit as shown in Figs. 1 and 3. Such reversed assembly can be readily accomplished since the notches **25***a* and **25***b* are symmetrical with respect to the opening through the contact for the hollow eyelet **18**. In order to insulate each of these fixed contacts from the eyelets **18**, each eyelet **18** may be surrounded by an insulating bushing **26**. Thus it will be seen that the improved switch structure utilizes a minimum number of interlocking duplicate parts especially adapted for low-cost, large-scale manufacture and for ready assembly into either single, double or multiple-pole switch structures as desired.

In the double-pole switch structure shown in Figs. 1, 2, and 3, the duplicate switch blades **10***a* and **10***b* may be

joined together for operation in unison by means of a suitable spring clip 28. This spring clip 28 is formed to interlock with the slot 29 and the hole 30 punched in alignment in each switch blade.

When two double-pole switch units are mounted in juxtaposition on a common mounting bracket as shown in Fig. 4, each of the spring clips 28 may be provided with a suitable finger-tip operating block 31 formed of a molded plastic, if desired.

As indicated schematically in Fig. 3, the double-pole, double-throw switch may be utilized to control the reversing circuits of a small electric motor, for example, the seat or top raising or lowering motor of an automobile. For this purpose, the operating motor armature 35 has one brush grounded in accordance with standard practice and the other brush connected to the terminal screw 36 of the switch contact 13*a* which also serves as the terminal for switch contact 13*b* as indicated in Fig. 2. The "Raise" field winding R of the motor also has one terminal grounded and the other connected to the terminal screw 24*d*. The "Lower" field winding L of the motor also has one terminal grounded and the other terminal connected to the terminal screw 24*a*. The battery B in accordance with standard practice has one terminal grounded and the other terminal connected to each of the fixed contacts 24*b* and 24*c*.

Thus, in operation when the two switch blades 10*a* and 10*b* are raised in unison by means of the spring tip 28 as indicated in Fig. 3, the rounded head 11 readily rotates in the encompassing opening 12 until the upper edge of each blade engages with the corresponding contact 14*b* and 14*d*. Thereupon each blade pivots upon the rounded end of the contact 14*b* and 14*d* engaged thereby, thus forcing the rounded head 11 into good current conducting relation with the lower side of the recess 12. This establishes a circuit from the battery B through the conductor 37 to the contact 14*b* and thence through blade 10*a* to contact 13*a*. From contact 13*a* one circuit extends through conductor 38 and the motor armature 35 to ground, and another circuit extends through terminal screw 36 to contact 13*b*. From contact 13*b* the circuit then extends through switch blade 10*b* and contact 14*d* through the "Raise" motor field winding R to ground. With both the motor armature and the "Raise" field winding energized, the motor 35 will operate in the "Raise" direction until the switch blades 10*a* and 10*b* are released for return to their midposition in accordance with the bias of spring 15*b*.

Upon downward movement of the switch blades 10*a* and 10*b* into engagement with contacts 14*a* and 14*c* respectively, an energizing circuit is extended from the ungrounded terminal of the battery through conductor 39 to terminal 14*c* and thence through switch blade 10*b* to contact 13*b*. One circuit then extends from terminal 36 through conductor 38 and motor armature 35 to ground. The other circuit extends through contact 13*a*, switch blade 10*a*, contact 14*a* and thence through the "Lower" field winding L to ground. In this case the motor 35 will operate in the reverse direction until the switch blades 10*a* and 10*b* are released for return to their midposition in accordance with the bias of spring 15*a*.

In the modified double-throw, double-pole pivoted blade switch construction shown in Figs. 5 and 6, only a single switch blade 10 is required. This blade 10 is provided with a round headed end 11, the same as shown in Figs. 1, 2 and 3. In this case the round headed end 11 is encompassed within a complementary curved opening 12 formed in the fixed switch contact 13. The switch blade 10 is provided with a pair of duplicate rocker contact members 41 and 42 pivotally mounted on the pins 43 and 44. The rocker contacts 41 and 42 are thus supported in symmetrical straddling relation with the opposite edges of blade 10 by means of the spacers 45 and 46 as shown in Fig. 6.

Two pairs of duplicate contacts 50*a*, 50*b*, 50*c* and 50*d* are spaced apart on opposite sides of blade 10 to be engaged by the rocker contacts 41 and 42, respectively. Each of these contacts is provided with an offset terminal screw and with the interlocking notches 25*a* and 25*b* so that the duplicate contacts can be assembled in reverse relation with the binding screws in offset relation to be readily accessible from the same side of the switch unit as indicated in Fig. 5. Each of the fixed contacts 50*a*, *b*, *c*, *d* is provided with a projection 51 offset on the same side of the contact as the terminal screw as shown in Fig. 5.

The switch parts just described are mounted in operating alignment between a pair of duplicate insulating and clamping plates 52 and 53. These plates are provided with suitable interlocking means for engaging with the notches 25*a* and 25*b* when the plates are clamped together by means of the cooperating pairs of hollow eyelets 17, 18 and 19, the same as shown in Figs. 1, 2 and 3. The two pairs of juxtaposed contacts 50*a*—*b* and 50*c*—*d* are maintained in parallel spaced apart relation by means of the flat insulating washers 54 and 55, as well as the insulating bushings 56 and 57 that surround the hollow eyelets 18. The springs 58 and 59 and also the contact 13 are assembled centrally between the plates 52 and 53 so as to be maintained in operative relation with the switch blade 10, when the eyelets are headed over to form the switch unit.

Thus, in operation when the switch blade 10 is raised, the rocker contact 42 is carried into self-aligning engagement with the reversed offset projecting tips 51 of the contacts 50*c* and 50*d*. This causes the switch blade to pivot on pin 43 to increase the contact pressure between the headed end 11 and the encompassing opening 12. With the same motor armature, field and battery connections shown in Fig. 3, the modified form of switch shown in Fig. 5 will produce the same direction of rotation of the motor when the blade 10 is raised. Likewise when the blade 10 is lowered, rocker contact 41 is carried into self-aligning engagement with the projecting contact tips 51 of the pair of contacts 50*a* and 50*b*. With the same connections shown in Fig. 3, the direction of motor rotation will be reversed.

Fig. 7 schematically shows the improved crisscross contact alignment principle of the modified form of switch shown in Figs. 5 and 6. As indicated in Fig. 7, the projecting contact tips 51 of the pair of contacts 50*c* and 50*d* and of the pair of contacts 50*a* and 50*b* are in spaced apart crisscross alignment with the blade 10 as indicated by the dotted lines X and Y. As a result the blade 10 will carry the rocker contact 42 to engage the diagonally opposite corners thereof with the projecting tips 51 that project from the diagonally offset corners of the contacts 50*c* and 50*d*. In the same way the blade 10 will carry the rocker contact 41 to engage the diagonally opposite corners thereof with the tips 51 that project from the diagonally opposite corners of the fixed contacts 50*a* and 50*b*.

While I have described by way of illustration preferred embodiments of my invention, many modifications will occur to those skilled in the art and I, therefore, wish to have it understood that I intend in the appended claims to cover all such forms and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. An electric circuit controlling switch having in combination a flat switch blade provided with a flat round headed current conducting end, and parallel insulating plates having a first flat contact and a second flat contact mounted in predetermined spaced relation therebetween and having the second contact provided with a complementary curved opening for coplanar nesting the round headed current conducting end of the blade to rotatably support the blade in circuit controlling relation with the first contact.

2. A switch structure having in combination a flat switch blade provided with a flat round headed current conducting end, a first flat fixed contact, a second flat contact

provided with a complementary curved opening for coplanar nesting the flat round headed end of the blade to pivotally support the blade, and a pair of insulating and clamping plates provided with interlocking means for mounting the flat fixed contacts and the flat blade in operating alignment therebetween.

3. A selective circuit controlling switch having in combination parallel insulating plates having current conducting parts extending therebetween and including a flat switch blade provided with a flat round headed current conducting end and having an operating connection at the outer end, a pair of flat fixed contacts spaced apart on opposite sides of the blade adjacent the round headed end, and a third flat fixed contact offset from the spaced apart pair of contacts and provided with a complementary curved opening therebetween for coplanar nesting the round headed end of the blade to substantially increase the contact pressure between the round headed end of the blade and the third contact when the blade engages either of the pair of fixed contacts.

4. A selective circuit controlling switch having in combination current conducting parts of uniform thickness including a flat switch blade provided with a flat round headed end, a pair of flat fixed contacts in spaced apart alignment with the edges of the blade, and a third flat fixed contact provided with a complementary curved opening for coplanar nesting the round headed end of the blade to rotatably support the blade for circuit closing engagement with either of the pair of contacts, and a pair of insulating and clamping plates provided with interlocking means for mounting therebetween the fixed contacts in edgewise spaced apart alignment and the blade in edgewise operating alignment with the fixed contacts.

5. A double-throw electric switch having in combination parallel insulating plates having current conducting parts extending therebetween and including two pairs of juxtaposed flat fixed contacts in edgewise spaced apart alignment, a blade provided with a round headed end, and a fifth flat contact in edgewise offset alignment with the pairs of fixed contacts and provided with a complementary curved opening for coplanar nesting the round headed end of the blade to pivotally support the blade for selective circuit closing engagement with either of the juxtaposed pairs of fixed contacts.

6. A double-throw electric switch having in combination, a pair of spaced apart insulating plates having current conducting parts extending therebetween and including a blade having a round headed end, a pair of rocker contacts pivotally mounted on opposite edges of the blade adjacent the round headed end, two pairs of fixed contacts having tips in spaced apart crisscross alignment with the rocker contacts, and a fifth contact provided with a complementary curved opening for coplanar nesting the round headed end of the blade to pivotally support the blade for selective circuit closing engagement of each of the rocker contacts with the tips of the corresponding pair of fixed contacts.

7. A double-throw electric switch having in combination, a pair of spaced apart insulating plates having current conducting parts extending therebetween and including two pairs of juxtaposed flat fixed contacts in edgewise spaced apart alignment and each pair having contact tips projecting from diagonally opposite corners thereof, a blade having a round headed end and provided with rocker contacts pivotally mounted on opposite edges thereof adjacent the round headed end, and a fifth flat contact in edgewise offset alignment with the pairs of fixed contacts and provided with a complementary curved opening for coplanar nesting the round headed end of the blade to pivotally support the blade for selective circuit closing engagement of diagonally opposite corners of each rocker contact with the contact tips of the corresponding fixed contacts.

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