United States Patent

[11] 3,592,982

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[32] Priority **Feb. 3, 1967**
[33] **France**
[31] **93626**
Continuation-in-part of application Ser. No. 700,119, Jan. 24, 1968, now abandoned.

[54] **ROTARY SELECTOR SWITCHES FOR ELECTRONIC CIRCUITS**
21 Claims, 23 Drawing Figs.

[52] **U.S. Cl.** ..... **200/16 R,** 200/11 EA, 200/166 BH, 200/4, 200/18
[51] **Int. Cl.** **H01h15/00,** H01h 9/00
[50] **Field of Search** ..... 200/4, 14, 16, 18, 11.11, 11.21, 166 B8, 166.1, 5 A, 47; 74/3.2, 27, 29, 89.15, 424.8

[56] **References Cited**

UNITED STATES PATENTS

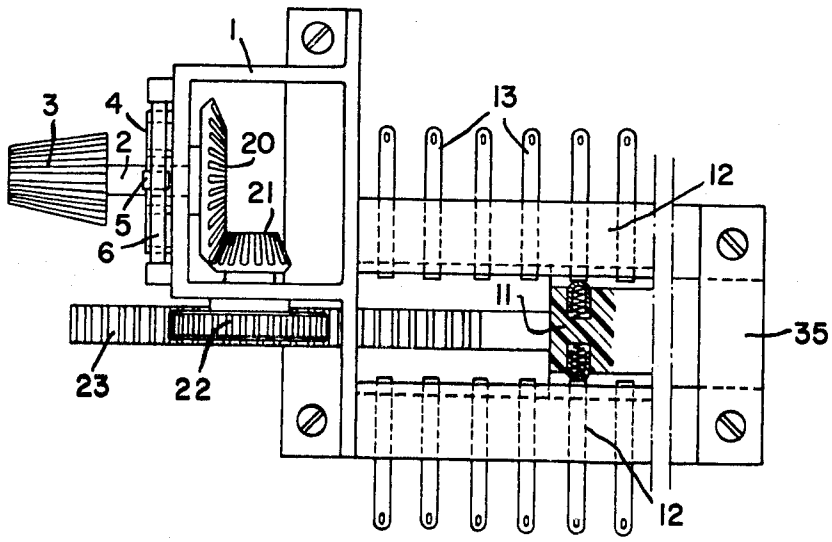
2,079,124	5/1937	Lockett	200/47 X
2,441,808	5/1948	Fry	200/11 (.21)
3,047,683	7/1962	Shlesinger, Jr.	200/4 X
3,220,718	11/1965	Wikkerink	74/89.15
3,267,224	8/1966	Vega	200/11 (.11)
3,270,148	8/1966	Oxley	200/14

FOREIGN PATENTS

1,141,359	12/1962	Germany	200/16

Primary Examiner—J. R. Scott
Attorney—Stevens, Davis, Miller & Mosher

ABSTRACT: A multiple position switch in which the moving contact or contacts slide between a pair of parallel sets of fixed contacts, the movement of the moving contact being obtained from the rotation of a knob which is constrained to a plurality of circumferentially fixed positions so that step by step rotation of the knob causes adjacent pairs of fixed contacts to be bridged by the moving contact step by step.



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SHEET 1 OF 7

FIG. 1

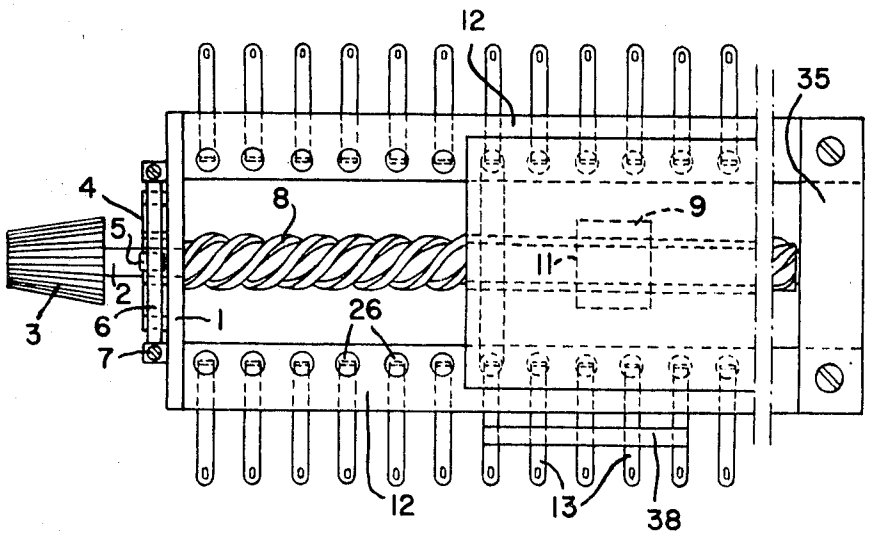


FIG. 2

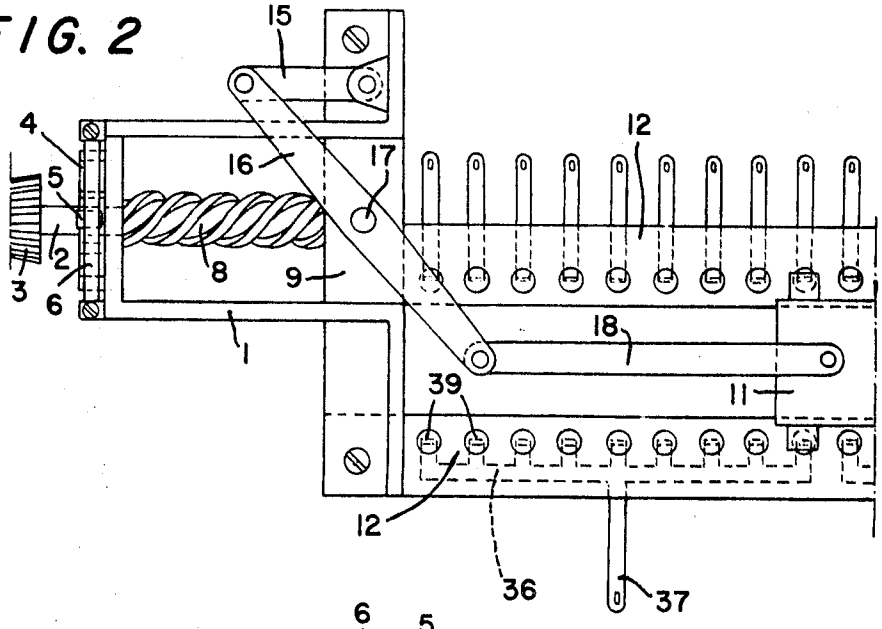
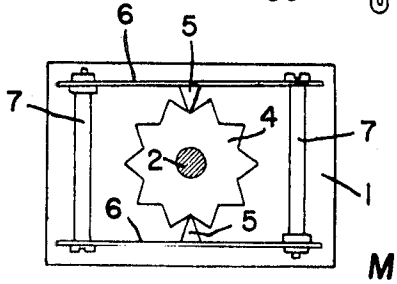


FIG. 4



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FIG. 3

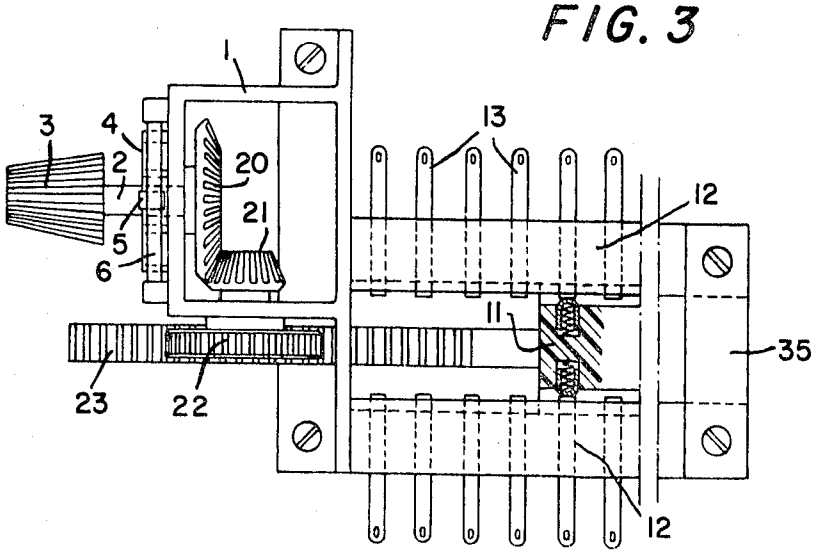


FIG. 5

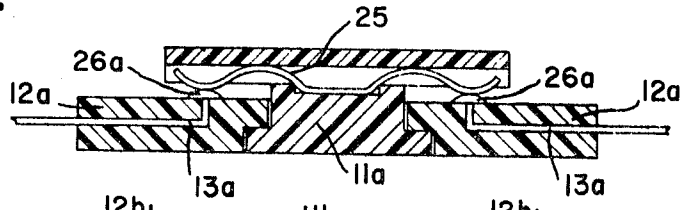


FIG. 6

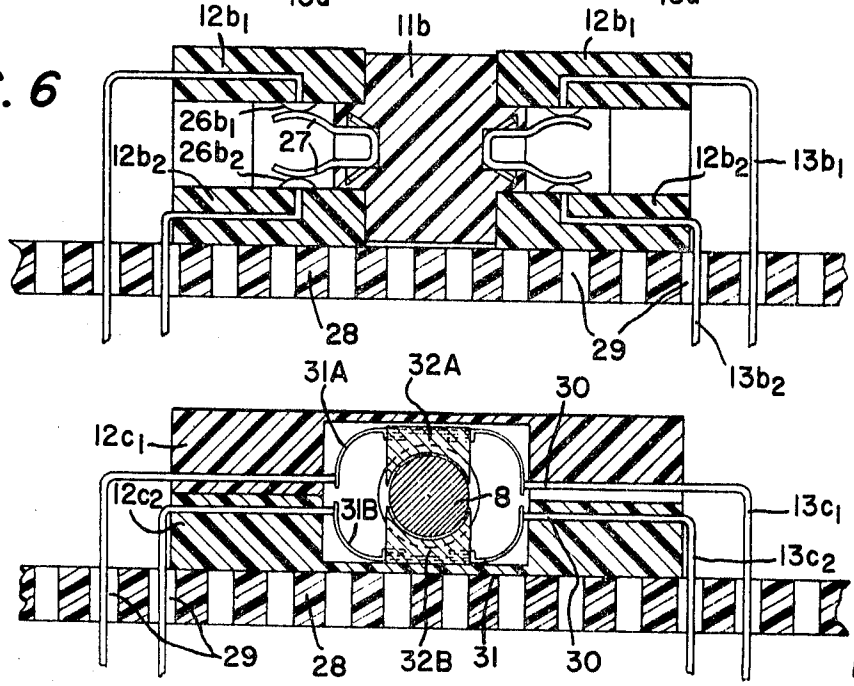


FIG. 7

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FIG. 8

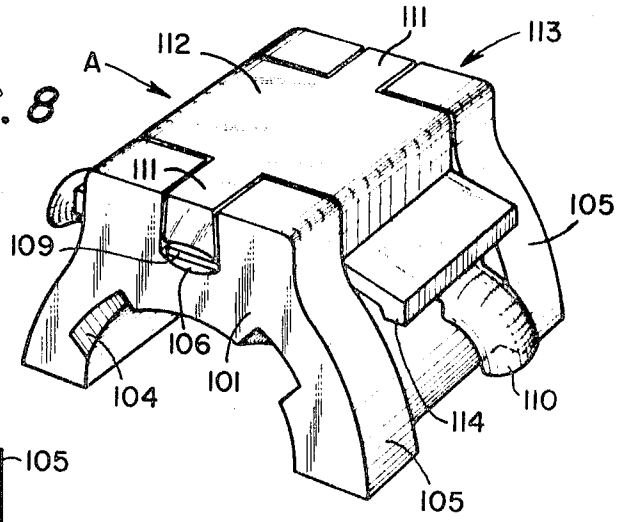


FIG. 11

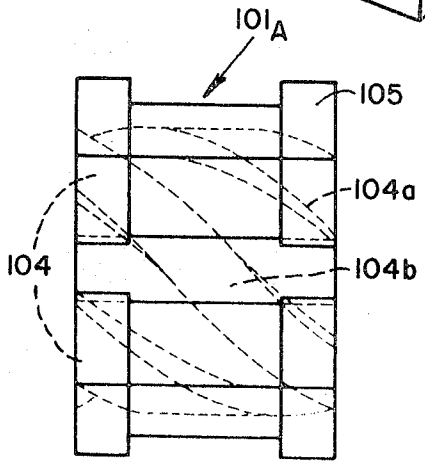


FIG. 10

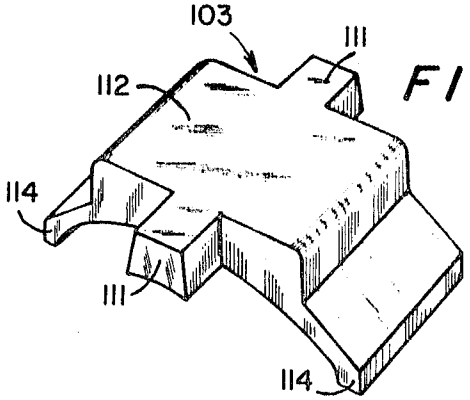
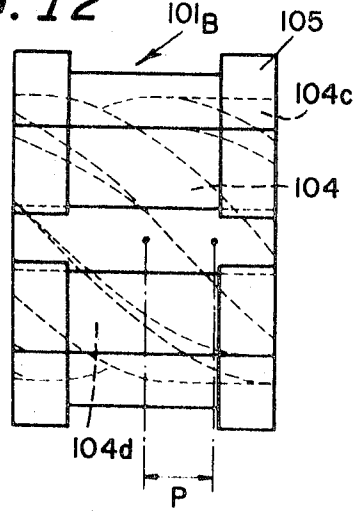


FIG. 12



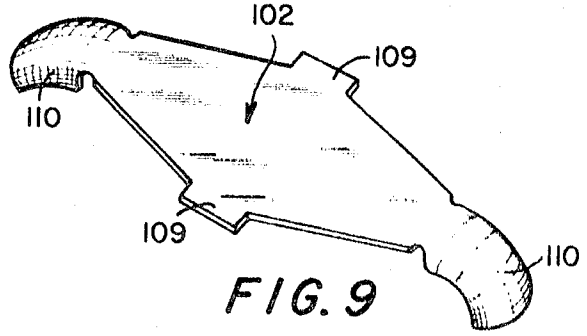
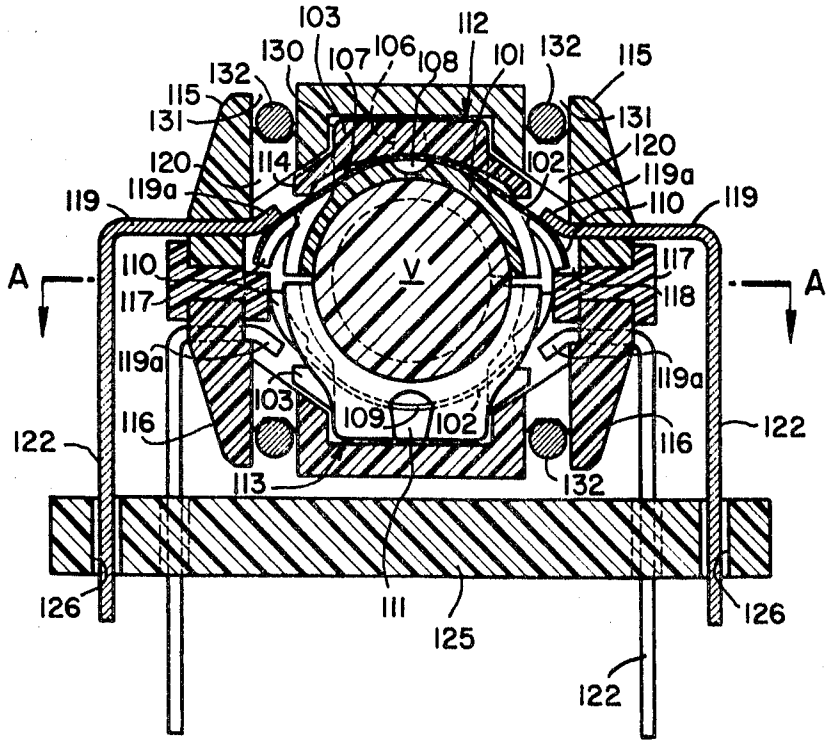


FIG. 9

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FIG. 13



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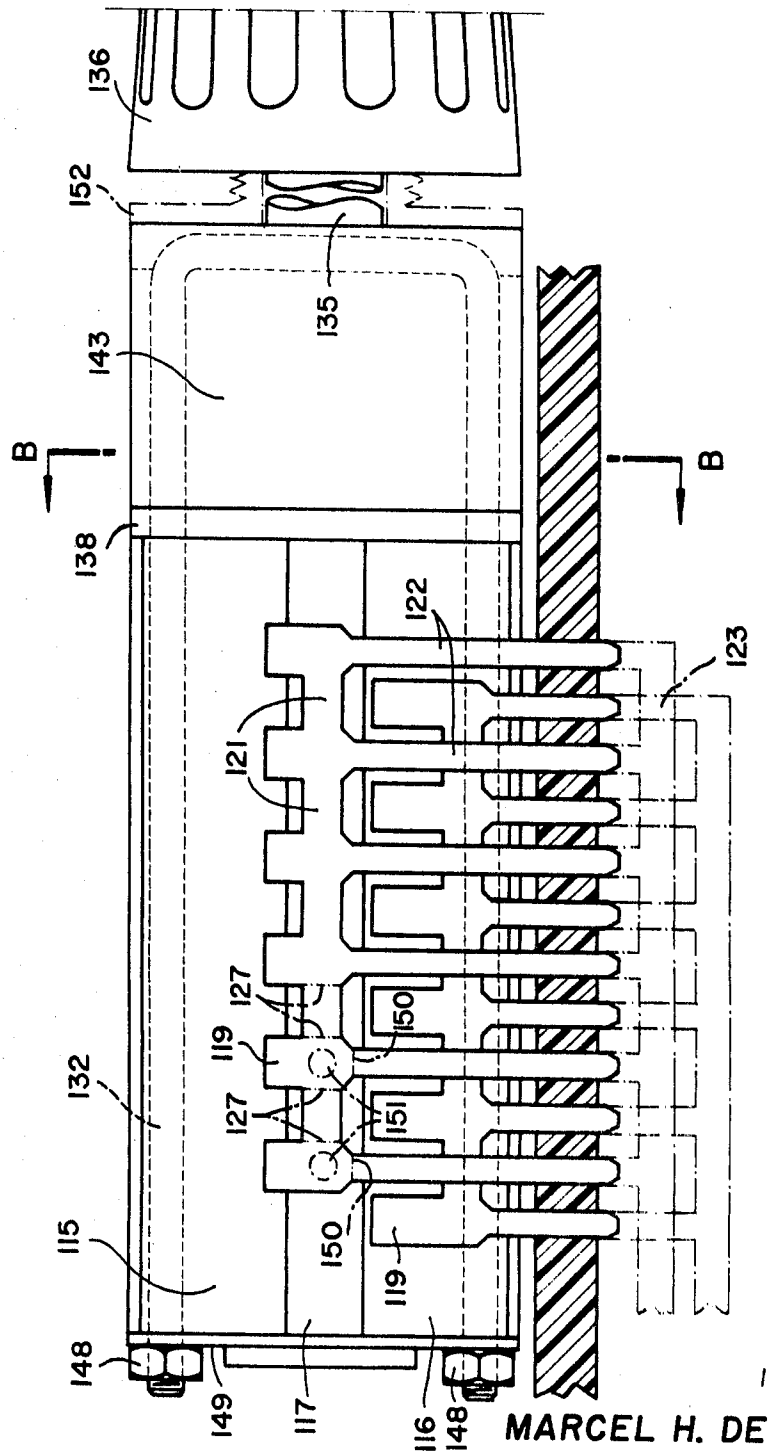


FIG. 14

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FIG. 15

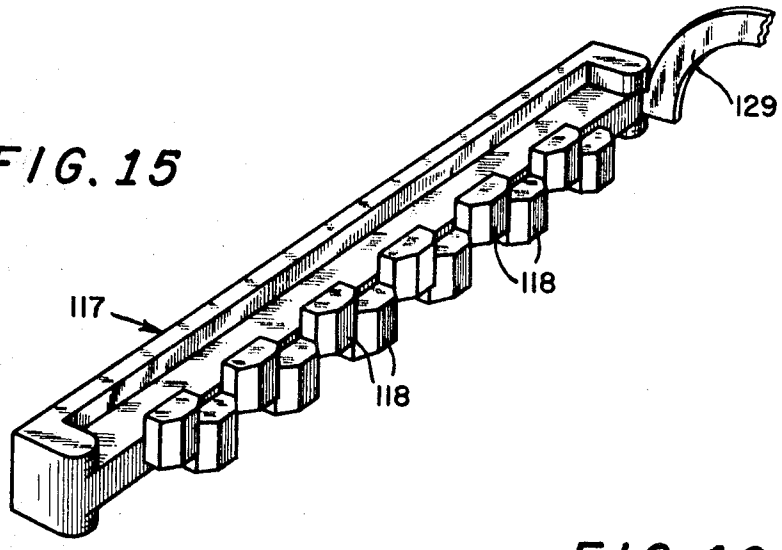
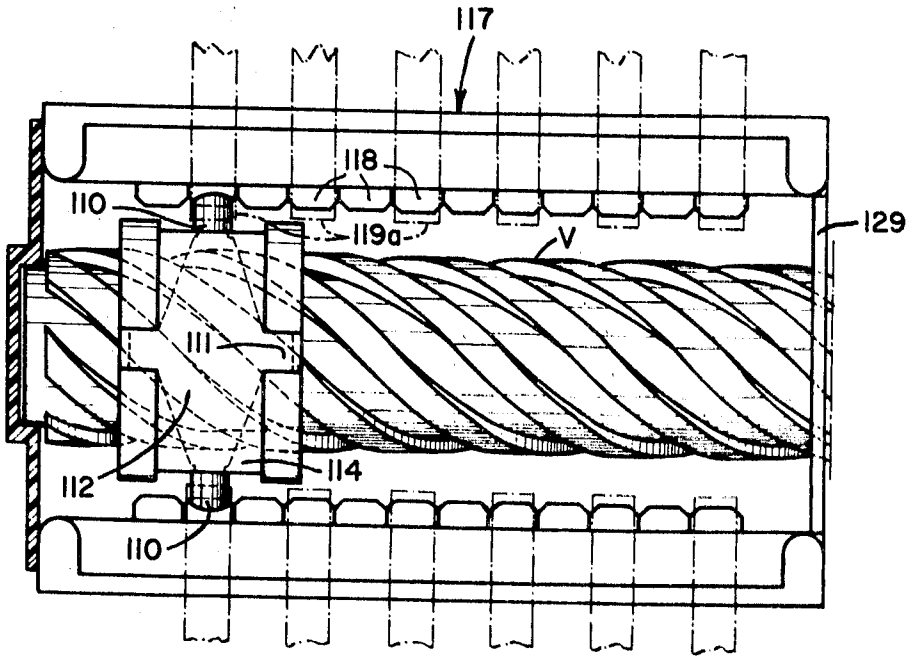


FIG. 16



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FIG. 17

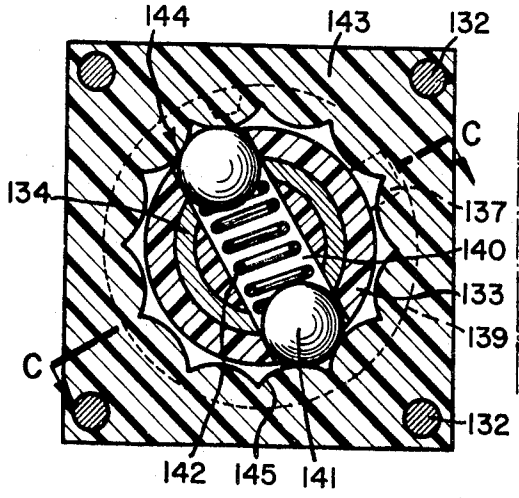


FIG. 18

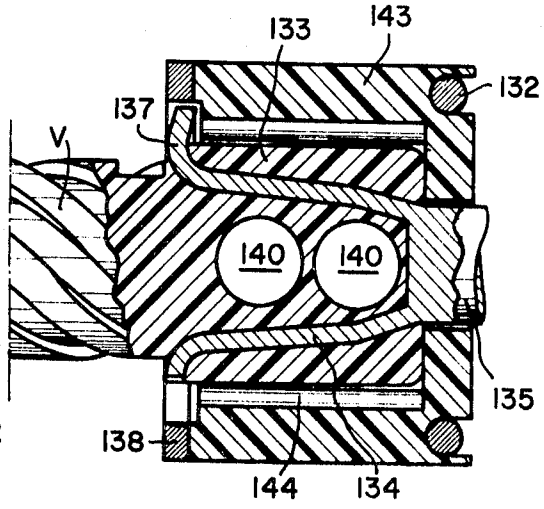


FIG. 19

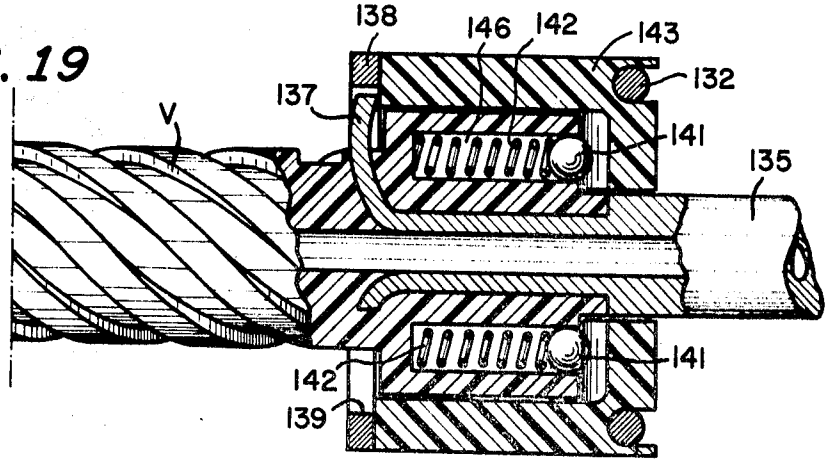
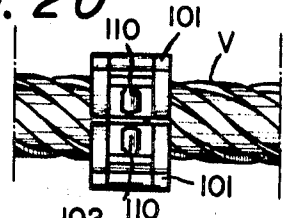


FIG. 20



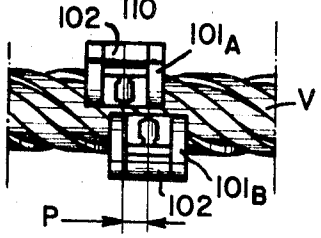
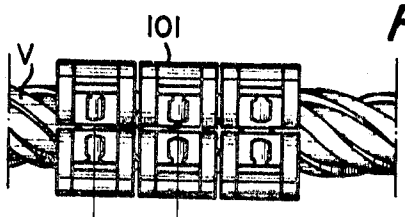


FIG. 21

FIG. 22



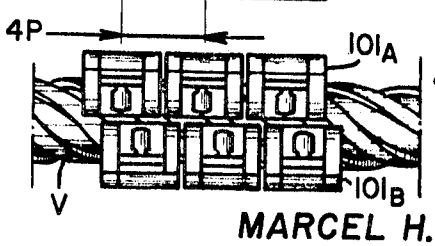


FIG. 23

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ROTARY SELECTOR SWITCHES FOR ELECTRONIC CIRCUITS

BACKGROUND OF THE INVENTION

The present application relates to multiple position switches, and is a Continuation In Part of U.S. Pat. application Ser. No. 700,119, filed in Jan. 24, 1968 and now abandoned and entitled "Multiple Position Switches."

Switches having multiple marked positions are already known. Such switches enable a number of circuits or sets of circuits to be successively switched. Generally, these switches are of the rotary type. In order that they can switch a number of sets of circuits they comprise a stack of associated rotor and stator discs or, with the interposition of bevel gears, a plurality of pairs of discs, rotor and stator respectively, which occupy various positions.

Consequently these types of multiple position rotary switches are bulky, and moreover, the number of circuits on which they can act is limited. Furthermore, they are not particularly suitable for use in the standardized grids formed with perforations distributed in the form of a checker-work, which are employed to support printed circuits, various electronic components, as well as the switches themselves, and wiring associated therewith.

However, multiple position rotary switches have appreciable advantages. Firstly, their knobs are easy to operate; secondly, the ratchet mechanisms for marking the positions are well known and of simple construction and their operation is familiar to the users of electronic apparatus; and finally, it is difficult to exceed the desired final position by quick or violent operation thereof.

The present invention relates to switches having multiple marked positions, the particular positions being dependent upon the position of a knob, and which switches are well adapted to standardized perforated grids and permit the use of any desired number of circuits.

SUMMARY OF THE INVENTION

According to the present invention, there is provided a multiple position switch comprising a frame, a shaft mounted for rotational movement on said frame, a knob attached to one end of said shaft for manual rotation of said shaft, a toothed wheel mounted on said shaft, at least one pawl, a resilient member connecting said pawl to the frame, the pawl cooperating with the toothed wheel to define a plurality of positions in which the shaft and knob can be rotated into at least two sets of fixed contact members secured to the frame in parallel relation with one another, a sliding block member arranged to slide between and parallel to the two sets of fixed contact members, and a transmission system connecting said shaft to said sliding block member whereby rotational movement of the shaft is converted into translational movement of the sliding block.

Thus, on rotation of the knob, the sliding block is translationally moved, and since it supports along its length an arbitrary number of movable contacts, it can effect all the desired switching operations between sets of circuits by travelling along the sets of contacts, each contact bridging from one pair of studs to the other.

A single sliding block associated with a plurality of sets of contacts in a row can thus replace all the pairs of stator and rotor discs of the most complex rotary switches and render possible any desired contact arrangements.

The switch, according to the invention, also affords all the advantages of rotary switches having marked positions, plus the advantage that the rotary knob may, if desired, perform more than one revolution without the switch passing the same switching positions.

Various mechanisms may be provided to convert a uniform rotation into an also uniform translational movement such as a screw-and-nut mechanism, which, if desired, may be amplified by a lever, and the rack-and-pinion mechanism.

In addition to those objects discussed above, it above, it is a further object of the invention to provide a multiple position switch which permits a distribution of the stationary contacts along the screw with a step as small as the smallest step standardized for printed circuits, namely 1.27 mm. (one-twentieth in.), this displacement by one step of the slide being obtained for a unit rotation of the control knob, included between two stable positions established by pawls, reduced to a fraction of a revolution as small as, for example, one-twelfth of a turn (30°).

The invention also permits, with a small number of parts, great flexibility in the making of connections between stationary contacts.

In accordance with one characteristic of the invention, with the threaded shaft or screw having an even number of threads, and in particular four, shoes cooperating with said screw are made of elastic insulating material. The shoes surround the screw over half its circumference and each of them bears a contact bridge, each shoe thus having the shape of a half-nut.

On the screw having an even number of threads, there corresponds to each of them a thread which, at all points, is diametrically opposite another thread. As in an embodiment of this type the pitch of the threads is large due to the fact that the screw has a relatively small diameter and that a small rotation of the screw results in appreciable displacement of the half-nut along same, these threads are substantially inclined with respect to the axis of the screw.

Accordingly, a half-nut, even if short, has recessed therein the imprints of these portions of screw threads, two of which, diagonally opposite near its ends, assure an elastic engagement by pressure of the half-nut against the screw into the threads of the latter. Thus, such a half-nut engages the screw, is fastened thereto, and cooperates with same for its longitudinal displacement without the reactions of the threads on the half-nut during rotation, tending to separate the half-nut from the screw.

Therefore, in order to effect the longitudinal sliding of the half-nut along the screw, there are sufficient means intended simply to prevent said half-nut from turning, without it being necessary for said means to press the half-nut against the screw.

The use of half-nuts, each of which bears a bridge contact, makes it possible, by placing them opposite each other and bringing them together, with or without stagger, to produce all varieties of contact-bearing slides capable of use in a switch of this type.

It is shown that it is thus possible to obtain a switching upon each angular step of the control knob, or else switching by pairs of circuits every two steps of rotation of the control knob.

In accordance with another characteristic feature of the invention, each contact bridge borne by a half-nut is an elastic blade which is tapered towards its ends, which ends are curved at least transversely. Each blade is fastened to a half-nut and is maintained curved by a cap surrounding the central part of the blade and its resting surface on the half-nut, and the cap is maintained on each side by a stud engaged in a radial housing of the half-nut, the width of which housing is greater towards the axis thereof than towards the outside.

It is thus possible, after having placed the blade on the half-nut, to place the cap, accentuating the bend of this half-nut and forcing the studs of the cap into the recesses in the half-nut. In this way, when the half-nut is engaged elastically on the screw, the recesses close and the studs which hold the cap cannot escape from their housing. Furthermore, the blade itself is preferably provided laterally with studs engaging in holding recesses of the studs so that the blade is also fastened by the cap to the half-nut.

The resting surface of the blade against the half-nut is advantageously a cylindrical portion of the latter while the cap presses the blade on both sides of said cylindrical supporting surface.

The above-enumerated objects of the present invention, as well as many of the attendant advantages thereof, will become

more readily apparent when reference is made to the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 through 3 diagrammatically illustrate, in elevation, three switches having marked positions;

FIG. 4 illustrates a position-marking device;

FIGS. 5, 6 and 7 are cross sections through movable parts and fixed parts of a switch having a rectilinear translational movement;

FIG. 8 shows, in perspective, a half-nut bearing a contact bridge;

FIG. 9 shows, in perspective, a contact blade;

FIG. 10 shows the cap of a half-nut;

FIGS. 11 and 12 are top plan views of two types of half-nuts, the threads of which are a distance apart equal to the length of a linear step of displacement of a half-nut for an angular step of rotation of a control knob;

FIG. 13 is a cross section through an example of a switch in accordance with the invention;

FIG. 14 is a side view of the switch shown in FIG. 13.

FIG. 15 shows, in perspective, an element for insertion between the two housing parts of the switch shown in FIGS. 13 and 14;

FIG. 16 is a section view along the line A–A of FIG. 13;

FIG. 17 is a section view along the line B–B of FIG. 14;

FIG. 18 is a section view along the line C–C of FIG. 17;

FIG. 19 shows, in section, an alternate embodiment of the pawl mechanism producing the rotation step; and

FIGS. 20 through 23 illustrate different possible embodiments of the slide bearing the bridge contact by means of half-nuts such as shown in FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The switches illustrated in FIGS. 1 through 3 comprise a frame 1 in the form of a cage, which supports the bearing of a rotary shaft shaft 2. A knob 3 is connected to the end of the shaft 2, and is provided for manual actuation. A toothed wheel 4 (FIG. 4) having triangular teeth is secured to the shaft 2. A pair of pawls 5 supported by the resilient blades 6 engage in the spaces between the triangular teeth of the wheel 4. The blades 6 are secured at one of their ends to supports 7 and slide in the supports 7 at the other of their ends. Thus, the shaft 2 can turn only through fractions of a revolution which are equal to the angular distance between two teeth and it is held in its successive positions.

In the construction illustrated in FIG. 1, the shaft 2 is secured to a screw 8 having four threads, the screw engaging with a nut 9, which is secured to a sliding block 11 movable between two strips 12 on which fixed contact members 13 are mounted. The strips 12 are held at their two ends by means of the frame 1 and the cross member 35 so as to be parallel with one another. On rotating the knob 3 through a given angle the sliding block 11 moves a given length, which movement is constant throughout the travel of the sliding block owing to the conversion of the rotation into a translational movement by the mechanism comprising the screw 8 and the nut 9. The spacing between the triangular teeth on the wheel 4 is such that each step of the rotation of the knob 3 causes the sliding block 11 to move step by step between consecutive contacts 13.

By reason of the small diameter of the screw 8, the travel corresponding to one revolution of the knob 3 cannot be very great even with a multiple-thread screw. As illustrated in FIG. 2, this travel may be amplified by a lever mechanism. The nut 9 carries a pin 17, on which there pivots the lever 16, which is connected to the frame 1 by a link 15 and to the sliding block 11 by a link 18.

Thus, the translational movement of the nut 9 is amplified with a substantially constant ratio so that the sliding block 11 moves farther than the nut 9 for each rotational step of the knob 3. The total travel, and consequently the number of contact members passed over by a point of the sliding block for one revolution of the button 3, may thus be greatly amplified.

In the construction illustrated in FIG. 3, a bevel wheel 20 is secured to the shaft 2. The bevel wheel 20 meshes with a bevel pinion 21 secured to a spur tooth pinion 22, which engages in a rack 23 secured to the sliding block 11. By choosing the number of teeth of the gears 20, 21 and 22, any desired length of movement of the sliding block 11 may correspond to one revolution of the knob 3.

The strips 12 and the sliding block 11 may be made of molded insulating material with incorporated contacts or contacts which are secured to the block 11. Different arrangements of fixed and movable contacts are shown in FIGS. 5 through 7.

In the construction illustrated in FIG. 5, the sliding block 11*a* supports resilient contacts 25 which form a bridge between the studs 26*a* of the contacts 13*a* associated with the strips 12*a* situated on either side of the sliding block.

In the case of the construction shown in FIG. 6, the movable contacts 27 are C-shaped. The contacts 27 are laterally secured to the sliding block 11*b* by their legs which are fitted into recesses in the same sliding block. These contacts 27 may thus connect the studs $26b_1$ and $26b_2$ associated with the strips $12b_1$ and $12b_2$ superimposed on either side of the sliding block 11*b*. As compared with the construction illustrated in FIG. 5, the possibilities of connection and switching are thus doubled. Cross members of appropriate thickness maintain the strips $12b_1$ and $12b_2$ in the appropriate spaced relationship and the contact conductors $13b_1$ and $13b_2$ may be bent over to engage in parallel-aligned holes 29 in an insulating grid 28, the holes being so located as to form a cross-lined screen.

FIG. 7 illustrates a construction which is applicable to the construction shown in FIG. 1. The contact studs consist of the bared ends 30 of the contact blades $13c_1$ and $13c_2$ incorporated in the thickness of the superimposed strips $12c_1$ and $12c_2$. The opposite studs 30 are connected by the blades 31A and 31B, each of which is disposed in an insulating block 32A, 32B comprising an internally screw-threaded portion in engagement with the screw-threaded rod 8. The conductors 13, and where necessary the contact studs 26, may be incorporated in the strips 12 in the molding stage of the manufacture. They may also be fitted into recesses formed in the molding of the strips and of the sliding block and secured in the latter by screws, or bent over tags.

In addition, the interconnections of the studs may be provided for in advance in the studs incorporated in the strips 12. For example, as shown in FIG. 2, a number of contact members 39 may be cut out of the same conductive blade while remaining connected by a common portion 36 which is embedded in the material of the strip 12 and comprises a single connecting tag 37.

It is also possible to provide over the whole length of the strips 12, single, like contacts 13 and, as shown in FIG. 1, to interconnect their leadout tags by means of a welded conductive bridge 38.

With reference now to FIG. 8, 9 and 10 the slide element is shown at A and comprises a half-nut 101 of elastic insulating material, a bridge contact blade 102 (shown in detail in FIG. 9) and a cap 103 (shown in detail in FIG. 10).

The half-nut 101 has, recessed therein, screw threads 104 which correspond to the four threads of a screw "V" (See for example FIG. 16.) the diameter at the thread bottom corresponding to that of the half-nut.

The half-nut is limited by two collars 105, each being provided with a dovetail notch 106, the widest portion thereof facing the axis of the half-nut 101. In addition to the collars 105 (See FIG. 13), the half-nut comprises a pair of cylindrical supporting surfaces 107 which, for ease of molding, are separated by a groove 108. The width of these surfaces corresponds to that of the base of the dovetail notches 106.

The bridge contact blade 102 is applied against the supporting surfaces 107. This blade, whose width decreases towards

the ends, has two studs **109** intended to take their positions in the bottom of the notches **106**. At the ends, the blade **102** has contact elements **110** which are curved with a small radius of curvature in the transverse direction and with a larger radius of curvature in the longitudinal direction.

Each blade **102** is held in place by the cap **103** which, for this purpose, is provided with studs **111** fit into the notches **106**. A rectangular central portion **112** is interposed between the collars **105** and forms with it a rectangular boss **113** and two supporting edges **114** (See FIG. 13) against the blade **102** to curve the latter at the contact with the surfaces **107**.

As the half-nut **101** is made of elastic plastic material, one can, by squeezing it so as to bring its linear edges together, open the notches **106** to insert therein the studs **111** which are locked in position when the half-nut resumes its shape.

As shown in FIGS. **11** and **12**, two types of half-nuts **101A** and **101B** are used. They differ from each other by the fact that in the axial direction of the half-nut, the threads **104** are shifted apart by the width of a linear step "*p*." This linear step "*p*" is the displacement which the half-nut undergoes when the screw "V" turns through angle corresponding to the step of rotation of its control knob. It will be seen subsequently that, for the embodiment shown, the rotation step is one-twelfth of a revolution while the linear step "P" is 1.27 mm. As a matter of fact, in the embodiment shown, the central thread of the half-nut **101A** passes through the center of said half-nut while in the case of the half-nut **101B**, the central thread is shifted by the step "*p*" from the center.

In both cases, the half-nut has two thread portions **104***a* and **101***b* in the case of the half-nut **101A**, and **104***c* and **104***d* in the case of the half-nut **100B**. The threaded portions form a hook or claw which engage with two diametrically opposite threads of the screw "V" so that the half-nut engages elastically on the latter when pressed into contact with same. The half-nut is then effectively held in place on the screw by virtue of the great obliqueness (due to the length of the pitch of the threads) of the portions **104***a*, **104***b* and **104***c*,**104***d* of the recessed threads which hook onto the opposite threads of the screw.

In order to facilitate rotation and reduce wear, the screw "V" and the half-nuts are made of plastic material of a low coefficient of friction and which emerge polished from molding, for instance, of the material known on the market under the name "Delnn."

The screw, equipped with at least one half-nut, is arranged axially in the housing shown in FIGS. **13** and **14**. The housing is formed of two shells **115** and **116** separated by braces **117**, the braces bearing barbs **118** which constitute bosses between stationary contacts. The shells **115** and **116** are substantially similar but reversed with respect to each other. In the embodiment shown, these shells each bear on six contacts per side, totally 12 contacts. The 12 contacts of one shell are obtained from a single metal sheet suitably cut out and punched. The cuttings produce, towards the inside of the shells, tongues **119** which upon molding are incorporated in the molded material except for their ends **119***a* onto which the molded material is prevented from penetrating due to the squeezing of each of these portions **119***a* between two punches which grip same. The punches furthermore provide in the shells, channels **120**, each of which corresponds to one contact.

The molded material of the shells **115** and **116** is selected, not only for its electrical properties but also for its properties of mechanical strength. In particular, the material can be filled with short glass fibers.

The tongues **119** are originally joined together by portions **121** and are extended by small bars **122** which, in the original sheet, are connected together by a longitudinal selvage **123** used for positioning the punched plate forming the contacts in the shell-shaping mold.

After molding, the parts **123** are eliminated so that the small bars **122** become connecting tongues which can be shaped as shown in FIG. **13** in such a manner as to be electrically separated and so that the distance between their planes corresponds to a whole number of steps "*p*" separating, in a printed circuit **125**, two consecutive openings **126** in said circuit. It will be recalled that the standard pitch of the openings is either 1.27 mm. or 2.54 mm. In a similarly known manner, the carrying "grids" of printed circuits can have staggered holes. That is to say, the circuits may be formed of alignments of holes with double pitches of 2.54 mm., spaced apart by a double pitch, the holes of one of these alignments being staggered with respect to those of the adjacent alignment by a single pitch.

Between the tongues **119**, the portions **121** may be kept, which makes it possible to form a "common line," for instance, for feeding voltage to a plurality of circuits. These portions **121** can also be eliminated as indicated by the dotted lines **127** so as to separate each of the contacts entirely from its neighbor.

Each shell thus bears towards the inside six pairs of contacts **119***a* opposite each other, two consecutive pairs being separated by a double pitch "*p*," while the six corresponding pairs of the lower shell are interposed between those of the upper shell so that two pairs of contacts belonging successively to the upper shell and to the lower shell, and conversely, are separated only by the pitch "*p*."

The barbs **118** (See FIG. **15**.) are arranged in such a manner that each forms a boss which takes its place, respectively, in a space between two consecutive ends **119***a* of the upper shell and of the lower shell. For this purpose, the barbs **118** are arranged staggered on both sides of the plane of symmetry of the cross members **117** as shown in FIG. **15**. These bosses, as will be made clear below, are intended to facilitate the passage from one bridge contact of a pair of stationary contacts to the next one, avoiding any danger of short circuiting between these pairs.

To facilitate the mounting, the two cross members **117** which bear the barbs **118** may be connected by a bow **129** making it possible to position and hold the two cross members **117** of one and the same unit during the assembly of the housing.

The bosses formed by the barbs **118** could also be molded integral with the shells. However, when these shells are molded with material containing an abrasive filler (glass fibers) there is very rapid wear of the contact blades **102**. Since the cross members **117** to do suffer any mechanical stress, they can be molded of a plastic material of a reduced coefficient of friction, for instance, of "Delrin."

Each shell finally comprises on its inner face an axial groove **130** intended to receive the rectangular boss **113** of a half-nut and, on its outer face, two grooves **131** in which the assembly rods **132** are housed.

The molded screw "V" has a head **133** in which there is embedded a fork **134** forming the termination of the metal shaft portion **135** to the end of which the operating knob **136** (FIG. **14**) is fastened. One of the branches of the fork forms a spur **137** which, passing through the notch **139** provided in the edge of the circular opening of a plate **138**, permitting the passage of the head **133**, limits the permissible angle of rotation of this screw. This notch may substantially extend over practically a complete revolution, or else the rotation of the knob **136** can be limited to half a revolution or even, as will be seen below, to a smaller fraction such as one-sixth of a revolution. This metal spur **137**, movable in the opening of a plate which is also of metal, necessarily limits the possible rotation of the knob without risk of damage to the less resistant parts of molded material when the user attempts to force the rotation of the knob **136** after it has come to the end of its stroke.

In the head **133**, between the two branches of the for, there are provided circular openings **140** each of which contains two balls **141**. Between the balls is positioned a compression spring **142**.

The plate **138** forms the cover of a molded housing **142**. The section of the cavity **144** which serves to receive the head **133** of the screw is of a star-shape **145**, in the present case, with 12 rays. Upon rotation of the screw, the balls **141**, pushed

by the spring **142**, jump from one peripheral hollow of the cavity to the next, imposing upon the knob and therefore upon the screw a step of rotation corresponding to the angular path between these hollows, namely, in the present case, 30°. In order for this angular step to correspond to a linear pitch of a half-nut equal equal to 1.27 mm., the pitch of the threads of the screw "V" is therefore 15.24 mm.

The balls housed in the holes **140** have a small drawback of preventing the use of an axial passage in the screw "V" and in the shaft **135**. In order to remedy this drawback, however, the arrangement shown in FIG. **19** can be used.

The screw "V" is tubular as is the shaft **135**, and the head **133** is provided with axial channels **146**. As previously, the head is rigidly connected with the shaft **135** by a terminal flaring of the latter which can be effected by means of attached parts.

In the channels **146**, there are arranged the balls **141** and the spring **142** which separates them. In this case, the star-shaped hollows **147** are provided in the walls of the housing **143** which are perpendicular to the axis of the screw. One can thus arrange coaxially to the main knob **136** the knob of smaller diameter (not shown), which acts on a shaft axially transversing the shaft **135** and the screw "V" to act on a fine adjustment member mounted at the end of said screw (coil, potentiometer, capacitor). In this case, the contacts driven by the screw "V" permit stepwise variations of the magnitudes adjusted by the fine adjustment member.

The housing **143**, the plate **138** and the pair of shells **115**, **116** with the cross members **117** interposed, are assembled, as already indicated, by the rods **132**. These rods constitute preferably (FIG. **14**) a pair of U-shaped straps and are terminated with threaded portions on which there are screwed the nuts **148** fastening a plate **149** serving as an axial stop to the screw "V."

An assembly **101**, **102**, **103** (that is to say a half-nut bearing a contact bridge) having been engaged on the screw, upon each rotation of one-twelfth revolution of the latter (FIGS. **13** and **16**) the curved ends **110** of the blade jump from a stationary contact **119***a* to the adjacent barb **118**, or conversely, from a surface of a barb to the following tongue end. As shown in FIG. **13**, upon the passing of each barb **118**, the curved end **110** of the blade is spaced from the tongue ends **119***a*. One thus avoids any risk of short circuiting between two consecutive tongue ends produced by the blade coming between said ends.

By using blade ends **110** of a width smaller than the space between two stationary contacts, one could dispense with the use of the bosses which are formed by the barbs **118**. However, in this case, it is necessary to shape the ends **119***a* forming fixed contacts in such a manner that the blade ends can "rise" on the following contact after having "dropped" in the space between them.

Furthermore, as shown, the end **110** is also curved in the longitudinal direction and the terminal portion of this end cooperates with the bosses **118** while a portion closer to the center of the blade cooperates with the contacts. The wear due to the rubbing of the end **110** on the contacts and the bosses is thus distributed over two separate surface portions.

Under these conditions, if, as shown in FIG. **20**, two identical half-nuts of type **101A** or type **101B** are engaged opposite each other, the contact blades **102** are opposite each other, and when the portions **110** of an upper blade touch the two corresponding ends **119***a*, the portions **110** of the lower blade rest against a pair of barbs **118**. Thus, upon each step of rotation of the knob **136**, every one-twelfth revolution in the present case, the contact is alternately established in the upper shell and in the lower shell, or vice versa.

If the 12 contacts located on the same side of the switch are connected together, in particular, by preservation of the portions **121**, an electrical connection of two of the tongues **122** belonging to the lower shell and the upper shell, respectively, one can successfully place 12 circuits under voltage with a slide composed only of two half-nuts, as shown in FIG. **20**.

On the otherhand, if one uses two different half-nuts, for instance, one of type **101A** and one of type **101B**, as shown in FIG. **21**, the two blades **102** are apart one step "*p*." In this case, it is possible, for example, simultaneously, to apply two different voltages to the two circuits of a pair of circuits and by rotation of one revolution of the knob, assuring the placing under voltage successive of six pairs of this type, each placing under voltage being separated by a position of rest of the control knob **136**.

In the same manner, one can produce a slide bearing six bridge contacts by means of six half-nuts **101** arranged in such a manner that the blades are opposite each other or a slide (FIG. **23**) in which the six blades are shifted three by three by one step. In the first case, one can, upon each step of rotation of the knob, obtain a group of three connections, the rotation of the knob being limited to four steps, namely, three groups, and in the second, one can obtain two groups of six connections, the rotation of the knob being adapted to be limited to one step on each side of an intermediate rest position.

In order for it to be possible to thus place together several half-nuts in order to constitute a complex slide, it is advisable that the axial length of the half-nuts be practically identical to four steps "*p*" so that each blade **102** can relate to the opposite pairs of ends **119***a* and one of the two adjacent pairs after two steps of rotation.

The useful axial length of screw "V" is therefore equal to one step (pitch) "*p*." of the screw thread (i.e. **12** "*p*.") plus the axial length of a half-nut (4 "*p*."), or, in the example considered, 16×1.27=20.32 mm.

It is possible to arrange end to end several assemblies consisting of a unit length of screw in two associated shells. Experience shows, however, that it is scarcely possible to place more than three lengths of screw end to end, and this, furthermore, only under the condition that each of them controls only one slide formed of two half-nuts. Beyond this, the manual force necessary for the rotation of the knob becomes prohibitive.

It will nevertheless be noted that such an embodiment permits the switching of 12 groups of three circuits, each one after the other.

Although in the embodiments illustrated, the switch in accordance with the invention has been described and shown as associated with printed circuits, it may also, in the same manner as ordinary knob selector switches, be fastened in the front plate of an apparatus by means of a threaded sleeve base **152** (FIG. **14**) surrounding the shaft **135**.

In this case, the tongues **122** can be cut as indicated by the dotted lines **150** and the ends protruding to the outside of the tongue portions **119** can be perforated, as indicated at **151**, for the soldering of connecting wires connecting the switch to a plurality of any desired circuits (that is to say, not necessarily printed circuits).

The invention is applicable in all electronic devices employing microcircuits and requiring successive switches of circuits, for instance, for adjustments, measurements, changes of tuning or measuring ranges, etc. It is therefore the intent that this invention not be limited to the above, given for exemplary purposes only, but be limited only as defined in the appended claims.

What I claim is:

1. A selector switch comprising a rotary knob; a shaft having a plurality of protruding threads and supporting said knob; the knob and shaft having definite angular positions defined by click-stops; at least a pair of shoes in the form of half-nuts of elastic insulating material facing each other and applied against the threads of the shaft; a C-shaped resilient contact blade substantially capping each shoe; a pair of shells facing each other, each enclosing one shoe and provided in the central portion with means parallel to the shaft for guiding the corresponding shoe, and in each lateral portion with a row of stationary contacts, each cooperating with one end of said blade; and means for fitting together said shells substantially in edge to edge relationship for enclosing the shaft, the shoes and the contacts.

2. A switch according to claim 1, characterized by the fact that the C-shaped blade is tapered towards its ends which are curved at least transversely, said blade being fastened to the half-nut and held curved by a cap surrounding its central portion and the resting surface on the half-nut, which cap is held on each side by a stud engaged in a radial recess in the half-nut, the width of which is larger towards the axis thereof then towards the outside.

3. A switch according to claim 2, characterized by the fact that the resting surface of the blade blade is a cylindrical portion of the half-nut, and the cap is in contact with the blade only on opposite sides of said resting surface.

4. A switch according to claim 2, characterized by the fact that the blade has lateral studs held in the recesses of the half-nut by the studs of the cap.

5. A switch according to claim 1, characterized by the fact that the pitch of the threads of the threaded shaft is 15.24 mm., while the angular step of the control knob of said shaft is 30°.

6. A switch according to claim 1, characterized by the fact that the stationary contacts are tongues embedded in the material of the shells and protruding towards the inside of the shell, the tongue portions protruding outside of the shell providing the electrical connection.

7. A switch according to claim 6, characterized by the fact that the assembly of tongues of one and the same shell is obtained from a perforated single metal blade embedded in the mold upon manufacture, the needless connections between tongues being eliminated after molding.

8. A switch according to claim 6, characterized by the fact that the stationary contacts located on the same side of a shell are separated by bosses forming, towards the inside of the shell, protrusions which are larger than the said contacts.

9. A switch according to claim 8, characterized by the fact that the bosses are borne by a pair of small barbs of molded material having a low coefficient of friction with respect to the component metal of the blades; which parts are interposed between the adjacent edges of the shells.

10. A switch according to claim 8, characterized by the fact that the ends of the blades are curved in the longitudinal direction and come into contact at their terminal portion with the bosses and, via a portion close to their center, with the stationary contacts.

11. A switch according to claim 6, characterized by the fact that the stationary contacts borne by the shells are separated by the same pitch, but are interposed between each other, the distance between two consecutive stationary contacts belonging to the two shells being equal to the linear displacement of the half-nut for one step of rotation of the control knob.

12. A switch according to claim 11, characterized by the fact that the stationary contacts located on one side of the shells being interconnected, the threaded shaft comprises two half-nuts precisely opposite.

13. A switch according to claim 11, characterized by the fact that the stationary contacts located on the same side of two shells being separately interconnected, the screw comprises two opposite half-nuts, the contact blade of which are shifted by one step of linear displacement of said half-nuts.

14. A switch according to claim 11, characterized by the fact that a slide formed of several pairs of opposite half-nuts is mounted on the threaded shaft, the distance between two contact bridges borne by two adjacent half-nuts being equal to twice the distance between stationary contacts of one and the same shell.

15. A switch according to claim 11, characterized by the fact that the distance between two consecutive stationary contacts of one and the same shell is equal to 2.54 mm., while the axial length of a half-nut is slightly less than 5.08 mm.

16. A switch according to claim 6, characterized by the fact that the shells are assembled by connections between the housing of the head of the threaded shaft and a bottom plate which can form the stop for the said threaded shaft.

17. A switch according to claim 1, characterized by the fact that the threaded shaft is rigidly connected with a head comprising at least one borehole for the housing of two balls with an interposed compression spring, said head being housed in a housing having star-shaped depressions which receive the ball portions in elastic protrusion with respect to said head, the distance between two consecutive depressions being equal to one angular step of rotation of the control knob.

18. A switch according to claim 17, characterized by the fact that the threaded portion of the shaft and the head thereof are of molded material of a low coefficient of friction, the flared end of a metal shaft which forms an extension of the threaded portion being embedded in the molded material of the head.

19. A switch according to claim 18, characterized by the fact that the threaded shaft, its head and its extension, are tubular are are transversed by an axial shaft operated by an auxiliary knob.

20. A switch according to claim 18, characterized by the fact that an extension of the flaring of the metal shaft protrudes with respect to the head and cooperates with the opening of a metal plate placed against the housing containing the head for limiting the rotation of the shaft.

21. A switch according to claim 1, characterized by the fact that the threadings borne by the two facing half-nuts permit placing the two corresponding C-blades with an axial spacing equal to one step of linear displacement of the half-nuts corresponding to one step of linear displacement of the half-nuts corresponding to one step of angular rotation of the control knob.