Oct. 27, 1964 P. PARLATO 3,154,645

CAM OPERATED SEQUENTIAL SWITCHING DEVICE

Filed Sept. 17, 1962

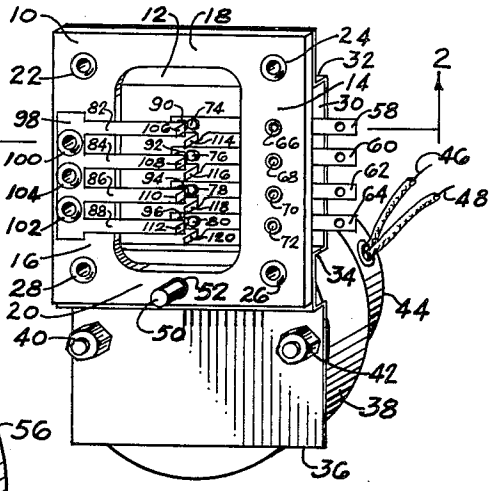
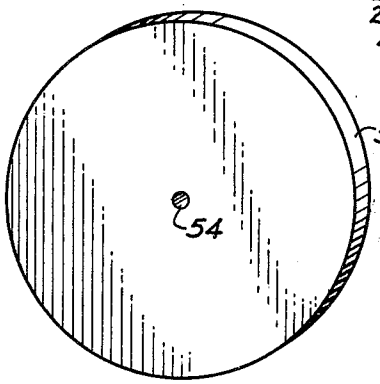


FIG. 1



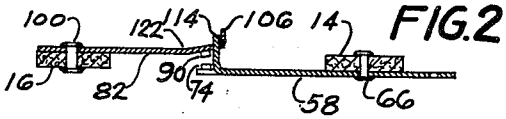
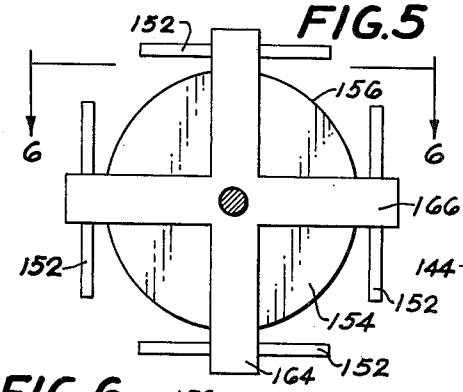


FIG. 2

FIG. 5



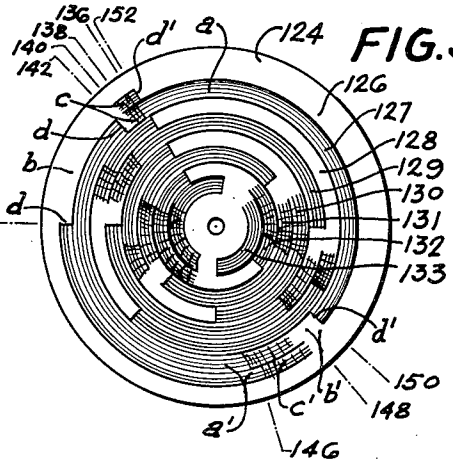
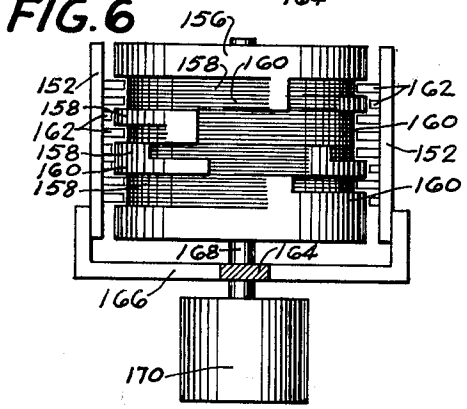


FIG. 3

FIG. 6



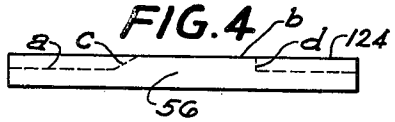


FIG. 4

INVENTOR.
Philip Parlato
BY
Leonard H. King

United States Patent Office

3,154,645

Patented Oct. 27, 1964

3,154,645
CAM OPERATED SEQUENTIAL SWITCHING DEVICE

Philip Parlato, 730 Home St., Elmont, N.Y.

Filed Sept. 17, 1962, Ser. No. 225,405
4 Claims. (Cl. 200—38)

This invention relates to switching devices and has particular reference to a switching arrangement wherein a plurality of switch contacts are sequentially operated by means of a motor driven timing device as may, for example, be employed to sequentially operate glow lamps in a lighting display, warning device, or the like.

Common switching devices may utilize a simple motor driven rotating armature contact for interrupted and sequential connection with a plurality of stator contacts peripherally spaced along the path of the armature contact. The armature contact wipes the stator contact in the manner of a brush to create the on-off effect. Such arrangements are deficient in failing to produce a precise, abrupt make-and-break contact. Furthermore, sparking caused by the approach or proximity of the armature contact to a stator contact causes pitting and rapid deterioration of devices of this type. In hitherto known devices of the character described, these disadvantages could be overcome only by the addition of considerable weight and expense to the assembly.

It is, accordingly, one object of this invention to provide an improved switching device.

It is another object of this invention to provide a sequential switching arrangement characterized by abrupt make-and-break of contacts.

It is a further object of this invention to provide a sequential switching arrangement wherein the switching members are preloaded so as to rapidly make and break contact.

It is yet another object of this invention to provide a sequential switching arrangement characterized by positive control of the timing of making and breaking contact.

It is a still further object of this invention to provide a sequential switching arrangement wherein the timing may be positively controlled by a cam member which is exacly reproducible so as to permit mass production of the arrangement.

It is another object of this invention to provide a sequential switching device wherein the timing may be positively controlled by means of a cam actuating the contact members and wherein the cam is replaceable by a dissimilar cam to selectively alter the timing arrangement.

An important object of this invention is the provision of a sequential switching arrangement which is characterized by a compact assembly, wherein the number of contacts may be readily altered, upon which other switch units can be radially mounted and which is inexpensive and sturdy.

In accordance with the invention, there is provided an electrical switching arrangement comprising a non-conductive mounting board, a first resilient contact member on the mounting board adapted for connection to an electrical conductor, a second resilient electrical contact element mounted on the mounting board so as to be spaced from the first contact element, rotatable cam means for biasing the first of the elements directly away from the second and for biasing the second element toward the first beyond the unbiased position of the first element, and release means included on the cam means for releasing the elements. The cam means are arranged for simultaneously biasing both of the elements and for releasing, after a predetermined period, the first element so as to make sudden contact, and for releasing, after a second predetermined period, the second element so as to suddenly break the contact.

As a feature of this invention, such a switching arrangement is incorporated in a sequential switching device which includes a plurality of the pairs of contact elements described, each operated in sequence by the additional surfaces on the cam means which coact therewith and which are angularly displaced therefrom.

The various features of novelty which characterize this invention are pointed out with particularity in the claims. For a more complete understanding of this invention, its operation and its other objects, reference may be had to the following descriptive matter, wherein an embodiment is described and the accompanying drawings wherein:

FIGURE 1 is an exploded pictorial presentation of one embodiment of the invention;

FIGURE 2 is a section 2—2 of FIGURE 1 and represents a detail of a pair of contact elements and their mounting so as to illustrate their comparative positions;

FIGURE 3 is a plan view of the cam which engages the contact elements for actuation thereof and illustrates the manner in which sequentional timing is achieved by means of the cam;

FIGURE 4 is a schematic elevation of the cam disc schematically illustrating the level variations in the relief pattern of its surface;

FIGURE 5 is an end view taken in elevation of an alternative embodiment of this invention; and

FIGURE 6 is a section taken along lines 6—6 of FIGURE 5 and shows a pair of contact assemblies in operative relationship to an actuating drum.

Referring now to the drawings, the switch construction of the present invention comprises a rectangular non-conductive mounting board 10 which is caused to approximately conform to a D shape by a rectangular opening 12 centrally located therein to form a pair of vertical legs 14 and 16 and a pair of horizontal legs 18 and 20. It will be understood that the mechanism of FIGURE 1 may assume any position; the words "horizontal" and "vertical" being descriptive of the position of the legs shown in FIGURE 1. The mounting board 10 is suitably supported at each corner by means of locking rivets 22, 24, 26 and 28 upon a sheet metal backing 30 which is folded into supporting flanges 32 and 34 so as to be spaced from the mounting board 10 for most of its length. The backing 30 terminates in a depending support brace 36. A disc-shaped gear housing 38 is attached at one of its flat faces by meansof nuts 40 and 42 to the support brace 36 and carries on the other flat face a coaxial disc-shaped motor housing 44 of smaller diameter. A pair of lead wires 46 and 48 issue from a synchronous motor (not shown) in the motor housing 44 for connection to a suitable source of A.C. power. The synchronous motor in the motor housing 44 serves to drive a gear arrangement (not shown) in the gear housing 38 which ultimately rotates a cam shaft 50 projecting perpendicularly from the face of the housing 38 at a location removed from the axis of the housing and which clears an opening 52 in the horizontal leg 20 of the board 10. The cam shaft 50 is adapted for keying to an axial bore 54 in a cam disc 56 to be more fully described with respect to FIGURE 3.

A plurality of spaced resilient conductive strips 58, 60, 62 and 64 are joined by means of rivets 66, 68, 70 and 72 to the vertical leg 14 of the mounting board 10 and extend horizontally beyond the vertical centerline of the mounting board 10 in one direction and terminate in the other direction to form connector lugs suitable for electrical connection to one of a plurality of circuits to be interrupted. The strips are positioned on the face of the board 10 which faces the backing 30 in such a manner so as to be electrically insulated from one another and

terminate at their inner end in precious metal contact discs 74, 76, 78 and 80 mounted on the surface thereof adjacent to the board 10. Overlying the contact discs 74, 76, 78 and 80 and their corresponding strips are four spaced parallel resilient copper bands 82, 84, 86 and 88, provided with contact discs 90, 92, 94 and 96 facing the discs 74, 76, 78 and 80, which bands terminate at the vertical leg 16 at a common junction 98. Rivets 100, 102 and 104 serve to hold the bands 82, 84, 86 and 88 upon the mounting board 10.

The relative positions of the strips 58, 60, 62 and 64 and the bands 82, 84, 86 and 88 may best be appreciated from the showing in FIGURE 2 which is a cross-section 2—2 of FIGURE 1.

For convenience in assembly the board 10 is provided with grooves to receive the copper bands and thereby provide positive alignment. Such grooves may be formed by molding the board from a synthetic resin molding composition and integrally forming the grooves, or by machining the grooves into a preformed board employing a jig to insure reproducibility and accuracy.

Referring to FIGURE 1 as well as FIGURE 2, the bands 82, 84, 86 and 88 are folded at their inner ends to form contact lugs 106, 108, 110 and 112, which project transverse to the plane of the board 10 toward the cam disc 56. Follower lugs 114, 116, 118 and 120 are each carried at the lower edge of the strips 58, 60, 62 and 64 respectively, and also project toward the cam transverse to the plane of the board 10. As shown in FIGURE 1, the lugs 114, 116, 118 and 120 extend into the spaces between the lugs 106, 108, 110 and 112, and are slightly longer than the latter whereby their ends almost align with the ends of the latter; the lugs are relatively narrow so as to provide adequate clearance between adjacent lugs for electrical and mechanical purposes.

Referring again to FIGURE 2, the band 82 which is identical with the remaining bands is folded at 122 so as to slightly incline the contact disc 90 with respect to the disc 74. A clearance exists between the contact discs in the undisplaced condition of the resilient bands and strips. The inclination on the disc 90 with respect to the disc 70, assures intimate contact between the faces of the discs when a force upon the lug 106 displaces the disc 90 toward the disc 74 and biases the band 82.

The hidden face 124 of cam disc 56 is depicted in FIGURE 3 and displays relief pattern of adjacent annular surfaces 126, 127, 128, 129, 130, 131, 132 and 133. The mean radius of each surface corresponds to the distance of one lug such as, for example, 106 or 114 from the center of the cam shaft 50. The disc 56 is molded so that each annular surface represents a rotatable cam surface against which one lug is biased so as to control the action of the contact discs. In operation the disc 56 is longitudinally and rotatively secured to the shaft 50 for rotation therewith, so as to cause continual engagement between each annular surface and a corresponding lug. In the preferred embodiment, the fit between the shaft 50 and the opening 54 is sufficiently tight so as to prevent shifting of the disc 56. Other means may, however, be used to secure the disc, such as a keyway and the like. It is to be understood that any suitable means of securing the disc to the shaft is within the scope of this invention; and the term "keyed" is used throughout this specification and the appended claims to generally impute the condition of being rotatably secured although no keyway is shown on the drawings.

A preferred method is to employ a threaded motor shaft and provide a mating bore on the cam wheel. The thread direction chosen is opposite the direction of shaft rotation so as to prevent loosening of the cam wheel during operation.

Referring now to FIGURE 4, there is shown a schematic illustration of levels and slopes displayed by the surfaces with respect to the face of the cam 56. In FIGURE 3 the angular positions of these levels is identified by

suitable shading and marking and identical levels and slopes are uniformly shaded for ready identification.

Each annular surface includes a receding or releasing level designated "*a*" which is located a fixed inward distance from the face of the disc, an advancing or biasing level, designated "*b*," which is coplanar with the face 124, a transient or intermediate slope, designated "*c*," for gradual transition between the levels and a step, designated "*d*," for abrupt transition between the levels.

The disc 56 is adjusted for rotation upon the shaft 50 and engages the lugs such as, for example, 106 and 114, whereby ultimately make and break action is produced by rotation of the disc. This construction and operation is best understood when one strip such as 58 and one band, such as 82, are considered as a pair in their relation with the annular surfaces 126 and 127.

To further facilitate understanding of the operation as the disc 56 is turned, each lug is described as travelling along a circular path adjacent one surface. It should be understood, however, that this is a mere matter of convenience and that in ordinary use the lugs are kept rotationally stationary while the cam disc 56 is turned by the shaft 50. In their initial position all the lugs are considered aligned along the radial line 136 so that the lugs 106 and 114 rest against receding levels *a* of surfaces 126 and 127. When the cam disc is adjusted and operating, the engagement of the surfaces 126 and 127 at the receding levels lightly bias the band 82 as well as the strip 58, so as to cause displacement of contacts such as 90 and 74 away from the cam 56, i.e., downward displacement in FIGURE 2. As will be noted, due to the more accentuated projection of the lug 106 in the unbiased position, the latter will be further displaced from the cam disc 56 than the lug 114.

For simplicity, this displacement of the contacts may be henceforth referred to as the "unbiased" or "energized" condition of the contacts. As cam disc 56 rotates clockwise, as viewed in FIGURE 3, or correspondingly as lugs 114 and 106 are moved counterclockwise (as viewed in FIGURE 3) along the line 138 and into engagement with the slopes *c* of surfaces 126 and 127, resulting in further displacement of contact discs 90 and 74, a maximum displacement is obtained, at which time the lugs engage the level *b* of surfaces 126 and 127 along line 140.

The contact disc 90 is in this position displaced slightly beyond the position occupied by the contact disc 74 in its unenergized condition. Both contacts may now be referred to as in their biased or energized condition.

When the lugs advance into alignment with line 142 and the lug 114 reaches the step *d* on surface 127, where it is released by the surface, the stored energy in the strip 58 produces a sudden snapping movement toward the cam disc 56, i.e., upward as in FIGURE 2, whereby abrupt contact is made between the discs 90 in the energized condition and the disc 74 in the unenergized condition.

After further movement the lugs reach the angular position of line 144 and the step *d* on the surface 126. The contact disc 90 is in this position snapped away from disc 74 by the resilient band 82. Both contacts remain in the unenergized condition until the lugs reach line 146 and the slopes *c'* of surfaces 126 and 127 (FIGURE 3) and the cycle is repeated at slopes *c'*, levels *b'* and stops *d'* of surfaces 126 and 127. Contact discs 74 and 90 are energized when aligned with line 148. At line 150 contact 74 is snapped away due to step *d'* on surface 127. Step *d'* on surface 126 along line 152 releases contact disc 90 to break contact. Similar displacement and release of contact discs 74, 76, 78, 80, 90, 92, 94, and 96 is effected by the pairs of annular surfaces 128 and 129, 130 and 131, and 132 and 133, whose relief pattern of levels, slopes, and steps are angularly displaced from each other and from that of surfaces 126 so as to produce sequential making and breaking of contact between the various contact discs.

Since all the lugs are radially aligned as shown in FIGURE 1, it is possible by referring to FIGURE 3 to determine the condition of displacement of any lug or contact disc with respect to another lug or contact disc. For this purpose an imaginary radial line may be drawn through the annular surfaces. The intersection of that line with the surfaces will indicate the level or slope thereof allowing the proper inferences to be drawn with respect to contact of one contact disc with another. The lugs and surfaces coast in pairs and contact exists in this embodiment only when the band mounted lug rests against a receding level while the corresponding strip mounted lug rests against an advancing level.

The term "bias" or "biasing" or the like, as used herein, in particular with respect to biasing of the contacts by the cam surfaces, or biasing of the strips or bands by the cam surfaces, is intended to mean "displace against the urging of a resilient force."

It will, of course, be noted that the invention may be otherwise embodied. An example of such embodiment which is within the scope of the invention follows:

Referring now to FIGURES 5 and 6, wherein FIGURE 6 is a section 6—6 of FIGURE 5, there is shown a schematic arrangement which embodies the invention and which includes four mounting boards each designated 152 and positioned at angular intervals adjacent a control drum 154. The cylindrical surface or periphery, 156, of the control drum 154 is comprised of a plurality of coaxial adjacent cam surfaces, 158 and 160, each surface defining a cam disc between parallel planes and being in contact with a corresponding lug 162 upon each of the adjacent mounting boards 152. A pair of crossed trunions 164 and 166 support the mounting boards 152 and a rotating drive shaft 168, upon which is mounted drum 154, in parallel relation to each other. A motor 170 serves to provide rotary motion to the drum 154 with respect to the boards 152.

The details of FIGURES 5 and 6 are omitted since these are not necessary for an understanding of this embodiment wherein each mounting board and the electrical apparatus thereon coacts with the drum 154 in substantially the same manner as described for FIGURES 1–4. The mounting boards 152 are each identical with the board 10 in FIGURE 1 and serve to support strips and bands with contact discs and projecting lugs 162 in the same manner as in FIGURE 1. Furthermore, each of the peripheral cam surfaces 158 and 160 engage and bias the lugs 162 upon rotation of the shaft 168 and drum 154 by the motor 170 in the manner described for the annular surfaces of FIGURES 1 and 3. Instead of undulating into and out of a cam face as in FIGURES 1 and 3, the cam surfaces of FIGURES 5 and 6 undulate with respect to the cylindrical surface or periphery 156 of the control drum 152. In the embodiment of FIGURES 5 and 6 the lugs again engage and are biased in pairs by the surfaces 158 and 160, which coact in pairs to first displace both contacts in the same direction, release one lug to make contact and release another lug to break contact. It will, of course, be noted that the cam drum 154 is here operative with four sets of contacts and can therefore effect connection with four times as many contact discs as the cam disc shown for FIGURES 1 and 3. However, it should be appreciated that the embodiment of FIGURES 1 and 3 may be provided with additional sets of contacts.

The construction illustrated provides an improved switching device wherein positive displacement of biased contacts and sudden release thereof produces abrupt make and break of the contact surfaces. Specifically the construction at first displaces both contact disc or element and then releases one which is snapped back by its resilient mounting against the other, then the other is released and snaps back from contact with the first disc or element. The construction further provides a number of such contacts which are sequentially switched by a time displacement of their actuation. The cam member 56 is readily susceptible to mass production so as to allow the construction to be cheaply distributed. The cam disc 56 is also suspectible to replacement by a dissimilar cam disc as long as its relief pattern follows along annular surfaces of proper radius whereby the sequence and timing arrangement may be conveniently altered.

Thus, in brief, it may be said that the mechanism comprises two spring loaded members, the energy stored in one member being used upon release to make contact, and the energy stored in the other member to break contact.

The foregoing detailed description has been given for clarity of understanding only, and no unneccessary limitation should be understood therefrom, for modification will be obvious to those skilled in the art.

What is claimed is:

1. An electrical switching arrangement comprising:
a nonconductive mounting member;
a first resilient conductive contact element mounted on said mounting member and adapted to be connected to an electrical conductor;
a second resilient conductive contact element mounted on said mounting member so as to be spaced from and in overlapping alignment with said first contact element and adapted to be connected to an electrical connector;
a contact on said first element and a contact on said second element spaced from the contact on said first element and engageable by biasing of said second element with the contact on said first element, said first element forming with the overlying said second element, a contact pair;
a lug member extending transversely from the end of said first conducting element and a projection member extending from the end of said second conducting element, whereby said projection member extends from said second conductive element in the same direction as said lug member;
an electric motor secured to said mounting member and having a rotatable shaft projecting perpendicuarly from said mounting member at a position aligned with said lug member and said projection member;
a single circular cam plate secured for rotation on said shaft and parallel to said mounting member, said cam plate having a plurality of coplanar, concentric annular cam surfaces coaxial with said shaft;
one of said surfaces being in engagement with said first contact element and biasing said contact in the direction away from said cam plate, the remaining one of said cam surfaces being in engagement with said second contact element and biasing said contact in the direction away from said plate; and
one of said annular surfaces being arranged with respect to the adjacent surface to form a camming pair for simultaneously biasing during rotation of said cam the overlying said first and second contacts away from said cam, abruptly restoring said second contact element so as to make rapid connection between the pair of overlying contacts, abruptly restoring said first contact element so as to rapidly break connection between the pair of contacts.

2. An electrical switching arrangement comprising:
a nonconductive mounting member;
a plurality of first parallel resilient conductive contact strips secured in side-by-side spaced relation on said mounting member, first ends of said strips extending in one direction and the second ends of said strips in the other direction outwardly from said mounting member so as to adapt each of said strips for connection to electrical conductors;
a plurality of second parallel resilient conductive contact strips secured in side-by-side spaced relation on

said mounting member in overlapping alignment with said first strips;

electrical means connecting said second strips;

a contact on each of said first strips and a contact on each of said second strips spaced from the contacts on said first strips and engageable by biasing of said second strips with the contacts on said first strips;

a plurality of aligned lug members each extending transversely from the end of one of said first conducting strips;

a plurality of projection members extending from said second strips into the space between said strips in the same direction as said lug members and into alignment with said lugs so as to form a single row;

each of said first strips forming with the overlying one of said second strips, and the contacts and members associated therewith, a contact pair;

an electric motor secured to said mounting member and having a rotatable shaft projecting perpendicularly from said mounting member at a position aligned with said lug members and said projection members;

a single circular cam plate secured for rotation on said shaft and parallel to said mounting member, said cam plate having a plurality of coplanar, concentric annular cam surfaces coaxial with said shaft, centric annular cam surfaces being in engagement with said lug members and biasing said contacts in the direction away from said cam plate, the remaining ones of said surfaces being in engagement with said projection members and biasing said contacts in the direction away from said plate;

each of said alternate annular surfaces being arranged with respect to one of the adjacent surfaces to form a camming pair for simultaneously biasing during rotation of said cam the overlying pairs of said first and second contacts away from said cam, abruptly restoring said second contact strips so as to make rapid connection between the pair of overlying contacts, abruptly restoring said first contact strips so as to rapidly break connection between the pair of contacts; and

adjacent ones of said annular camming pairs being angularly positioned with respect to the adjacent camming pairs whereby in the adjacent contact pairs contact is made and broken in sequence with respect to the other contact pairs.

3. An electrical switching arrangement comprising:

a nonconductive mounting board;

a plurality of first parallel resilient conductive contact strips secured in side-by-side spaced relation on said mounting board;

first ends of said strips extending in one direction and the second ends of said strips in the other direction outwardly from said board so as to adapt said strip for connection to a wire;

a plurality of second parallel resilient conductive contact strips secured in side-by-side spaced relation on said board in overlapping alignment with said first strips;

electrical means connecting said second strips;

a contact on each of said first strips and a contact on each of said second strips spaced from the contacts on said first strips and engageable by biasing of said second strips with the contacts on said first strips, each of said first strips forming with the overlying one of said second strips, a contact pair;

an electric motor secured to said board and having a rotatable shaft projecting perpendicularly from said board;

a single, circular cam plate secured for rotation on said shaft and parallel to said board, said cam plate having a plurality of coplanar, concentric annular cam surfaces coaxial with said shaft, alternate ones of said surfaces being in engagement with said first

strips and biasing said contacts in the direction away from said cam plate, the remaining ones of said surfaces being in engagement with said second strips and biasing said contacts in the direction away from said plate, said cam surfaces each including an advancing path for engagement with said members so as to bias said contacts away from said plate;

a receding path for engagement with said members so as to maintain said contacts in the released position of said strips;

an intermediate transient path for engagement with said members so as to gradually move said contacts from the released to the biased position by rotation of said plate and a step for abruptly restoring said strips and contacts from the biased to the restored position by rotation of said cam by said motor means;

each of said alternate annular surfaces being arranged with respect to one of the adjacent surfaces to form a camming pair for simultaneously biasing during rotation of said cam the overlying pairs of said first and second contacts away from said cam, abruptly restoring said second contact strips so as to make rapid connection between the pair of overlying contacts, abruptly restoring said first contact strips so as to rapidly break connection between the pair of contacts; and

adjacent ones of said annular camming pairs being angularly positioned with respect to the adjacent camming pairs whereby in the adjacent contact pairs contact is made and broken in sequence with respect to the other contact pairs.

4. An electrical switching arrangement comprising:

a flat nonconductive mounting board;

a plurality of first parallel resilient conductive contact strips secured in side-by-side spaced relation on said mounting board and extending in one direction and the second ends of said strips in the other direction outwardly from said board so as to adapt said strip for connection to a wire;

a plurality of second parallel resilient conductive contact strips secured in side-by-side spaced relation on said board in overlapping alignment with the said first strips;

electrical means connecting said second strips;

a contact on each of said first strips and a contact on each of said second strips spaced from the contacts on said first strips and engageable by biasing of said second strips with the contacts on said first strips;

a plurality of aligned lug members each extending transversely from the end of one of said first conducting strips;

a plurality of projection members extending from said second strips into the space between said strips in the same direction as said lug members and into alignment with said lugs so as to form a single row;

each of said first strips forming with the overlying one of said second strips, and the contacts and members associated therewith, a contact pair;

an electric motor secured to said board and having a rotatable shaft projecting perpendicularly from said board at a position aligned with said lug members and said projection members;

a single circular cam plate secured for rotation on said shaft and parallel to said board, said cam plate having a plurality of coplanar concentric annular cam surfaces coaxial with said shaft, alternate ones of said surfaces being in engagement with said lug members and biasing said contacts in the direction away from said cam plate;

the remaining ones of said surfaces being in engagement with said projection members and biasing said contacts in the direction away from said plate;

said cam surfaces each including an advancing path for engagement with said members so as to bias said contacts away from said plate;

a receding path for engagement with said members so as to maintain said contacts in the released position of said strips;

an intermediate transient path for engagement with said members so as to gradually move said contacts from the released to the biased position by rotation of said plate and a step for abruptly restoring said strips and contacts from the biased to the restored position by rotation of said cam by said motor means;

each of said alternate annular surfaces being arranged with respect to one of the adjacent surfaces to form a camming pair for simultaneously biasing during rotation of said cam the overlying pairs of said first and second contacts away from said cam, abruptly restoring said second contact strips so as to make rapid connection between the pair of overlying contacts, abruptly restoring said first contact strips so as to rapidly break connection between the pair of contacts; and

adjacent ones of said annular camming pairs being angularly positioned with respect to the adjacent camming pairs whereby in the adjacent contact pairs contact is made and broken in sequence with respect to the other contact pairs.

References Cited in the file of this patent

UNITED STATES PATENTS

2,073,782	Cole et al.	Mar. 16, 1937
2,209,084	Foster	July 23, 1940
2,782,271	Jordan	Feb. 19, 1957
2,953,667	Kavanaugh	Sept. 20, 1960
2,976,377	Jordan	Mar. 21, 1961

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,154,645 October 27, 1964

Philip Parlato

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 7, line 27, for "centric annular cam" read -- alternate ones of said --.

Signed and sealed this 20th day of April 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,154,645 October 27, 1964

Philip Parlato

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 7, line 27, for "centric annular cam" read -- alternate ones of said --.

Signed and sealed this 20th day of April 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents