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J. L. SLONNEGER ETAL

3,142,730

TIMER SWITCHING MECHANISM WITH MULTI-STEP ONE-PIECE CAM

Filed Dec. 21, 1960

2 Sheets-Sheet 1

FIG. 1.

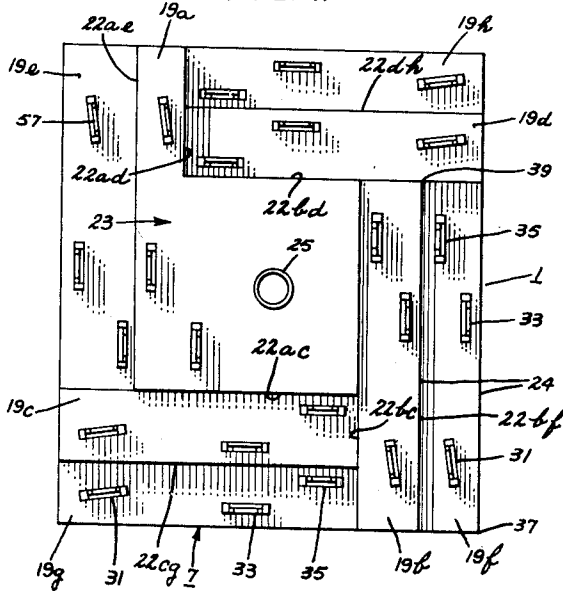
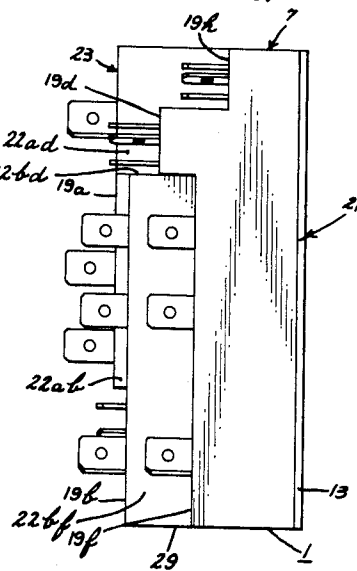


FIG. 2.



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FIG. 4.

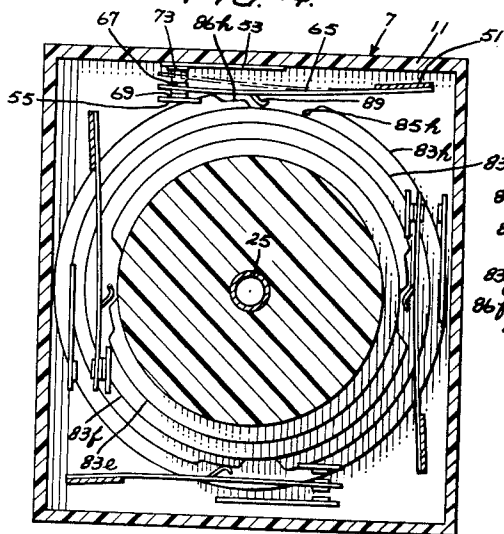


FIG. 6.

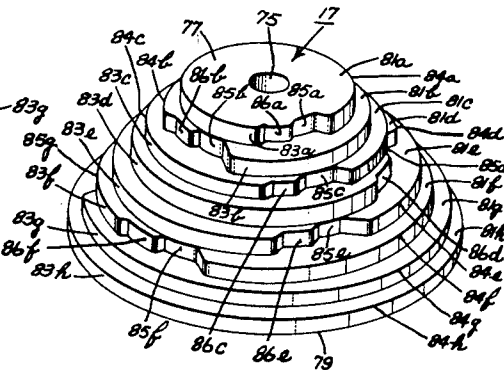


FIG. 7.

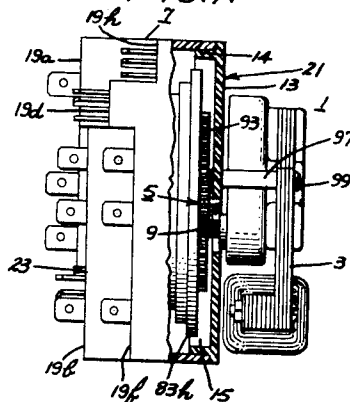


FIG. 8.

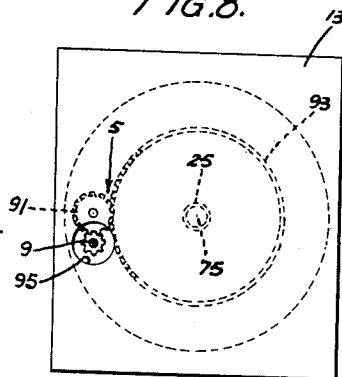
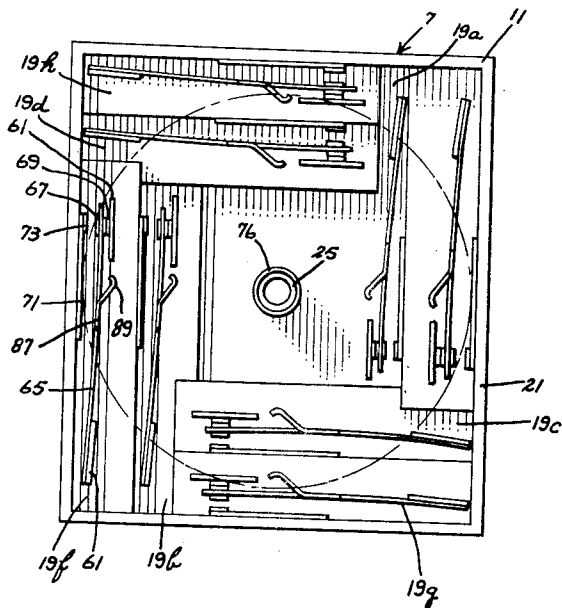


FIG. 5.



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TIMER SWITCHING MECHANISM WITH MULTI-STEP ONE-PIECE CAM

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8 Claims. (Cl. 200—38)

The present invention relates to control timers and more particularly to a mechanism for operating a plurality of electric switches in accordance with a predetermined sequence or pattern. Timers designed to provide this type of switching operation have generally become known as "sequence timers."

Such "sequence timers" have found widespread application in the control of electrical appliances, such as washing machines, dryers, and dishwashers. As these appliances are improved, the number of electric switches and circuits which are required increases and the control cycle becomes more and more complicated. It is at the same time desirable, however, that these sequence timers remain small and compact. In prior art sequence timers, to operate a multitude of various switches, stacks of rotatable camming discs often have been arranged coaxially to tangentially engage associated movable contact blades. These blades are then operated to the desired circuit controlling positions when the stack of discs reaches certain predetermined angular positions. Such camming discs as these are usually axially positioned next to each other with spacing members interposed between them, and held together in an integral fashion along with the spacing members to form an over-all timer camming stack. Such camming stacks as this have been found to be overly complicated, thereby adding appreciably to the overall cost of the timer switch mechanism. In addition, the configuration of the aforesaid camming stack along with the other various complementary parts of the timer switch mechanism, usually eventuates in a mechanism of relatively large configuration.

In some instances, the prior art for sequence timers has also experienced the use of one-piece molded cams which have been called monobloc cams. These cams usually assume barrel-shaped configurations, and they have been found to be considerably difficult to mold, while at the same time also necessitating a relatively large over-all switch mechanism. More particularly, the configuration of prior art monobloc cams such as are used in sequence timers has been relatively inflexible, thereby adding appreciably to the manufacturing expenses involved in producing cams of varying sizes and with various switch actuating capabilities.

It has, therefore, become desirable to provide a timer switch mechanism which is simple in construction and readily manufacturable, thereby contributing to a substantially lower over-all cost. It is further desirable that such a mechanism be relatively small in size, thus occupying a minimum space in the timer housing, and/or appliance which the timer is intended to operate. It is additionally desirable that such a mechanism be sturdy and compact.

Accordingly, it is an important object of this invention to provide a switching mechanism for a timer which due to its relative simplicity, may be manufactured at a reduced cost.

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Another object of this invention is to provide an improved timer switching mechanism that is relatively small in size and compact.

5 An additional object of this invention is to provide an improved sequence timer having a rotatable switch actuating member which is of a one-piece or monobloc construction and has a configuration which substantially enhances the simplicity of manufacture thereof.

10 A further object of this invention is to provide an improved sequence timer having a rotatable switch actuating member which is axially stepped to substantially enhance the flexibility and simplicity of manufacture thereof.

15 It is a still further object of this invention to provide an improved sequence timer which includes a rotatable switch actuating member and a recessed housing which complement each other in a new and improved manner to form a compact timer switch mechanism with a substantially enhanced efficiency.

20 In carrying out the present invention, in one form thereof, there is provided a sequence timer having a timing motor and a plurality of switches. A one-piece rotatable cam member is mechanically driven by the timing motor to actuate movable contacts of the switches at predetermined intervals. This cam member has a 25 centrally disposed axis of rotation and a plurality of axially stepped cylindrical surfaces are arranged concentrically about the axis. These cylindrical surfaces increase progressively in radius between top and bottom ends of the member. At least one radial discontinuity 30 such as an indentation is formed on each of the cylindrical surfaces to radially actuate an associated movable contact arm of each of the switches. By axially stepping the cylindrical surfaces of the cam member, progressively decreasing the radii of these surfaces between the bottom 35 and top ends of the member, and forming radial discontinuities in the surfaces, a one-piece molded cam member which is readily and flexibly manufacturable is thereby obtained. To support the timer switches as well as the rotatable cam member in a compact over-all housing, a recessed base having specially disposed stepped 40 walls has also been provided. The stepped walls of the base support the switches and complement the cylindrical surfaces of the cam member to provide a timer switch mechanism which is relatively small in size.

45 Further aspects of our invention will become apparent hereinafter, and the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as our invention. The invention, however, as to organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, when taken in conjunction with the accompanying drawings in which:

50 FIG. 1 is a top view of our improved sequence timer from the terminal side thereof;

55 FIG. 2 is a side view of the sequence timer of FIG. 1 with the motor removed therefrom;

FIG. 3 is a perspective view of the improved timer of FIG. 1 with the switch housing partially broken away to illustrate the relative positioning therein of the cam 60 member, terminals, and contacts;

FIG. 3a is a perspective view of representative terminals and their associated contacts, for the sequence timer;

65 FIG. 4 is a sectional view of the timer switching mechanism, partially broken away to show four of the movable contact blades and their associated radial discontinuities of the switch actuating member;

FIG. 5 is a bottom view of the improved sequence timer with the cover, switch actuating member, and driving motor removed to illustrate the movable contact blades and the manner whereby they are supported in the timer switch casing;

FIG. 6 is a perspective view of the improved rotatable switch actuating member of the present invention;

FIG. 7 is a side view partially in section and partially broken away, of the timer illustrating one form of a suitable driving means mechanically connected to the switch actuating member; and

FIG. 8 is a bottom view of the timer with the driving motor removed from its pinion to illustrate further the driving means of FIG. 7.

Referring in detail to the drawings, and in particular to FIG. 7, there is shown a sequence timer 1 having a suitable timing motor 3, a suitable type of drive mechanism 5, and a new and improved switching mechanism 7. Motor 3, as illustrated, is of the self-starting synchronous type, and it will be understood by those skilled in the art that drive mechanism 5 transmits rotary motion from output drive pinion 9 of motor 3 at the desired number of revolutions per minute to operate switching mechanism 7. The structure and operation of drive mechanism 5 shall be described in detail, hereinafter.

To conveniently and compactly support and contain the various elements of switch mechanism 7 in a very small housing, as shown in FIGS. 3 and 7, sequence timer 1 includes a rectangular switch casing 11 of molded insulating material. Casing 11 has a mating cover or plate 13 secured to its open end by snapping a pair of opposed perpendicular flanges 14 into engagement with the inner walls of the casing at the open end thereof (FIG. 7). Casing 11 and cover 13 thus cooperate to provide a substantially enclosed chamber 15 for the switch mechanism 7. (See also FIG. 3.) To afford maximum space utilization, and also facilitate the use of common switch parts such as those shown in FIG. 3a, casing 11 includes a plurality of stepped transverse walls 19a-19h. These walls structurally complement an improved actuating member 17 of the present invention, as shown in FIGS. 1 and 3. Walls 19a-19h are parallel to each other and to bottom end 21, being also disposed at different levels between bottom end 21 and top end 23 of casing 11. (See also FIG. 2.) Each of the walls 19b-19h is generally of oblong configuration (FIG. 1), having a pair of oppositely disposed elongated inner and outer sides 24 and a pair of inner and outer shorter ends 26 perpendicular thereto (as shown in FIGS. 1 and 3, for walls 19b and 19f). Outer wall 19a is farthest away of all of the transverse walls from bottom end 21 of the casing and forms a coplanar part of the outer end wall 23a of top end 23. The transverse wall 23a of top end 23, as shown in FIGS. 1 and 3, is therefore shaped like a rectangle which is similar to the configuration of bottom end 21, but also includes coplanar wall 19a appended to one of its sides. Wall 19a thus has the same generally oblong configuration as wall 19b.

To axially and rotatably support the switch actuating member 17, as shown in FIG. 3, cylindrical sleeve 25 is fastened to a central opening in the outer end wall 23a of top end 23. One end of the sleeve may, for example, be secured to the casing when the casing is being molded. The central rectangular section of the outer end wall 23a of top 23 thus serves as a supporting hub for sleeve 25. Sleeve 25 extends perpendicularly inwardly from end wall 23a toward bottom end 21 to serve as an axle for rotatably supporting member 17. Wall 19b is spaced axially from wall 19a by longitudinal wall 22ab (as shown in FIG. 2) and disposed laterally or transversely on the other side of axis 25 (FIG. 1). The longitudinal axis of wall 19b is generally parallel to the longitudinal axis of wall 19a. The outer end of wall 19a abuts outer longitudinal wall 27 (FIG. 3), and the outer end of wall 19b

(FIG. 2). The inner ends of walls 19a and 19b abut the oppositely disposed and parallel longitudinal walls 22ac and 22bd respectively. It will thus be seen that transverse walls 19a and 19b are partially opposed when viewed from the top of the casing (FIG. 1); and then extending outwardly in opposite directions. The axial spacing of the parallel walls 19a and 19b is represented by the height of longitudinal wall 22ab which connects end wall 23a to wall 19b (FIG. 3).

Wall 19c is axially spaced from wall 19b toward bottom end 21 of the casing 11. The longitudinal axis of wall 19c extends, however, in a lateral direction generally perpendicular to that of the longitudinal axis of wall 19b. This may be clearly seen in FIG. 1. Wall 19c is thus stepped axially downwardly or inwardly at its inner side by longitudinal wall 22ac and stepped axially inwardly at its inner end by longitudinal wall 22bc (FIG. 1). Wall 19d is axially disposed downwardly or inwardly from wall 19c, and is in the same relationship to wall 19c when viewed from the top (i.e., FIG. 1) as previously described for walls 19a and 19b. In other words, walls 19c and 19d also extend in outwardly opposite directions when they are viewed from the top of the casing 11, and the longitudinal axis of wall 19d also extends in a direction generally parallel to that of the longitudinal axis of wall 19c. Wall 19d is stepped axially inwardly at its inner side by longitudinal wall 22bd and stepped axially inwardly at its inner end by longitudinal wall 22ad. (See FIG. 2.)

It will thus be seen that the four transverse walls 19a-19d are disposed in axial progression from top end 23 of the casing toward bottom end 21. The walls 19a-19d are also positioned in a quadrangular fashion around four sides of the rectangular hub which supports axle 25, so that they are laterally spaced apart in an expeditious manner. The special relationship between axially adjacent walls is such that each of the walls 19a-19d is either positioned with its longitudinal axis extending in a direction perpendicular to that of its axially adjacent wall(s) or it is disposed on the opposite side of axle 25 from its axially adjacent wall. For example, axially adjacent walls 19b and 19c have their longitudinal axes extending in perpendicular directions, and axially adjacent walls 19c and 19d have their longitudinal axes extending in parallel directions and disposed on opposite sides of axle 25.

Walls 19e, 19f, 19g, and 19h are each stepped axially inwardly or downwardly from walls 19a, 19b, 19c, and 19d, by the longitudinal connecting walls 22ae, 22bf, 22cg, and 22dh, respectively. For example, wall 19f is stepped axially from wall 19b toward bottom end 21, by longitudinal wall 22bf (FIGS. 2 and 3). The walls 19e-19h are formed in the same axial progression as described for walls 19a-19e, but each of the walls 19e-19h is outwardly disposed transversely from a laterally adjacent one of the walls 19a-19d, respectively. The longitudinal axes of laterally adjacent walls of each pair thus formed are in directions parallel to each other. For example, as shown in FIG. 3, wall 19f is laterally adjacent to wall 19b, and the longitudinal axes of these walls are in directions parallel to each other. (See also FIG. 1.) The laterally adjacent walls are each axially spaced apart by a distance generally equivalent to the axial dimension or depth of vertical wall 22bf (as shown in FIG. 3). The dimension of this axial spacing between the laterally adjacent walls, due to the progressive axial spacing of the aforementioned walls 19a-19d, is greater than the spacing between walls 19a and 19d. The axial spacing of laterally adjacent walls is, therefore, substantially maximal.

It will thus be seen that by means of the stepped wall configuration of the improved casing 11, each axially adjacent pair of walls is spaced apart laterally by a substantially maximum distance, and each laterally adjacent pair of walls is spaced apart axially by a substantially maximum distance. Casing 11, therefore, provides eight

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supporting walls or levels which are expeditiously spaced apart to provide an extremely compact switch housing. Each of these walls, in the illustrated switch, supports a 3-position single pole double throw switch using the switch parts shown in FIG. 3a.

To mount the contacts and terminals of the switching mechanism 7, each of the transversely extending levels or walls 19a-19h has three slots 31, 33, and 35 formed to extend generally longitudinally therein. (See FIG. 1.) As an example, to illustrate the arrangement of the slots 31, 33, and 35 in wall 19f, elongated slot 31 is positioned near corner 37 of casing 11 and the longitudinal axis of slot 31 extends in a generally diagonal fashion toward inner corner 39 of wall 19f. Slots 35 and 33 extend parallel to the longitudinal sides of wall 19f and are spaced apart, with slot 35 being disposed near corner 39 and the inner side of the wall, and slot 33 being disposed near the outer side of the wall and toward slot 31. In viewing FIG. 1, it will be seen that three slots are formed in each of the other seven axially stepped walls in the same manner as described for wall 19f.

Each switch of the illustrated timer 1 is a 3-position single pole double throw switch. To provide conductive terminations and support the contacts for each of the switches, terminals 51, 53, and 55 are extended through the terminal slots 31, 33, and 35, respectively (FIG. 3). Each of the terminals 51, 53, and 55, as shown in FIG. 3a, includes a relatively flat blade portion 57 which projects outwardly from the slotted supporting wall (FIG. 3), or in a direction away from cover 13. Detent hole 57a is formed in each blade portion 57 for engagement with an associated "quick-connect" terminal. In the illustrated timer, each terminal also includes a pair of bent over arms 59 which extend across the width of each of the slots and clamp against opposite end walls thereof to securely fasten the terminals to the casing. Terminal 51 also includes a contact supporting section 61 (FIG. 3a). Section 61 extends inwardly from wall 19f (as shown in FIG. 5) toward cover 13, and supported end 63 of movable contact blade 65 is secured thereto (FIG. 3). Supported end 63 of blade 65 may be secured to terminal section 61 by welding (FIG. 3a), or it may be staked thereto (not shown). The free end 66 of movable contact blade 65 has a two-sided movable contact button 67 attached thereto.

Terminal 55 is generally of the same configuration as terminal 51, except for the fact that it has a fixed contact button 69 formed upon section 61 thereof (FIG. 3a). Contact button 69 mates with contact button 67 of movable contact blade 65. Terminal 53 differs from the terminals 51 and 55 in that it includes a contact supporting section 71 which is elongated, as shown in FIG. 3a. Section 71 serves to properly space fixed contact button 73 thereof from blade portion 57 of the terminal 53. Fixed contact button 73 is attached to elongated supporting section 71 in a position opposite to movable contact button 67 so that it may mate therewith when blade 65 is moved in a counter-clockwise direction from where it is shown in FIG. 5. It will thus be seen by those skilled in the art that each of the movable contact blades 65 cooperate with fixed contacts 69 and 73 to provide a 3-position single pole double throw switch. Each of the walls 19a-19h of casing 11, has a switch mounted upon its inner side in the same manner, as described for wall 19f. (See FIG. 5.)

Turning now to an important aspect of the present invention, whereby a readily manufacturable and low cost switch actuating member has been provided, attention is directed to FIG. 6. As shown therein, actuating member 17 is a one-piece cam which in general resembles a frusto-conically shaped beehive. Such a cam may be very inexpensively molded to various predetermined switch actuating configurations. More particularly, cam member 17 includes a cylindrical bore 75 which extends generally perpendicularly between top end 77 and bot-

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tom end 79. This bore surrounds and receives axle or sleeve 25 of casing 11 and serves as a smooth bearing surface for the cam member. Bore 75 has an annular step (not shown) near the bottom end 79 of cam member 17, to engage the free inner end 76 of sleeve 25 (FIG. 5).

As shown in FIG. 6, member 17 also includes a plurality of concentric and parallel annular surfaces 81a-81h. These surfaces are disposed in axially spaced and parallel transverse planes which are perpendicular to the axis of the cam member. The outermost radii of these annular surfaces progressively increase between top and bottom ends 77 and 79. The annular surfaces 81a-81h perpendicularly intersect the generally cylindrical surfaces 83a-83h, respectively, to provide concentric circular edges 84a-84h. The radii of cylindrical surfaces 83a-83h thus correspond to the outermost radii of surfaces 81a-81h, as well as to the radii of the circular edges 84a-84h which they describe. For example, the radius of cylindrical surface 83f is equal to the outermost radius of annular surface 81f and it is also equal to the radius of the included circular edge 84f. The radii of surfaces 83a-83h thus increase progressively between the top end 77 and bottom end 79 to provide a progressively stepped group of cylindrical cam tracks. This arrangement of the cylindrical surfaces 83a-83h and their perpendicularly related annular surfaces 81a-81h provides a cam member 17 which in general resembles a stack of discs having outer peripheries of progressively increasing radii between top end 77 and bottom end 79. The cam configuration also generally resembles that of a frusto-conically configured beehive.

It will thus be seen that by means of the present invention, cylindrical surfaces 83a-83h are progressively and concentrically stepped along the axis of the cam member 17. To enable the cylindrical surfaces 83a-83h to operate one of the movable contact blades 65 (FIG. 5), each cylindrical surface has at least one radial discontinuity formed therein. These discontinuities are represented as peripheral interruptions 85a-85h in FIGS. 4 and 6. It will be understood by those skilled in the art that while the radial discontinuities (e.g. 85a), as shown in FIG. 6, are peripheral interruptions or indentations, the present invention is not necessarily limited to such structure, and other various configurations of these discontinuities, such as radial projections (not shown), could be formed upon the cylindrical surfaces of the switch actuating member to operate the switch contact blades. In the illustrated switch actuating member 17, the radial discontinuities 85a-85h include indented cylindrical surfaces 86a-86h respectively, which serve to provide a middle or open position for each switch, as shall be further described hereinafter.

As illustrated best in FIG. 5 of the drawings, each of the movable contact blades 65 is disposed edgewise with respect to the inner surface of its supporting wall and has an extension 87 formed thereon which projects axially in the casing toward open bottom end 21. Extension 87 includes a lanced portion which is bent angularly from the flat surface of the blade toward an adjacent cylindrical surface of the cam member 17 and then back toward the blade itself to provide a generally V-shaped and inwardly curved contact section 89. Contact sections 89 of the respective movable contact blades 65 normally ride upon the periphery of associated cylindrical surfaces. Each cylindrical surface thus serves as a cam track for one of the stepped and axially spaced switch blades 65. For example, as shown in FIG. 4, contact section 89 of one movable contact blade 65 uses cylindrical surfaces 83h and 86h as cam tracks. This particular blade 65 is supported by wall 19h (FIG. 5) and it rides along the periphery of surface 83h until it reaches the radial discontinuity 85h formed therein. The position which blade 65 of wall 19h assumes when contact section 89 rides along the outer periphery of cylindrical surface 83h, is shown by dotted lines in FIG. 4. With this condition

in effect, a circuit may be closed through terminal 51 of blade 65 and terminal 53. It is important to note that each of the movable contact blades 65 is tangentially biased toward its associated cylindrical surface(s). As motor 3 then drives cam member 17 in a timed sequence, contact section 89 reaches discontinuity 85h (as shown in FIG. 4), after a predetermined interval. When this condition occurs, due to the tangential biasing of the blade, contact section 89 enters discontinuity 85h and moves radially inwardly toward cylindrical sleeve 25. This causes movable contact button 67 to move away from the one fixed contact 73 and into either an intermediate off position or into engagement with the other fixed contact 69, depending upon the direction of rotation of the cam member 17. A circuit energized by engagement of contacts 67 and 73 is thus de-energized, and when section 89 reaches the radially innermost position within the discontinuity, any circuit connected across terminals 51 and 55 is thereby energized. As shown in FIG. 4, to assure efficient closure of contacts 67 and 69, when section 89 is in its innermost position, it is spaced from the innermost surface of the discontinuity.

Assuming that cam member 17 is rotated in a clockwise direction of rotation in FIG. 4, when section 89 of blade 65 first reaches the right side of discontinuity 85h, the biasing of the blade gradually moves section 89 into its innermost position as shown. Contacts 67 and 69 are then closed and section 89 remains spaced from the innermost surface of the discontinuity until it reaches or is engaged by surface 86h. Movable contact 67 is then moved to an open position away from contact 69 until section 89 rides back into its outermost position on surface 83h. Contacts 67 and 73 are then reclosed.

To transmit rotary motion from output drive pinion 9 to switch actuating member 17 at the desired number of revolutions per minute, in the illustrated timer 1, as shown in FIGS. 7 and 8, drive mechanism 5 has been provided. The mechanism 5 includes intermediate gear 91 (FIG. 8) which is rotatably supported on the inside of cover plate 13. Gear 91 meshes with and is driven by pinion 9. As shown in FIG. 7, cam member 17 includes an integral molded driven gear portion 93 coaxially positioned underneath surface 83h. Molded gear 93 of cam member 17 meshes with intermediate gear 91 and is driven thereby to provide the desired output speed for actuating the switches of timer 1.

To properly position pinion 9 in mesh with intermediate gear 91, aperture 95 is formed in plate 13 (FIG. 8) so that the pinion may extend into switch cavity 15 from motor 3. Motor 3 is supported adjacent to and outside of cover plate 13 by means of two threaded sleeves 97, one of which may be seen in FIG. 7. Sleeves 97 are fastened at their inner ends to plate 13. Screws 99 extend through suitable apertures in the field of motor 3 to engage the threaded outer ends of sleeves 97 and thus rigidly fasten the motor to the switching mechanism 7.

It will thus be seen by those skilled in the art that by means of our invention, there has been provided a switching mechanism for a timer which is simple in construction, and which may be manufactured at a reduced cost. In addition, the rotatable switch actuating member which is taught by our invention is of one-piece or monobloc construction and due to the frusto-conical "beehive" configuration thereof, it readily lends itself to convenient and inexpensive manufacturing techniques. In particular, this frusto-conical configuration of the switch actuating member significantly enhances the flexibility of manufacture by substantially simplifying the making of molds for different types of actuating members that perform various switch camming functions. By means of the complementary relationship of the improved switch actuating member and its associated stepped housing, common switch parts may be utilized for the various switches and a very compact timer switch mechanism with a substantially enhanced efficiency has been thereby evolved.

It should be realized that certain aspects of the present invention may be efficiently and beneficially incorporated in numerous other timer switching mechanisms having various types of switches (such as, for example, single pole single throw switches) with equally beneficial results.

While in accordance with the patent statutes, we have described what at present is considered to be the preferred embodiment of our invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and we, therefore, aim in the following claims to cover all such equivalent variations as fall within the true spirit and scope of this invention.

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

1. For use in a time controlled switching mechanism, a cam and switch structure comprising a cam member having a central axis of rotation and at least three axially stepped cylindrical cam surfaces arranged concentrically around said axis, said surfaces being immovable relative to each other and having progressively increasing radii between the top and bottom ends of said member, a base means receiving said cam member, said base means including a plurality of axially spaced walls disposed around said cam member, and a plurality of switches mounted on said walls in an axially spaced relationship, each of said switches having an actuating member located adjacent a different one of said cam surfaces for operation thereby.

2. A time controlled switching mechanism comprising a frusto-conically shaped actuating member of one-piece molded construction, said member having a central axis of rotation and at least three axially stepped cylindrical surfaces arranged concentrically about said axis, said surfaces having progressively increasing radii between top and bottom ends of said member, at least one radial discontinuity emanating from each of said cylindrical surfaces, a gear portion molded integrally and concentrically to the bottom end of said member, an electric motor operatively connected to said gear portion for imparting rotation to said member, and a plurality of switches each having at least one movable arm with an actuating extension formed thereon, said extension being disposed tangentially, biased toward and movable radially with respect to an associated one of said cylindrical surfaces, the extensions of said arms being engageable with the radial discontinuities of the associated surfaces to operate said switches upon the rotation of said actuating member by said motor.

3. A time controlled switching mechanism comprising a frusto-conically shaped actuating member of one-piece molded construction, said member having a central axis of rotation and at least three axially stepped cylindrical surfaces arranged concentrically about said axis, said surfaces having progressively increasing radii between top and bottom ends of said member and uniform axial depth, at least one radial indentation disposed in each of said cylindrical surfaces, a gear portion molded integrally and concentrically to the bottom end of said member, an electric motor operatively connected to said gear portion for imparting rotation to said member, and a plurality of switches each having at least one movable arm with an actuating extension formed thereon, each of said arms at least partially overlying and biased toward an associated one of said cylindrical surfaces, the extension of said arms being engageable with the radial indentations of the associated cylindrical surfaces and movable radially in response to the tangential biasing of the arms thereby to operate the switches upon the rotation of said actuating member by said motor.

4. A time controlled switching mechanism comprising a switch actuating member having a central axis of rotation and at least three axially stepped cylindrical surfaces arranged concentrically about said axis, said surfaces being immovable relative to each other and having

progressively increasing radii between top and bottom ends of said member, at least one radial discontinuity emanating from each of said cylindrical surfaces, driving means operatively connected to said actuating member for imparting rotation thereto, a recessed base receiving said actuating member, a plurality of walls formed in said base, said walls being disposed in spaced apart planes extending transverse to the axis of rotation of said actuating member, and various of said walls each having at least one switch arranged thereon to provide a plurality of axially spaced switches, each of said switches having at least one actuating means located adjacent an associated one of said cylindrical surfaces, the actuating means of said switches being respectively engageable with the radial discontinuities of the associated surfaces to operate said switches upon the rotation of said actuating member by said driving means, whereby said actuating member and said base assume a complementary relationship to provide a compact and low cost switching mechanism.

5. A time controlled switching mechanism comprising a switch actuating member having a central axis of rotation and at least three axially stepped cylindrical surfaces arranged concentrically about said axis, said surfaces being immovable relative to each other and having progressively increasing radii between top and bottom ends of said member, at least one radial discontinuity emanating from each of said cylindrical surfaces, driving means operatively connected to said actuating member for imparting rotation thereto, a recessed base receiving said actuating member, a plurality of axially stepped walls formed in said base, said walls being disposed in axially spaced apart planes extending generally perpendicular to the axis of rotation of said actuating member, and at least one switch supported on the interior surface of each of said walls thereby to provide a plurality of axially spaced switches, each of said switches having at least one movable actuating extension biased toward and movable radially with respect to an associated one of said cylindrical surfaces, the extensions of said switches being respectively engageable with the radial discontinuities of the associated surfaces to operate said switches upon the rotation of said actuating member by said driving means, whereby said actuating member and said base assume a complementary relationship to provide a compact and low cost switching mechanism.

6. A time controlled switching mechanism comprising a switch actuating member having a central axis of rotation and a plurality of at least three axially stepped cylindrical surfaces arranged concentrically about said axis, said surfaces being immovable relative to each other and having progressively increasing radii between top and bottom ends of said member, at least one radial discontinuity emanating from each of said cylindrical surfaces, driving means operatively connected to said actuating member for imparting rotation thereto, a recessed base receiving said actuating member, means for rotatably supporting said actuating member within said base, a plurality of axially stepped walls formed in said base, said walls being elongated longitudinally and disposed in axially spaced apart parallel planes extending generally perpendicular to the axis of rotation of said member, said walls comprising a first pair of axially adjacent walls disposed on opposite sides of the axis of rotation of said member and having their longitudinal axes extending in a first direction, a second pair of axially adjacent walls successively spaced axially from said first pair of walls, disposed on opposite sides of the axis of rotation of said member and having their longitudinal axes extending in a second direction generally perpendicular to said first direction, said first and second pairs of walls being arranged in a substantially quadrangular fashion, at least one switch supported on the interior surface of each of said walls thereby to provide a plurality of axially spaced switches, each of said switches having at least one movable actuating extension

biased toward and movable radially with respect to an associated one of said cylindrical surfaces, the extensions of said switches being respectively engageable with the radial discontinuities of the associated surfaces to operate said switches upon the rotation of said actuating member by said driving means, whereby said actuating member and said base assume a complementary relationship to provide a compact and low cost switching mechanism.

7. A time controlled switching mechanism comprising a frusto-conically shaped switch actuating member of one-piece molded construction, said member having a central axis of rotation and at least eight axially stepped cylindrical surfaces arranged concentrically about said axis, said surfaces having progressively increasing radii between top and bottom ends of said member, at least one radial discontinuity emanating from each of said cylindrical surfaces, driving means operatively connected to said actuating member for imparting rotation thereto, a recessed base receiving said actuating member, means for rotatably supporting said actuating member within said base, a plurality of axially stepped walls formed in said base, said walls each being elongated longitudinally and disposed in axially spaced apart parallel planes extending generally perpendicular to the axis of rotation of said member, side walls comprising a first pair of axially adjacent walls disposed on opposite sides of the axis of rotation of said member and having their longitudinal axes extending in a first direction, a second pair of axially adjacent walls successively spaced axially from said first pair of walls, disposed on opposite sides of the axis of rotation of said member and having their longitudinal axes extending in a second direction generally perpendicular to said first direction, said first and second pairs of walls being arranged in a substantially quadrangular fashion, a third pair of axially adjacent walls successively spaced axially from said second pair of walls, disposed on opposite sides of the axis of rotation of said member and having their longitudinal axes extending in said first direction, the walls of said third pair being disposed radially outwardly of the walls of said first pair respectively and in stepped and laterally adjacent association with the walls of said first pair thereby to provide a pair of stepped and laterally adjacent walls on each one of oppositely disposed sides of said axis of rotation, a fourth pair of axially adjacent walls successively spaced axially from said second pair of walls, disposed on opposite sides of the axis of rotation of said member and having their longitudinal axes extending in said second direction, the walls of said fourth pair being disposed radially outwardly of the walls of said second pair respectively and in stepped and laterally adjacent association with the walls of said second pair thereby to provide a pair of stepped and laterally adjacent walls on each one of oppositely disposed sides of said axis of rotation, at least one switch supported on the interior surface of each of said walls thereby to provide a plurality of axially spaced switches, each of said switches having at least one movable actuating extension biased toward and movable radially with respect to an associated one of said cylindrical surfaces, the extensions of said switches being respectively engageable with the radial discontinuities of the associated surfaces to operate said switches upon the rotation of said actuating member by said driving means, whereby said actuating member and said base assume a complementary relationship to provide a compact and low cost switching mechanism.

8. As an article of manufacture for a time controlled switching mechanism, a one-piece molded cam member having a frusto-conical configuration and a central axis of rotation, said member comprising at least three axially stepped cylindrical surfaces arranged concentrically about said axis and having progressively increasing radii between top and bottom ends of said member, at least one discontinuity emanating from each of said cylindrical surfaces, and a gear portion molded integrally and concentrically to the bottom end of said member, the radial dis-

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continuities of said axially stepped cylindrical surfaces being arranged for engaging movable switch arms upon the rotative engagement of the gear portion of said cam member with a pinion of a timing motor to operate circuit controlling switches at predetermined intervals.

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